VOLUME II

INSTITUTIONAL CONTROLS PLAN

TABLE OF CONTENTS
VOLUME II
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Page

1.0 Introduction 1
- 1.1 Purpose and Organization of this Institutional Controls Plan 3
- 1.2 Summary of Support Documents 3
- 1.3 Definition and Purpose of Institutional Controls 4
- 1.4 Types of Institutional Controls 5
- 1.5 Agency Requirements for Institutional Controls 5
- 1.6 Updates to the Institutional Controls Plan 5

2.0 Controls On Disturbance and Use of the FCP 7
- 2.1 FCP Site 7
  - 2.1.1 Proprietary Controls and Points of Contact 7
  - 2.1.2 Governmental Controls 7
  - 2.1.3 Preventing Unauthorized Use of FCP 8
    - 2.1.3.1 Informational Devices 8
    - 2.1.3.2 Security of Site Facilities and Infrastructure 9
    - 2.1.3.3 Routine Inspection of Property 9
- 2.2 OSDF 9
  - 2.2.1 Proprietary Controls and Points of Contact 10
  - 2.2.2 Governmental Controls 10
  - 2.2.3 Preventing Unauthorized Use 10

3.0 Controls to Minimize Human and Environmental Exposure to Residual Contaminants 14
- 3.1 FCP Site 14
  - 3.1.1 FCP Site Inspections 14
  - 3.1.2 Surface Water Discharge 14
  - 3.1.3 Groundwater Remedy and Monitoring 14
- 3.2 OSDF 15
  - 3.2.1 OSDF Inspection and Maintenance 16
  - 3.2.2 Leak Detection/Leachate Monitoring 17
  - 3.2.3 Leachate Management 18

4.0 Contingency Planning 23

5.0 Information Management for FCP Institutional Controls 25
- 5.1 FCP Site 25
  - 5.1.1 Inspection Data/Results 25
  - 5.1.2 Public Access to Information 25
- 5.2 OSDF 25
  - 5.2.1 Inspection Records 25
  - 5.2.2 Monitoring Data 25
  - 5.2.3 Public Access to Information 25
- 5.3 Reporting 26
  - 5.3.1 Routine Reporting 26
  - 5.3.2 CERCLA Five-Year Review 26

References 27

TABLE OF CONTENTS
(Continued)

LIST OF TABLES

Table 2-1 Controls on Disturbance and Use of the FCP Site 11

Table 2-2 Controls on Disturbance and Use of the OSDF 12

Table 3-1 Controls to Minimize Human and Environmental Exposure to Residual Contaminants for FCP Site 19

Table 3-2 Controls to Minimize Human and Environmental Exposure to Residual Contaminants for OSDF 20

LIST OF FIGURES

Figure 1 Fernald Future Use 6
Figure 2 Fernald Institutional Controls 13

APPENDICES

Appendix A Cleanup Program Status
Appendix B Institutional Control Requirements as Stated in the Records of Decision
Appendix A Fernald Closure Project Contact Information
Appendix B Example of OSDF and FCP Site Inspection Forms

LIST OF ATTACHMENTS

Attachment A Operations and Maintenance Master Plan for the Aquifer Restoration and Wastewater Treatment
Attachment B Post Closure Care and Inspection Plan
Attachment C Groundwater/Leak Detection and Leachate Monitoring Plan

LIST OF ACRONYMS

CAWWT	Converted Advanced Waste Water Treatment
CERCLA	Comprehensive Environmental Response Compensation and Liability Act
CFR	Code of federal regulations
DOE	Department of Energy
GJO	Grand Junction Office
EPA	Environmental Protection Agency
FCP	Fernald Closure Project
GWLMP	Groundwater/Leak Detection and Leachate Monitoring Plan
GMA	Great Miami Aquifer
GMR	Great Miami River
IC(s)	institutional control(s)
IEMP	Integrated Environmental Monitoring Plan
LCS	leachate collection system
LDS	leak detection system
LMICP	Comprehensive Legacy Management and Institutional Controls Plan
NARA	National Archives Record Administration
NPDES	National Pollutant Discharge Elimination System
NRRP	Natural Resource Restoration Plan
OMMP	Operations and Maintenance Master Plan for the Aquifer Restoration and Wastewater Project
OSDF	On-Site Disposal Facility
OU	operable unit
PCCIP	Post Closure Care and Inspection Plan
RCRA	Resource Conservation and Recovery Act
RI/FS	Remedial Investigation/Feasibility Study
ROD	record of decision
US	United States
WAC	waste acceptance criteria

1.0 INTRODUCTION

The Fernald Closure Project (FCP) is situated on a 1,050-acre tract of land, approximately 18 miles northwest of Cincinnati, Ohio. The FCP site is located near the unincorporated communities of Ross, Fernald, Shandon and New Haven. Land use in the area consists primarily of residential areas, farming, gravel excavation operations, light industry and parks.

The Comprehensive Environmental Response Compensation and Liability Act (CERCLA) is the primary driver for environmental remediation of the FCP. The site was divided into five operable units and a Remedial Investigation and Feasibility Study (RI/FS) was conducted for each unit. Based on the results of the RI/FS, Records of Decision (RODs) were issued outlining the selected remedy for each Operable Unit (OU).

- **Operable Unit 1, Waste Pits Area** – The remedy for OU1 includes removing all material from the waste pits, stabilizing the material by drying, and shipping it off-site for disposal.
- **Operable Unit 2, Other Waste Units** – The remedy for OU2 includes removing material from the various units, disposing of material that meets the on-site waste acceptance criteria (WAC) in the On-site Disposal Facility (OSDF), and shipping all other material off-site for disposal. WAC were developed by DOE and regulators to strictly control the type of waste disposed on site. The WAC are documented in the Waste Acceptance Criteria (WAC) Attainment Plan for the On-site Disposal Facility (DOE 1998a)
- **Operable Unit 3, Production Area** – The OU3 remedy includes decontaminating and decommissioning all contaminated structures and buildings, recycling waste materials if possible, disposing of material that meets the on-site WAC in the OSDF, and shipping all other material off-site for disposal.
- **Operable Unit 4, Silos 1–4** – The OU4 remedy includes removal and treatment of all material from the silos and shipping it off-site for disposal.
- **Operable Unit 5, Environmental Media** – OU5 includes all environmental media, including soil, surface water, groundwater and vegetation. The Sitewide Excavation Plan (SEP, DOE 1998b) describes the remediation of soils. The OU5 ROD (DOE 1996) describes the approved remediation method of pump-and-treat for groundwater.

As of April 2004, the following cleanup benchmarks have been achieved:

- 734,799 Tons of Waste Pits material have been shipped off site and 107 unit trains have made the round trip from Fernald to the Envirocare disposal facility in Utah;
- More than 1.39 million cubic yards of contaminated soil and debris (construction materials from buildings, including steel and other metals, drywall, electrical supplies, transite, roofing materials, wood, glass, etc.) has been excavated and placed in the OSDF;
- 6 of 8 Individual disposal cells are in place;

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- 9 of 10 Uranium production plants have been dismantled;
- 159 Individual structures have been dismantled;
- Nuclear materials disposition is complete;
- 6.4 Million cubic feet of low-level waste has been shipped by truck to the Nevada Test Site for disposal;
- 57 Percent of the 1050-acre site footprint has been certified as meeting radiological and chemical cleanup levels; and
- 14.9 Billion gallons of contaminated groundwater has been pumped and treated, as necessary, to achieve surface water discharge limits.

A more detailed summary of the cleanup program status is included as Appendix A. Upon closure, all that will remain will be the ongoing actions necessary to achieve final cleanup of the Great Miami Aquifer restoration and the legacy management activities necessary to accommodate and maintain the designated final land use.

Ecological restoration follows remediation and is the final step to completing cleanup of the site. Ecological restoration is being implemented in order to begin to facilitate settlement of a 1986 State of Ohio Claim against the Department of Energy (DOE) for injuries to natural resources at Fernald under CERCLA. Settlement of the claim is still in the negotiation stages. Restoration activities at the site are also being implemented to address wetland mitigation requirements under the Clean Water Act and to stabilize and revegetate areas impacted during remediation. The approach to ecological restoration of the FCP is outlined in the Natural Resource Restoration Plan (NRRP, DOE 2002). Compliance with the 2002 NRRP is a closure contract commitment for Fluor Fernald, Inc.

The anticipated closure of the Fernald Closure Project is March 2006. At that time, the OSDF, located on the eastern side of the FCP will be complete. The OSDF will consist of 8 disposal cells and will cover an area of approximately 123 acres, including the surrounding buffer area. Approximately 904 acres of the FCP property will be ecologically restored, having been graded following excavations, amended, and seeded/planted or otherwise enhanced to create ecosystems comparable to native pre-settlement southwestern Ohio. A few facilities may remain on site following remediation. These include the Converted Advanced Wastewater Treatment (CAWWT) facility and supporting infrastructure, extraction wells, and associated piping and utilities, the outfall line to the GMR, and a few office trailers (Figure 1).

The DOE Office of Environmental Management is responsible for the remediation of the FCP. Post-remediation responsibilities will transition to the DOE Office of Legacy Management. The Office of Legacy Management will be responsible for the post-remediation operations, maintenance and enforcing of ICs at the site.

1.1 Purpose and Organization of this Institutional Controls Plan

This Institutional Controls Plan (IC Plan) outlines the institutional controls (ICs) that will be established and enforced once remediation is completed at the Fernald Closure Project (FCP). This IC Plan will document DOE's approach to maintaining ICs as required by United States Environmental Protection Agency (EPA) guidance. The ICs outlined in this Plan are designed to ensure the continued protection of human health and the environment following closure of the site. The Office of Legacy Management is responsible for monitoring, maintaining, reporting on and implementing ICs at the FCP. This Plan will be updated as the site moves towards closure and more detail regarding implementation of the IC Plan is identified. In addition, changes to any of the support plans attached to this IC Plan may trigger revisions to the IC Plan.

This IC Plan is Volume 2 of a two-volume document, the Comprehensive Legacy Management and Institutional Controls Plan (LMICP). The Legacy Management Plan (formerly the Comprehensive Long-Term Stewardship Plan) is Volume I of the document. The Legacy Management volume describes the policies that pertain to legacy management, and what is required at the FCP for legacy management purposes. The IC Plan volume of the document serves as the "umbrella" document providing the overview and approach to implementing ICs at the FCP. The detailed, subject specific documents attached to this Plan provide further detail and more subject specific information regarding ICs and other post-closure activities. These documents include the Operations and Maintenance Master Plan for the Aquifer Restoration and Wastewater Project (OMMP, DOE 2004a, Attachment A); Post Closure Care and Inspection Plan, On-site Disposal Facility (PCCIP, DOE 2004b, Attachment B); and the Groundwater/Leak Detection and Leachate Monitoring Plan (GWLMP, DOE 2004c, Attachment C). The three support documents are enforceable by the U.S. EPA.

1.2 Summary of Support Documents

The OMMP establishes the design logic and priorities for the major flow and water treatment decisions needed to maintain compliance with the FCP's NPDES permit and ROD (OU 5) based surface water discharge limits. The OMMP is designed to guide and coordinate the extraction, collection, conveyance, treatment and discharge of all groundwater, storm water, sanitary and remediation wastewater generated sitewide through the duration of the cleanup program. A summary of the information contained in the OMMP is included in Section 3.1.3, Groundwater Remedy and Monitoring. Periodic reviews and updates of the OMMP will be conducted to respond to needed changes in program emphasis or the addition of new components, as necessary.

The PCCIP addresses the inspection, monitoring and maintenance activities necessary to ensure the continued proper performance of the OSDF. Key concepts addressed include ownership; access controls and restrictions; deed and/or use restrictions; environmental monitoring; leachate

management; inspections; custodial maintenance; contingency repair; corrective actions; emergency notifications; reporting; and public involvement. Additional details from this plan are included in Section 3.2.1, OSDF Inspection and Maintenance. The PCCIP will continue to be updated throughout the closure period as needs and requirements for the care of the OSDF change. Section 11.2 of the PCCIP lists conditions under which the PCCIP may require modification.

The GWLMP specifies the frequencies and parameters being monitored in four horizons for each cell of the facility. These horizons are the leachate collection system (LCS), the leak detection system (LDS), perched water in the glacial overburden, and the Great Miami Aquifer (GMA) (both up- and down- gradient of each cell). Cell-specific data from these four horizons are evaluated holistically in order to verify the integrity of the cells. To date the data from this comprehensive leak detection program indicate that the liner systems for the existing cells (Cells 1, 2, and 3) are performing within the specifications established in the OSDF design documentation. The GWLMP is a "living document," that is, it will be modified over time as the OSDF is constructed and the individual cells are capped. These modifications will be based on the data collected prior to and just after capping. The final version of the GWLMP will govern the post closure leak detection and leachate monitoring program for the OSDF and will be attached to the final version of this IC Plan. Further details from the GWLMP are included in Section 3.2.2, Leak Detection/Leachate Management and Table 3-2.

1.3 Definition and Purpose of Institutional Controls

ICs are important to help minimize the potential for exposure to and release of residual contaminants, ensuring the protection of human health and the environment. ICs are also important in helping to protect engineered remedies by providing a means to ensure the remedy remains effective, is not showing signs of failure, or is not being vandalized or damaged by outside elements (natural or human) in any way.

The EPA, in draft guidance documents, has defined ICs as administrative and/or legal controls (i.e., non-engineered) that help to minimize the potential for human exposure to contamination and/or protect the integrity of a remedy. ICs work by limiting land or resource use by providing information to modify or guide human behavior at the site.

DOE has defined ICs as mechanisms designed to appropriately limit access to or uses of land and facilities, to protect cultural and natural resources, to maintain physical security of DOE facilities, and to prevent or limit inadvertent human and environmental exposure to residual contaminants. ICs include methods to preserve knowledge and to inform current and future generations of hazards and risks (DOE 2000).

Although the DOE and EPA definitions differ slightly, (DOE includes physical controls, such as fences and gates, as institutional controls) they both focus

on the same goal, to protect human health and the environment from residual hazards.

1.4 Types of Institutional Controls

The ICs that will be used at the FCP during legacy management, and are outlined in this plan, can be grouped into two categories, which are described below. The site was also divided into two sub-areas for IC purposes: the FCP site and the OSDF. The OSDF includes the disposal facility and its buffer area. This area will be enclosed by a fence and locked at all times, unless authorized personnel require access. The FCP site is all of the remaining property on site. The FCP site will be an accessible area to employees and the public, with only very small, fenced off, restricted area. The two areas are treated separately because of the greater restrictions that apply to the OSDF.

Controls on Disturbance and Use of the FCP (Section 2.0) – describes ICs that will apply to both the FCP Site and the OSDF that are designed to limit access and land use. This category of controls will focus on ensuring the FCP remains in a configuration consistent with the designated land use and that unauthorized uses of the FCP do not occur. These include proprietary controls; governmental controls; and preventing unauthorized use by means of informational devices, security, physical barriers and routine inspections. Tables 2-1 and 2-2 are a summary of these controls.

Controls to Minimize Human and Environmental Exposure to Residual Contaminants (Section 3.0) – Describes the controls (i.e., monitoring and sampling) used to ensure continued protection of human health and the environment. This category of controls will focus on maintaining engineered systems and infrastructure that are designed to protect human health and the environment. These include routine inspections, permits, continuing remedial activities, routine maintenance and monitoring, and leachate management practices. Tables 3-1 and 3-2 area a summary of these controls.

1.5 Agency Requirements for Institutional Controls

The need for ICs is described in the OU 2 and OU 5 RODs (Appendix B). The intent of the IC Plan is to describe the physical controls on access as well as the administrative and other ICs that will be implemented at the FCP. This IC Plan will be submitted to the U.S. EPA under the OU 5 ROD as a primary document. This IC Plan is an enforceable document with U.S. EPA.

1.6 Updates to the Institutional Controls Plan

Updates to this Plan will be managed by the Office of Legacy Management. Updates may be completed on an as-needed basis, based on resuits of the site and OSDF inspections and monitoring. The Plan will also be reviewed every five years in conjunction with the CERCLA five-year review. Updates may also be made at that time. Any proposed updates will be subject to review by the Regulatory Agencies.

FERNALD LEGACY MANAGEMENT
Future Use

LAND USE

- 395 acres of Woodlots
- 327 acres of Prairie
- 81 acres of Wetlands
- 60 acres of Open Water
- 75 acres of OSDF
- 33 acres of Savanna
- 30 acres of Development Area
- 49 acres of Infrastructure / Set Aside

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Graphic # 8131.4 6/04

2.0 CONTROLS ON DISTURBANCE AND USE OF THE FCP

2.1 FCP Site

The primary ICs on disturbance and use of the general FCP site include limiting access and land use, ensuring the site configuration remains consistent with designated land use (non-residential and non-agricultural uses only), and preventing unauthorized use of the FCP. The institutional controls for disturbance and use of the FCP are summarized in Table 2-1.

2.1.1 Proprietary Controls and Points of Contact

"Proprietary" controls are those controls that originate from the responsibilities associated with the ownership of property. These controls are established to ensure that the FCP site remains in a configuration consistent with the designated land use and ensuring unauthorized uses do not occur. In the case of the FCP, the federal government will maintain ownership of the FCP, as stated in the OU2 ROD (DOE 1995). Primary and secondary points of contact will be established to ensure authorized and emergency access (Appendix C). In the event of an emergency on-site, unacceptable behavior is observed, or someone has questions, the points of contact should be contacted. The following list of actions will be prohibited to ensure ongoing protection of the site itself and for anyone using the site. Prohibited actions will be clearly posted along the site perimeter, including access points. The following land use restrictions are not intended to be all-inclusive and will be finalized in this document's final version prior to closure.

- No removal or intentional damage of plants by unauthorized personnel.
- No removal or intentional damage of archaeological materials (as defined in the Archaeological Resources Protection Act).
- No swimming or wading in creeks, ponds or wetlands.
- No soil excavation for any reason by unauthorized personnel.
- No vehicles may leave designated roads.
- No dumping of any kind on the FCP.
- No smoking in prohibited areas, fires or other open flames.

Land use restrictions may be modified or terminated in consultation with USEPA.

2.1.2 Governmental Controls

A part of the governmental controls at the FCP will be the use of real estate notations and restrictions, should they become necessary. Notations on land records or similar restrictive real estate licenses will be in place for the FCP and off-site property that is impacted by FCP site activities. The Office of Legacy Management will ensure the real estate notations remain in place, as long as they are needed. In

addition, should there be a transfer of ownership of any part of the site, DOE will ensure compliance with Section 120(h) of CERCLA regarding transfer of ownership. Per the OU2 and OU5 RODs, deed restrictions, if implemented, will be reviewed on a regular basis by the Office of Legacy Management to ensure they remain in effect with the local authorities. A review of notations or real estate restrictions and other ICs will also be part of the CERCLA five-year review process.

In the event that DOE transfers management of or leases the property to an entity other than DOE, the appropriate restrictions and limitations will be communicated and implemented (e.g. zoning restrictions). A description of the various types of ICs pertaining to ownership and/or transfer of DOE land is included in Selecting and Implementing Institutional Controls in RCRA and CERCLA Response Actions at Department of Energy Facilities (DOE 2000).

For lands transferred to other Federal agencies, proprietary controls may not be an option because a deed does not exist or the landholding Federal agency lacks the authority to encumber the property. In such cases, DOE will work with the agency to ensure that institutional controls for the active site will remain effective. This may be documented in a memorandum of understanding or other appropriate instrument.

2.1.3 Preventing Unauthorized Use of the FCP

2.1.3.1 Informational Devices

Postings placed along the perimeter of the FCP, at all access locations, and on fences and gates will indicate site access restrictions, activity restrictions, and contact information. The OSDF restricted area, the CAWWT and fenced extraction wells will be posted (see Section 2.2.3) (Figure 2).

2.1.3.2 Security of Site Facilities and Infrastructure

Site facilities and structures will be locked when personnel are not present during "non-business" hours. Some site infrastructure such as the OSDF restricted area, the CAWWT an un-housed extraction wells, will have fences constructed around them to prevent unauthorized access. Controls also include enforcing the land use restrictions, maintaining fences and other infrastructure (as needed), and replacing or updating postings as needed to ensure the security of the site (Figure 2).

2.1.3.3 Routine Inspection of Property

Inspection of site property and infrastructure will be conducted on a quarterly basis. Inspections will include such things as fences, signs/postings, and the condition of perimeter areas, roadways, pathways, and access points (Figure 2). The attached example inspection checklist (Appendix D) outlines important components of all inspections for the FCP site (all areas outside the OSDF). The inspections will focus on key parameters to ensure that the primary institutional controls for the FCP are being maintained. The inspections will also include consultation with the public, regulatory agencies, local emergency response personnel and other key stakeholders. Ensuring that legacy management information is being managed and made available, as required by this LMICP, is also a key component of the inspections.

In addition to site inspections, agreements may be reached with the local law enforcement authorities to make perimeter checks of the site on a more frequent basis. Any unauthorized behavior noticed should immediately be reported to the site contact immediately.

2.2 OSDF

The primary ICs for the disturbance and use of the OSDF include limiting access to the OSDF and preventing unauthorized use of the OSDF and its associated buffer area. Engineered barriers, such as fencing, gates and locks are also important ICs (Figure 2). The ICs are summarized in Table 2-2. The table includes a description of the IC, where else the IC is referenced and what requirements drive the ICs. Primary and secondary points of contact will be established to ensure authorized and emergency access, and open communication (Appendix C).

2.2.1 Proprietary Controls and Points of Contact

"Proprietary" controls are those controls that originate from the responsibilities associated with the ownership of property. The first is that the federal government will maintain property ownership in perpetuity, as stated in the OU2 ROD. A second is that primary and secondary points of contact will be established to ensure authorized and emergency access, and open communication.

2.2.2 Governmental Controls

A fundamental part of governmental controls will be the use of real estate notations and restrictions. Notations on land records or similar restrictive real estate licenses will be in place for the land occupied by the OSDF. The Office of Legacy Management will ensure the real estate notations remain in place. DOE will also maintain the responsibility to manage and maintain the OSDF and all other activities needed to ensure that remedies remain effective. Any contract support required to implement specific aspects of maintenance and monitoring will be made aware of all restrictions on use and disturbance of the OSDF.

2.2.3 Preventing Unauthorized Use

Physical barriers to restrict access to the OSDF and its surrounding buffer area will include exclusion fencing, gates and locks, which will be maintained. Signs and postings will include information on restrictions, access information, contact information, and emergency information (Figure 2).

TABLE 2-1
CONTROLS ON DISTURBANCE AND USE OF THE FCP SITE

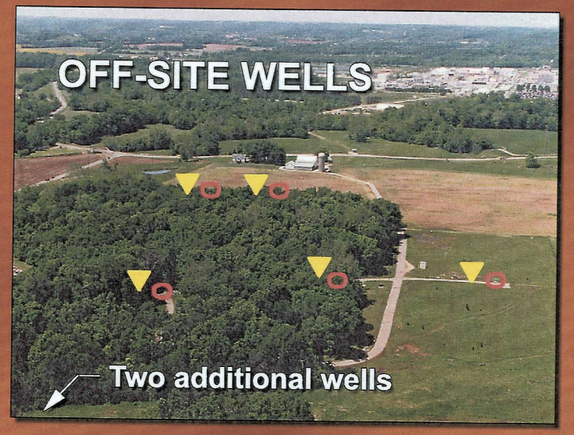
CONTROL	REQUIREMENT	FREQUENCY	SCOPE
PROPRIETARY CONTROLS			
1. Establish points of contact	1. DOE legacy management Guidance	1. Initially and when updates are needed	1. Provide primary and backup points of contact for emergencies. Points of contact will be updated in the Legacy Management Plan as needed. DOE-LM 24-hour emergency line is 877-695-5322.
2. Ownership	2. OU 2 ROD OU 5 ROD DOE legacy management Guidance	2. NA	2. Federal government will maintain ownership of site property. Management will transition from the DOE Office of Environmental Management to the DOE Office of Legacy Management.
GOVERNMENTAL CONTROLS			
1. Notations on land records or real estate restrictive license	1. OU 2 ROD OU 5 ROD	1. Annual verification	1. If oversight of portions of the FCP property (outside of the disposal facility area) is transferred at any time, all zoning and real estate restrictions will be communicated to the appropriate parties, and proper notifications will be provided as required.
PREVENTING UNAUTHORIZED USE OF THE FCP			
1. Access controls	1. OU 2 ROD OU 5 ROD	1. Quarterly	1. In order to maintain the integrity of the site, access may need to be limited or restricted in some areas. Signs indicating restricted access will require monitoring and maintenance to ensure their legibility and integrity.
2. Routine Site Inspections	2. OU 2 ROD OU 5 ROD	2. Quarterly	2. Inspections will be conducted to ensure infrastructure, signs/posting, fences/gates, perimeter areas, and access points are in a secure and safe configuration per FCP Site Areas Post Closure Inspections Checklist (Appendix B).

TABLE 2-2
CONTOLS ON DISTURBANCE AND USE OF THE OSDF

CONTROL	REFERENCE	REQUIREMENT	FREQUENCY	SCOPE
PROPRIETARY CONTROLS				
1. Establish points of contact	1. PCCIP	1. OAC 3745-27-11(B)(3) OAC 3745-66-18(c)(3) OAC 3745-68-10 40 CFR Sec. 258.61(c)(2) 40 CFR Sec. 265.118(c)(3) 40 CFR Sec. 264.118(b)(3)	1. Initially and when updates are needed	1. Provide primary and backup points of contact to ensure authorized and emergency access. Points of contact are provided in Table 4-2 of the PCCIP. Updates will be provided as needed. DOE LM 24-hour emergency number is 877-695-5322.
2. Ownership	2. PCCIP	2. OU2 ROD OU5 ROD	2. NA	2. The federal government will maintain property ownership of the area comprising the OSDF and associated buffer areas. Management will transition from the DOE Office of Environmental Management to the DOE Office of Legacy Management.
GOVERNMENTAL CONTROLS				
1. Notations on land records or real estate restrictive license	1. PCCIP	1. OU2 ROD OU5 ROD	1. NA	1. If in place, verify on an annual basis real estate restrictions are still in place. Restrictions will be provided in the deed, and proper notifications will be provided as required.
PREVENTING UNAUTHORIZED USE OF THE FCP				
1. Informational devices	1.PCCIP	1. OU2 ROD	1. NA	1. Signs and postings will include information on restrictions, access information, contact information, and emergency information.
2. Engineered barriers	2. PCCIP	2. OU2 ROD	2. NA	2. Access to the OSDF will be physically restricted by means of fences, gates and locks.

FERNALD LEGACY MANAGEMENT
Institutional Controls

INSTITUTIONAL CONTROLS
- Controls on Disturbance and Use
- Controls to Minimize Human and Environmental Exposure to Residual Contamination
- Information Management for Institutional Controls



POSTING

FENCE

GATE

Fluor Fernald

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3.0 CONTROLS TO MINIMIZE HUMAN AND ENVIRONMENTAL EXPOSURE TO RESIDUAL CONTAMINANTS

3.1 FCP Site

ICs will be established for the FCP site to minimize the potential of human and environmental exposure to residual contaminants, ensuring it is below acceptable limits. These include monitoring and sampling to ensure continued protection from exposure, and maintaining engineered systems and infrastructure designed to protect human health and the environment. Further details on these controls are discussed below and are included in Table 3-1.

3.1.1 FCP Site Inspections

DOE will conduct quarterly FCP site inspections to ensure there are no activities being conducted on site that would pose a threat to human health or the environment. After a year, the frequency of the inspections will be re-evaluated. A list of prohibited activities will be posted along the site perimeter and at access points. Inspections of the area outside the OSDF will be performed per the FCP Site Area Post Closure Inspection Checklist (see example, Appendix D) and will ensure that infrastructure designed and in place for the protection against human exposure to contaminants, such as fences and signs, are in good condition and functioning as intended. More frequent inspections may be required under certain circumstances (a pattern of unauthorized activities or uses). If warranted, more frequent inspections will be carried out to ensure site restrictions are being maintained (Figure 2, Appendix D).

3.1.2 Surface Water Discharge

Until the groundwater remedy is complete, a National Pollutant Discharge Elimination System (NPDES) permit or similar permit mechanism will need to be in place for surface water discharge to the GMR. Monitoring and reporting to maintain compliance with the permit requirements will be part of post-closure responsibilities at the FCP. Completion of the groundwater remedy will include the close out of the permit for surface water discharge. If prior to completion of the remedy it is decided that it is no longer necessary to monitor a particular outfall location, it may be removed from the permit at that time.

3.1.3 Groundwater Remedy and Monitoring

Aquifer restoration operations and maintenance activities are part of an on-going remedial action governed by the OU5 ROD. The requirements for the operations and maintenance activities are outlined in the OMMP (DOE 2004, Revision 1, Attachment A). The OMMP, as originally written, defines the operating philosophy for the extraction and re-injection treatment systems (re-injection is not being used at this time); establishment of operational constraints and conditions for given systems; and the establishment of the process

for reporting and instituting corrective measures to address exceedences in discharge limits. How to address exceptional operating conditions is also addressed.

Section 2.0 of the OMMP discusses the general commitments of the aquifer restoration. Provided are details regarding the aquifer cleanup levels, discharge limits, groundwater treatment capacity, groundwater treatment decisions, extraction rates and injection rate and quality (although injection is no longer used).

Section 3.0 of the OMMP goes into more specific detail about the design of the groundwater remediation systems, well field designs, and pump details. Section 4.0 discusses the projected flow during remediation activities. Section 5.0 discusses the Operations Plan, Section 6.0 discusses Operations and Maintenance, and Section 7.0 discusses Roles and Responsibilities. Section 6.0 and 7.0 provide information that pertain directly to ICs.

Once the groundwater remedy has been certified as complete (which will be defined in a Groundwater Certification Plan that is due to the EPA prior to the end of 2005) by DOE and approved by EPA, the well field infrastructure will be decommissioned and dispositioned as necessary. Post-remedy groundwater monitoring requirements (if any) will be defined as part of the groundwater remedy certification, and incorporated into a later version of this Plan. Any additional groundwater monitoring would be carried out along with the other requirements of this Plan and evaluated as part of the CERCLA five-year reviews.

3.2 OSDF

ICs will be established for the OSDF and its buffer area to ensure the prevention of human and environmental exposure to residual contaminants. Further details about these controls are discussed below and are included in Table 3-2. Details regarding OSDF inspection and maintenance, leak detection/leachate monitoring and leachate management are included in the PCCIP (Attachment B). The OSDF was constructed to permanently contain impacted materials derived from the remediation of the operable units at the FCP. All material placed in the OSDF is required to meet pre-established waste acceptance criteria (WAC). The WAC are presented in Table 3-1 of the PCCIP. The PCCIP also provides a description of the types of material or material categories (Table 3-2, PCCIP) that are allowed in the OSDF. The design and construction of the OSDF is described in Section 3.0.
Section 4.0 of the PCCIP discusses the ICs for the OSDF, which have been included and summarized in this IC Plan. Table 4-1 of the PCCIP shows ICs for the OSDF as they were identified in the OU 2 and OU 5 RODs.

Section 5.0 of the PCCIP discusses environmental monitoring activities that are necessary to continue during the post-closure care period, including air monitoring, groundwater monitoring, and other media (i.e., surface water, vegetation, etc.).

Section 6.0 provides in depth descriptions of the Leachate Management System, which is comprised of the leachate collection system and the leak detection system. This is discussed in Section 3.2.2 of this IC Plan. It provides the basic system operations, operation procedure information and inspection and maintenance activities. The inspection and maintenance activities are illustrated in Table 6-1 of the PCCIP and are used as part of the ICs for the OSDF. Section 6.7 discusses management of the leachate extracted from the OSDF, which is addressed in Section 3.2.3 of this IC Plan. Section 7.0 addresses routine inspections, which are important ICs. Section 3.2.1 of this IC Plan addresses these inspections in detail.

Also addressed in the PCCIP are unscheduled inspections (Section 8.0), custodial monitoring and contingency repairs (Section 9.0), and emergency notifications (Section 11.0).

3.2.1 OSDF Inspection and Maintenance

DOE will conduct inspection and maintenance on the cap and cover system. Inspections will be conducted quarterly until closure of the OSDF, then the frequency of inspections will be re-evaluated. Custodial and preventative maintenance and unscheduled inspections will be conducted as needed. Table 3-2 of this IC Plan provides current details on the required inspection and maintenance.

Routine inspections include monitoring the health of the vegetative cover; the existence of burrowing animals; the extent of surface erosion or cracking; subsidence, if any; extent of any leachate seeps; integrity of run-off controls; and integrity of benchmarks. If determined necessary or appropriate, the frequency of the routine inspections may be revised through the CERCLA five-year reviews. Routine custodial maintenance includes upkeep of vegetative cover; general mowing; clearing of debris and woody plants, and reseeding.

Unscheduled inspections will be conducted as needed if specific circumstances warrant. Examples would include follow-up on the completion of a maintenance action or cap inspection after an unusually large storm event. Based on the results and determinations made from the inspections, DOE will take appropriate actions to address any identified problems.

Maintenance and monitoring of the general support systems for the OSDF will include ensuring physical access controls and restrictions are maintained, routine inspections of the OSDF and surrounding area, routine maintenance activities, and environmental monitoring. Table 3-1 of this IC Plan provides additional detail on the required monitoring and maintenance.

The federal government will remain the property owner and access to the OSDF and associated buffer area will continue to be restricted in perpetuity by means of fences, gates, locks, and warning signs (Figure 2). Access is anticipated to be limited to personnel conducting inspections, custodial maintenance, and corrective action, and will be authorized by the federal government only.

Routine inspections will include evaluating the condition of physical access controls (fences, gates, locks, and signs); observing adjacent properties for evidence of land use changes; evaluating natural drainage courses in the immediate vicinity; and inspecting the general area for erosion, excess sediment, seepage and signs of human or animal intrusion. If determined necessary or appropriate, the frequency of the routine inspections may be revised through the CERCLA five-year reviews. More frequent monitoring is always a possibility, due to changes in the cap or surrounding areas; however, a decrease in frequency would require discussion, review and approval at the time of the five-year review.

3.2.2 Leak Detection/Leachate Monitoring

Routine OSDF leak detection and leachate monitoring is currently governed by the GWLMP (Attachment C). Section 3.0 of the GWLMP provides the regulatory analysis and strategy for the OSDF monitoring. The regulatory drivers come from the ARARs identified in the OU 2, 3 and 5 RODs. Section 4.0 of the plan provides significant detail on the OSDF leak detection monitoring program. The text includes the program elements, monitoring frequencies, selection of analytical parameters and data evaluation. Section 5.0 is a discussion of the leachate monitoring program. It discusses the management approach and monitoring needs. Section 6.0 provides the reporting requirements and notification and response actions for when there is excessive leak detection, which could be an indication of a failure in the cap or liner and could pose a threat to human health or the environment. Table 6-1 of the plan outlines these actions in detail.

3.2.3 Leachate Management

Also involved in the maintenance and monitoring of the OSDF system is the management of the leachate that enters the LCS. Additional information regarding leachate management is also found in Section 6.7 of the PCCIP (Attachment B). It is envisioned that leachate will continue to be treated on-site until weekly amounts collected are too small to continue operation of the on-site treatment facility. The leachate will be treated in the Converted Advanced Waste Water Treatment facility (CAWWT) as long as it is in operation. Treated leachate will be discharged to the GMR with other wastewater collected. Once the CAWWT is dismantled, leachate may be collected and transported for treatment off-site or treated as necessary in a small facility near the OSDF (post-closure leachate flow is anticipated to be < 1 gpm for the entire facility). The quantity of leachate collected, treated and discharged will continue to be documented. Leachate will be sampled and analyzed for a set of parameters specified in the OSDF GWLMP.

TABLE 3-1
CONTROLS TO MINIMIZE HUMAN AND ENVIRONMENTAL EXPOSURE TO RESIDUAL CONTAMINANTS FOR THE FCP SITE

CONTROL	REQUIREMENT	FREQUENCY	SCOPE
FCP SITE INSPECTIONS	OU 2 ROD OU 5 ROD	Quarterly initially. Frequency will be re-evaluated after the first year and through the CERCLA five year review process	• Inspect infrastructure in place for the protection against human exposure to contaminants, such as fences and postings, to ensure proper condition and function. • Inspect to ensure prohibited activities, such as digging, off-road travel, fishing or hunting, are not taking place on site.
SURFACE WATER DISCHARGE	IEMP	Quarterly initially. Frequency will be re-evaluated after the first year and through the CERCLA five year review process.	• Inspect surface water drainages and discharge to ensure water is not being impacted by other means, and that drainages are functioning properly.
GROUNDWATER REMEDY AND MONITORING	OMMP	Frequency of sampling and monitoring of groundwater is dependent upon the effectiveness of the remediation efforts and will vary over time.	• Monitor groundwater to ensure remedy is functioning properly until remedy certification is complete. Details are provided in the OMMP.

TABLE 3-2
CONTROLS TO MINIMIZE HUMAN AND ENVIRONMENTAL EXPOSURE TO RESIDUAL CONTAMINANTS FOR THE OSDF

CONTROL	REFERENCE	REQUIREMENT	FREQUENCY	SCOPE
OSDF INSPECTION AND MAINTENANCE 1. Routine OSDF cap inspection	1. PCCIP	1. OAC 3745-66-18(A) & (C) 40 CFR Sec. 264.118(b)(2) 40 CFR Sec. 265.118(c)(2) OU 5 ROD	1. Quarterly until closure, semi-annual Note that the monitoring frequency may be re-evaluated through the CERCLA five year review process	1. Detect and record any change of the following: • General health, density and variety of vegetative cover • Evidence of burrowing animals on the cover • Presence, depth, and extent of erosion or surface cracking, indicating possible cap deterioration • Visibly noticeable subsidence, either locally or over a large area • Presence and extent of visible settlement, including a determination of whether observed settlement is sufficient to pond water • Presence and extent of any leachate seeps • Integrity of run-on and run-off control features • Integrity of benchmarks The process for contingency planning and notification is provided in Section 4.0.
2. Unscheduled OSDF cap inspection	2. PCCIP	OU 5 ROD	2. As needed	2. Unscheduled inspections will be carried out as needed under specific circumstances (e.g., follow-up on maintenance, after significant natural events). Follow-up or contingency inspections will be conducted no more than 30 days after repair (see Section 4.0) to investigate and quantify specific problems encountered during a routine scheduled inspection, special study, or other DOE/regulatory agency activity. Follow-up inspections determine whether the cover/cap stability is threatened, and evaluate the need for maintenance/repair/corrective action. Contingency inspections may be situation-unique inspections ordered by DOE or regulatory agencies.

TABLE 3-2
(Continued)

CONTROL	REFERENCE	REQUIREMENT	FREQUENCY	SCOPE
3. Routine OSDF cap custodial and preventative maintenance	3. PCCIP	3. OAC 3745-66-18(A) & (C) 40 CFR Sec. 264.118(b)(2) 40 CFR Sec. 265.118(c)(2) OU 5 ROD OU 2 ROD	3. As needed (mowing of entire OSDF will occur at least once annually in late fall)	3. Routine custodial and preventative maintenance consists of the following: upkeep of the vegetative cover, general mowing, clearing of debris, removal of woody weeds and seedlings, reseeding
4. Routine OSDF site area inspection	4. PCCIP	4. OAC 3745-66-18(A) & (C) 40 CFR Sec. 264.118(b)(2) 40 CFR Sec. 265.118(c)(2) OU 5 ROD OU 2 ROD	4. Semi-annual Note that the monitoring schedule may be revised through the CERCLA five year review process	4. • Inspect the adjacent area within approximately 0.25 miles of the OSDF buffer area. Describe evidence of land use changes. • Inspect the adjacent area within approximately 0.25 miles of the OSDF buffer area. Describe evidence of land use changes. • Evaluate natural drainage courses in the immediate vicinity of the OSDF to determine whether there is a threat to the OSDF integrity. Walk approximately 1,000 feet of adjacent natural drainage courses and note unusual or changed sediment deposits, large debris accumulations, man-made or natural constrictions, and recent or potential channel changes. • Evaluate and record the development of gullies. • Evaluate growth of vegetation in channels. • Determine the condition and required maintenance of on-property roads. • Inspect and record the area adjacent to the OSDF for erosion channels, accumulations of sediment, evidence of seepage, and signs of animal or human intrusion.

TABLE 3-2
(Continued)

CONTROL	REFERENCE	REQUIREMENT	FREQUENCY	SCOPE
5. Unscheduled OSDF site area inspection	5. PCCIP	OU 5 ROD OU 2 ROD	5. As needed	5. Investigate reports that site integrity may be compromised. Follow-up or contingency inspections will be conducted to investigate and quantify specific problems encountered during a routine scheduled inspection, special study, or other DOE/regulatory agency activity. Determine whether the support systems are threatened, and evaluate the need for maintenance/repair/corrective action. Contingency inspections are situation-unique inspections ordered by DOE when it receives information indicating that site integrity has been or may be threatened.
6. Routine OSDF site area custodial and preventative maintenance	6. PCCIP	6. OAC 3745-66-18(A) & (C) 40 CFR Sec. 264.118(b)(2) 40 CFR Sec. 265.118(c)(2) OU 5 ROD	6. As needed (mowing will occur at least once annually in late fall)	6. • Repair/replace fencing, gates, locks, and signs due to normal wear, severe weather conditions, or vandalism. • Mow/clear undesired woody vegetation, reshape, reseed, repair banks, unplug culverts, and clean out channels of run-on/run-off diversion channels.
LEAK DETECTION/ LEACHATE MONITORING 1. OSDF Groundwater/ leachate monitoring	1. PCCIP & GWLMP	1. OAC 3745-27-10 OAC 3745-54-90 through 99	1. To be evaluated following closure of the facility	1. A routine monitoring program will be maintained for four zones within and beneath the OSDF. These zones include the LCS, the LDS, perched water within the glacial overburden, and the Great Miami Aquifer (GWLMP Section 3.2.1). Samples from the four zones will be collected and analyzed pursuant to requirements set forth in a future revision to the GWLMP.
2. Other OSDF environmental monitoring	2. PCCIP	2. DOE 5820.2A, Chapter III(3)(k)	2. To be evaluated following closure of the facility.	2. A site wide monitoring program may be required for at least a portion of the initial (30-year) post closure period. The specific parameters and frequencies will be presented in a future version of this Plan.
LEACHATE MANAGEMENT	PCCIP	OU 5 ROD GWLMP	As needed	Leachate will be treated on-site until weekly amounts collected are too small to continue on-site treatment. At that time, treatment will be off-site.

4.0 CONTINGENCY PLANNING

In the event that an unacceptable condition or disturbance occurs at the FCP during legacy management, corrective actions will be employed and appropriate notification will occur. Unacceptable conditions regarding disturbance or use of the FCP may include: unauthorized access to the site (e.g., off-road vehicles); attempts to use soil or water on the site in an inappropriate manner; attempts to access the OSDF; or damage to fencing, gates or postings. Unacceptable conditions related to exposure to residual contaminants could include damage or disruption to the OSDF or attempts to utilize groundwater still undergoing remediation.

To the extent that contingency actions can be anticipated or planned, they have been (and will continue to be) incorporated into the LMICP or attached support plans. Unanticipated contingency actions will be subject to CERCLA processes prior to implementation. The regulatory agencies, public and other stakeholders will be notified of any unanticipated contingency actions under CERCLA that has to be implemented.

Site inspections, monitoring and maintenance activities are designed to identify problems before they develop into a need for corrective action. In the unlikely case that a natural event, vandalism, or other event, threaten the integrity or operation of the OSDF or remainder of the site, corrective actions will be carried out to mitigate the problem. In addition, DOE will evaluate the factors that caused the problem and ensure that the possibility of recurrence is minimized or avoided.

The Office of Legacy Management will notify U.S. EPA and Ohio EPA of any IC breaches and DOE's plan for correcting them upon discovery of the situation. Final plans for other stakeholder notifications, as appropriate, will be described in the final version of this IC Plan issued prior to closure. Any activity that is inconsistent with the IC objective or use restrictions will be addressed by the Office of Legacy Management as soon as practical, but in no case will the process be initiated later than 10 days after the Office of Legacy Management becomes aware of the violation.

The DOE will notify U.S. EPA and Ohio EPA regarding how the DOE has addressed or will address the breach within 10 days of sending U.S.EPA and Ohio EPA notification of any activity that is inconsistent with the IC objective or use restriction or any action that interferes with the effectiveness of ICs. A follow-up inspection will occur within 30 days of the completion of any corrective action. The results of follow-up inspections will be provided to U.S. EPA and Ohio EPA.

Minor maintenance actions such as seeding small areas, minor erosion repairs on OSDF or other parts of site, replacement of postings and signs, minor fence and gate repair and minor maintenance of site infrastructure will not be subject to the notification process described above. The need for minor maintenance will be identified on routine inspection forms issued to U.S. EPA and Ohio EPA and will be subject to follow-up inspections as discussed above.

The Office of Legacy Management will send letters to the Hamilton County Sheriff's Department, Butler County Sheriff's Department, and both Ross and Crosby Township police and fire officials requesting that they notify the Office of Legacy Management in the event they observe an unauthorized human intrusion or unusual natural event. The U.S. Geological Survey National Earthquakes Information Center in Denver will be sent a letter by the Office of Legacy Management requesting that they notify the Office of Legacy Management in the event of an earthquake in the vicinity of the FCP. The Office of Legacy Management will also monitor emergency weather notification system announcements.

The public may use the 24-hour security telephone numbers monitored at the DOE Office at Grand Junction to notify the Office of Legacy Management of site concerns. The 24-hour security telephone numbers will be posted on the site perimeter, access points and other key locations on the site.

THE 24-HOUR EMERGENCY NUMBER

970-248-6070 OR 877-695-5322

5.0 INFORMATION MANAGEMENT FOR FCP INSTITUTIONAL CONTROLS

Information that is needed for IC purposes will be managed by the Office of Legacy Management, as the steward of the FCP. Any centralized system to provide stakeholders with access to information will also be managed by the Office of Legacy Management (see Table 6-1 in the legacy management Plan). Copies of selected information or data documenting past remedial activities (e.g., soil certification) and the design and contents of the OSDF will be retained and managed by the Office of Legacy Management for IC purposes. In addition, newly acquired information or data related to remedy performance will be readily available to stakeholders.

5.1 FCP Site

5.1.1 Inspection Data/Results

Inspection data will include information from inspections of the general site area, perimeter, access points, infrastructure, and signs and postings. The FCP Site Inspection Form (Appendix D) will be used to collect the data.

5.1.2 Public Access to Information

The Office of Legacy Management will make available to the public documents pertaining to FCP site inspections. These will include inspection forms, maintenance information and reports from non-routine inspections. These documents will be available on or near the FCP site. Additional information on information management and public access is presented in Volume 1 of this LMICP. It is also expected that information related to legacy management will be available through the Office of Legacy Management.

5.2 OSDF

5.2.1 Inspection Records

Inspection data will include information from inspections of the OSDF cap, infrastructure (e.g., LCS/LDS pipe networks), perimeter fencing, buffer area, and signs and postings. The OSDF Cell Post Closure Inspection Checklist (Appendix D) and the LCS/LDS Inspection Checklists will be used to collect the data.

5.2.2 Monitoring Data

Monitoring data will include monitoring of the leachate collection system, groundwater monitoring and any other environmental monitoring data that is required.

5.2.3 Public Access to Information

Data and Information pertaining to inspection and monitoring of the OSDF will be made available to the public. These will include routine inspection forms and checklists, monitoring data, and maintenance reports. These documents will be available on or near the FCP site.

Additional information on information management and public access is presented in Volume 1 of the LMICP.

5.3 Reporting

5.3.1 Routine Reporting

The Office of Legacy Management will issue annual reports to U.S. EPA, Ohio EPA and other key stakeholders, to be defined in a later version of this plan, providing information on ICs, monitoring, maintenance, site inspections and corrective actions. Once it is determined that the ICs are functioning, the remedy is performing as intended, and the GW remediation is effective, the reporting frequency nay be re-evaluated. In the event of unacceptable conditions or disturbance, more frequent notification reporting will be required as defined in Section 4.0. There will be reporting associated with the integrated Environmental Monitoring Plan (IEMP) while the aquifer remedy is on going. It is anticipated that IEMP reporting requirements and the Office of Legacy Management reporting requirements to support surveillance and maintenance of the site will be integrated. Final plans for integrating reporting requirements will be provided in the final version of this Plan. Assuming reporting requirements are integrated, the IEMP will be attached to the final version of the LMICP.

5.3.2 CERCLA Five-Year Review

Under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA), a review of the remedy at the FCP is required every five years. The CERCLA five-year reviews will focus on the protectiveness of the remedies associated with each of the five OUs. The IC portion of the CERCLA 5 year report will include the data collected from monitoring and sampling, summaries of the inspections conducted of the FCP site and OSDF site and cap during the five-year period, and a discussion on the effectiveness of the ICs. If a determination is made that a particular control is not meeting its objectives then planned corrective actions will be included in the report. The report will be written using the most recent guidance document available at that time.

An evaluation of the IC Plan will also occur as part of the five-year review. The effectiveness of ICs will be evaluated to determine if any update to the IC Plan is required. Any update to the IC Plan will be subject to review by the Regulatory Agencies.

REFERENCES

U.S. Department of Energy, 1995, "Record of Decision for Remedial Actions at Operable Unit 2", Final, Fernald Environmental Management Project, DOE, Fernald Area Office, Cincinnati, Ohio.

U.S. Department of Energy, 1996, "Record of Decision for Remedial Actions at Operable Unit 5", Final, Fernald Environmental Management Project, DOE, Fernald Area Office, Cincinnati, Ohio.

U.S. Department of Energy, 1998a, "Waste Acceptance Criteria Attainment Plan", Fernald Environmental Management Project, DOE, Fernald Area Office, Cincinnati, Ohio.

U.S. Department of Energy, 1998b, "Sitewide Excavation Plan", Final, Fernald Environmental Management Project, DOE, Fernald Area Office, Cincinnati, Ohio.

U.S. Department of Energy, 2000, "Selecting and Implementing Institutional Controls in RCRA and CERCLA Response Actions at Department of Energy Facilities", DOE, Office of Environmental Policy and Guidance.

U.S. Department of Energy, 2002, "Natural Resource Restoration Plan", Draft Final, Fernald Environmental Management Project, DOE , Fernald Area Office, Cincinnati, Ohio.

U.S. Department of Energy, 2004a, "Operations and Maintenance Master Plan for the Aquifer Restoration and Wastewater Project", Revision 1, DOE Fernald Area Office, Cincinnati, Ohio.

U.S. Department of Energy, 2004b, "Post-Closure Care and Inspection Plan, On-Site Disposal Facility", Revision 1, Fernald Environmental Management Project, DOE Fernald Area Office, Cincinnati, Ohio.

U.S. Department of Energy, 2004c, "Groundwater/Leak Detection and Leachate Monitoring Plan", Fernald Environmental Management Project, DOE Fernald Area Office, Cincinnati, Ohio.

APPENDIX A

CLEANUP PROGRAM STATUS

FCP Cleanup Program Status

Project	Work Scope	Status as of April 2004	2006 Strategy	Completion
Aquifer Restoration	– Remediate contaminated portions (approx. 170 acres) of the Great Miami Aquifer – Treat stormwater and wastewater resulting from site remediation activities	– Project - 66% complete – Extracted more than 14.9 billion gallons of water from the aquifer since 1993 – Treated more than 9.9 billion gallons of water – Removed more than 6,023 pounds of uranium from aquifer since 1993 – Successfully using re-injection well technology to speed aquifer remediation	– All infrastructure will be in place by 2006	2021
Building Demolition	– Dismantle 223 former production plants, support structures, and associated components	– Project - 63% complete – Dismantled 159 structures – Completed Safe Shutdown in March 1999, two years ahead of schedule and $7 million under budget – Current activities focused on D&D of Pilot Plant (last production plant standing)	– Add work crews, safety personnel, and equipment – Expedite demolition of structures	2006
Soil and Disposal Facility	– Remediate and dispose of contaminated soil – Certify site as clean and perform natural resource restoration	– Project – 51 % complete – Cell 1 – filled and capped – Cell 2 – filled and capped – Cell 3 – 99% filled – Cell 4 – 66 % filled – Cell 5 – 13 % filled – Cell 6 – 9% filled – Cell 7 – under construction – Excavated and dispositioned over 1.39 million cubic yards of contaminated soil – Over 57% of the site is certified "clean" – Completed six natural resource restoration projects	– Adopt self-performance and aggressive approach to work – Resequence work with more parallel activities – Greater integration with D&D and Waste Pit projects – Add Cell 8 to accommodate scope increase	2006
Silos 1 and 2	– Remove 8,900 cubic yards of high activity low-level waste from two concrete silos – Chemically stabilize waste and ship off site for disposal	– Project - 46 % complete – Construction – 75% complete – Accelerated Waste Retrieval Subproject – 100 % complete	– Use commercial design-build approach to integrate project activities and accelerate schedule – Implement a detailed constructability process to maintain required coordination of efforts – Revise design to increase operating flexibility and reduce downtime – Develop options for transportation and disposal	2006
Silo 3	– Remove 5,100 cubic yards of low-level waste from one concrete silo – Ship waste off site for disposal	– Project - 78 % complete – Construction is 100% complete – Waste retrieval to begin in May 2004 – Shipping to begin in June 2004	– Prepared ROD Amendment and Revised Proposed Plan to allow for treatment only as required to meet permitted disposal facility's waste acceptance criteria – Planning for opportunistic funding that would allow early completion	2006

000033

Project	Work Scope	Status as of April 2004	2006 Strategy	Completion
Waste Pits	– Remediate the contents of six waste pits containing low-level radioactive waste byproducts of uranium and thorium processing	– Project - 88 % complete – 115 unit trains pulling 6,830 cars have shipped 734,799 tons of waste	– Operate dryers 24/7 to address increased waste tonnage – Lease additional railcars – Evaluate plans to reduce number of shipments to Envirocare	2004
Waste Management	– Characterize, sample, package, and dispose of low-level radioactive, hazardous, and mixed waste site inventories – Provide site-wide support for waste planning and off-site shipping – Emphasize waste minimization, recycling or reuse wherever practical	– Project - 99% complete – Shipped 6.4 million cubic feet low-level waste to the Nevada Test Site for disposal – 99% complete – Shipped 163,912 low-level liquid mixed waste off site for incineration – 93% complete – Transferred 588,207 cubic feet low-level waste to Waste Pits Remedial Action Project – 94% complete – Transferred 792,510 cubic feet low-level waste to OSDF – 100% Complete – Shipped 23,778 cubic feet low-level mixed waste off site for treatment – 89% complete – Dispositioned all containerized waste on Plant 1 Pad – Approximately 1,300 containers remaining in inventory – Continue characterization, visual inspection, and packaging of uranium waste	– Maximize on site disposition of low-level waste – Pursue off-site treatment of mixed waste and low-level waste	2004
Nuclear Material Disposition	– Characterize, package, and ship nuclear materials off site	– Project – 100% complete – Dispositioned 31 million pounds of nuclear product through: ▪ Transfer to other DOE site for programmatic use ▪ Sale to private sector ▪ Transfer to Portsmouth Facility for interim storage under DOE's Uranium Facility Management Group (9.1 million net pounds transferred since June 1999) ▪ Burial of Department of Defense materials off site		2002

APPENDIX B

INSTITUTIONAL CONTROL REQUIREMENTS AS STATED IN THE RECORDS OF DECISION

INSTITUTIONAL CONTROL REQUIREMENTS AS STATED IN THE RECORDS OF DECISION

Operable Unit 2 Record of Decision (DOE 1995)

The selected remedy will include the following as institutional controls:

- Continued federal ownership of the OSDF site
- OSDF access restrictions (fencing, gates, and warning signs)l access will be controlled by proper authorization and is anticipated to be limited to personnel for inspection , custodial maintenance, or corrective action
- Restrictions on the use of property will be noted on the property deed before the property could be sold or transferred to another party
- Groundwater monitoring following closure of the on-site disposal facility

Operable Unit 5 Record of Decision (DOE 1996)

Long-term maintenance will be provided as part of the selected remedy. The selected remedy includes the following key components for institutional controls and monitoring:

- Continuation of access controls at the FCP, as necessary, during the conduct of remedial actions. Property ownership will be maintained by the federal government of the area comprising the disposal facility and associated buffer areas.
- Maintenance of remaining portions of the FEMP property (outside the disposal facility area) under federal ownership or control (e.g., deed restrictions) to the extent necessary to ensure the continued protection of human health commensurate with the cleanup levels established by the remedy. If portions of the FCP property are transferred or sold at any future time, restrictions will be included in the deed, as necessary, and proper notifications will be provided as required by CERCLA.
- Maintenance of the on-property disposal facility will be performed to ensure its long-term performance and the continued protection of human health and the environment.
- Conduct an environmental monitoring program during and following remedy implementation to assess the short- and long-term effectiveness of remedial actions.
- Provision of an alternate water supply to domestic, agricultural, and industrial users relying upon groundwater from the area of the aquifer exhibiting concentrations of contaminants exceeding the final remediation levels. The alternate water supply will be provided until such time as the area of the aquifer impacting the user is certified to have attained the final remediation levels.

APPENDIX C

FERNALD CLOSURE PROJECT CONTACT INFORMATION

EMERGENCY CONTACT
Grand Junction 24-hour Monitored Security Telephone Number
877-695-5322

PRIMARY CONTACT
Jane Powell
Department of Energy
Office of Legacy Management
Land and Site Management
Phone: 304-285-4687
Fax: 304-285-4100/0933
Email: jane.powell@netl.doe.gov

SECONDARY CONTACT
Jack Craig
Department of Energy
Office of Legacy Management
Office of Policy and Site Transition
Phone: 412-386-4754
Fax: 412-386-4775
Email: craig@netl.coe.gov

WEBSITES
Fernald site: http://www.fernald.gov

Office of Legacy Management site: http://www.lm.doe.gov

**This information will be updated as necessary.*

APPENDIX D

EXAMPLE OF OSDF AND FCP SITE INSPECTION FORMS

OSDF Cell 1 Post Closure Inspection Checklist

Date of Inspection:
Time of Inspection:
Inspection By:

Weather Conditions:
Temperature: ^{0}F
Transect Direction**

Wind Speed (Miles per hour) and Direction:

Inspection Component	Condition A* or U*	Comments	Corrective Action(s) Proposed	Reference Source
1. Entrance Road/Monitoring Access Road				
1A. Verify entrance gate, lock and signage are intact and in good working order.				PCC&IP 20100-PL-010 Rev. 1 July 97
1B. Verify that access gates are locked to prevent unauthorized entry.				"
1C. Visually observe condition of access road for signs of erosion, ruts, standing water, proper drainage and excess vegetation.				"
1D. Verify that access road surfacing, cross slope, reflectors, and signage are intact and in good condition.				"
2. Chain Link Fence and Signage				
2A. Walk length of fence and ensure fence, posts, etc. are intact and in good condition. Ensure that gates are closed/locked to prevent unauthorized entry.				PCC&IP & OSDF Tech Spec #02831
2B. Verify that the proper signage is intact and in good condition at the following locations: Restricted Access; Certified Area; and Restored Area. (Some signs not installed at this time).				"
2C. Check for vegetation growing over fences, barricades, signs and any noxious vegetation per State of Ohio Regulations (attached) and invasive plants growing on or around OSDF perimeter.				"
3. Surface Water Management				
3A. Check integrity of drainage channels around OSDF for erosion or debris restricting water flow (see attached map). Build up of debris/sedimentation in drainage ditch is not to exceed 6 inches.				OSDF Tech. Spec. #02270; PCC&IP
3B. Visually check the integrity of RipRap in drainage channels for signs of deterioration or removal of rock.				See above & OSDF Tech. Spec. #02271
3C. Visually check for the presence of woody vegetation growing in drainage channels and in Rip-Rap				"
3D. Visually check the integrity of run-on and run-off control features including: Ditch checks, Gravity Inlet structures, and Culverts.				See above & Construction Drawing # 90X-6000-G-00073

*A = Satisfactory *U = Unsatisfactory (comments required)
** Transect Direction should alternate each inspection (North to South & East to West)

OSDF Cell 1 Post Closure Inspection Checklist

Date of Inspection: Weather Conditions:
Time of Inspection: Temperature: 0F Wind Speed (Miles per hour) and Direction:
Inspection By: Transect Direction**

Inspection Component	Condition A* or U*	Comments	Corrective Action(s) Proposed	Reference Source
4. (A) Final Cover				
4A. Walk cover and side slopes in 25-ft (+/- 5-ft) transects and visually inspect for the following items:**				PCC&IP
4A1. Inspect erosion rills/channels. Flag any observable rills/channels greater than 3 inches wide and 6 inches deep or excessive erosion.				"
4A2. Any observable depressions, settlement/subsidence, slumping or desiccation cracks. Flag any observable depressions, slumps, settlement/subsidence or dessication cracks.				"
4A3. Any ponding or standing water. Flag any standing water.				"
4A4. Evidence of burrowing animals or other bio-intrusion. Flag any observable evidence of bio-intrusion.				"
4A5. Evidence of vehicle traffic on the OSDF cap.				"
4B. Walk toe of slope and visually inspect for the following:				PCC&IP & Phase III Drwgs #90X-6000-G-00302 & 90X-6000-G-00310
4B1. Evidence of settlement/subsidence, erosion, and seepage. Flag any observable evidence of settlement/subsidence, erosion, or seepage.				"
4B2. A 20-ft corridor at the toe for the presence of woody vegetation, siltation, and/or biointrusion. Flag any woody vegetation, siltation, and/or biointrusion.				"
4B3. Condition of rip-rap. Flag any observable abnormalities.				"
4C. Inspect toe at final cover for evidence of freezing or siltation. Flag any observable abnormalities.				"

*A = Satisfactory *U = Unsatisfactory (comments required)
** Transect Direction should alternate each inspection (North to South & East to West)

OSDF Cell 1 Post Closure Inspection Checklist

Date of Inspection: Weather Conditions:
Time of Inspection: Temperature: 0F Wind Speed (Miles per hour) and Direction:
Inspection By: Transect Direction**

Inspection Component	Condition A* or U*	Comments	Corrective Action(s) Proposed	Reference Source
4. (B) Final Cover — Vegetation				
4D. Walk cover and side slopes in 25-ft (+/- 5-ft) transects and visually check vegetative cover for the following:				OSDF Tech. Spec. #02930
4D1. General health of grass cover and signs of stressed or dead grass should be noted.				"
4D2. Adequate grass coverage/density with no bares spots greater than 3-ft in diameter. Flag any bare spots greater than 3-ft in diameter. Any areas with questionable vegetative coverage will be sampled for percent cover and type of vegetation using meter-square quadrats.				"
4D3. Inspect the cover for the presence of woody vegetation (i.e., trees or shrubs) or noxious/invasive plants growing. Flag any woody and/or noxious/invasive vegetation for removal/herbicide.				"
5. Cover Monitoring System				
5A. Visually inspect the integrity of the cover monitoring system: check Junction boxes, manholes, pressure transducer risers, soil water status nest headers, and settlement plates of the remote monitoring system for evidence of damage (see attached map). Check that lids and caps on enclosures are intact and in good working order.				OSDF Drwg. # 90X-5500-E-00581 & 90X-5500-G-00577
5B. Visually inspect monitoring system manholes and junction boxes for the presence of animals, insects, rodents or misc. biota. Note the presence or evidence of any biota.				"
5C. Visually inspect manholes and junction boxes and their immediate vicinity for the presence of standing water. Flag all standing water.				"
6. Groundwater Monitoring Wells				
6A. Visually inspect all groundwater wells for damage and integrity of well infrastructure.				PPC&IP
6A1. Groundwater Monitoring Wells				"
6A2. Horizontal Monitoring Wells				"

*A = Satisfactory *U = Unsatisfactory (comments required)

OSDF Cell 1 Post Closure Inspection Checklist

Date of Inspection: Weather Conditions:
Time of Inspection: Temperature: 0F Wind Speed (Miles per hour) and Direction:
Inspection By: Transect Direction**

Inspection Component	Condition A* or U*	Comments	Corrective Action(s) Proposed	Reference Source
7. Miscellaneous				
7A. Visually inspect the integrity of survey benchmarks. Flag/note any abnormalities.				PPC&IP
7B. Visually inspect the integrity of the perched water interceptor trench (once installed). Note any abnormalities.				
7C. Visually observe/inspect the corridor 50-ft outside of OSDF for signs/evidence of land use changes, settlement/subsidence, erosion, standing water, encroachment, livestock grazing or noxious vegetation. Note any changes/abnormalities.				
7D. Visually inspect all infrastructure for any act of vandalism.				"
7E. List any other observations not noted in the categories above.				"

*A = Satisfactory *U = Unsatisfactory (comments required)

FCP Site Area Post Closure Inspection Checklist

Date of Inspection:_____ Weather Conditions: Sunny/PtSunny/Cloudy/PtCloudy/Rain/Snow

Time of Inspection:_____ Temperature: _____ ^{0}F Wind Speed (Miles per hour) and Direction:_____

Inspection By:_____ Other observations_____

Inspection Component	Condition A* or U*	Comments	Corrective Action(s) Proposed	Reference Source
1. Disturbance and Use of FCP Site				
1A. Inspect access points to ensure that site restrictions and contact information are clearly posted.				LM & IC Plan
1B. Ensure that any perimeter gates/fences/barriers are in proper working condition.				"
1C. Visually inspect perimeter areas to ensure that no unauthorized use or disturbance is occurring.				"
1D. Note any change in adjacent off-property land use.				"
1E. Visually inspect site wetlands to ensure no dredge/fill or other type of disturbance is occurring.				Clean Water Act
1F. Visually inspect restored areas to ensure that prohibited Noxious weeds are not present.				Ohio Administrative Code
1G. Visually inspect northern portion of Paddys Run to ensure disturbance of Indiana Bat habitat is not occurring.				Endangered Species Act
1H. Annually verify that all Deed Restrictions and other Real Estate use restrictions are in place and are applicable.				LM & IC Plan
2. Prevent Human and Environmental Exposure to Residual Contaminants				
2A. Visually inspect infrastructure supporting Aquifer Remedy to ensure no unauthorized access or disturbance is occurring.				LM & IC Plan
2B. Visually inspect perimeter areas to verify that prohibited activities (e.g., digging, soil removal, swimming) are not occurring on FCP.				"
3. Information Management				
3A. Verify that site information is available to the public and other stakeholders as planned.				LM & IC Plan
3B. Verify that information on site inspections and maintenance is readily available.				LM & IC Plan
3C. Verify that requests for site information are being addressed and fulfilled as planned.				LM & IC Plan
3D. Verify that as-built drawings and information on OSDF contents and design are readily available.				LM & IC Plan

*A = Satisfactory *U = Unsatisfactory (comments and identification on site map required)

FCP Site Area Post Closure Inspection Checklist

Date of Inspection:_____ Weather Conditions: Sunny/PtSunny/Cloudy/PtCloudy/Rain/Snow

Time of Inspection:_____ Temperature: _____ ^{0}F Wind Speed (Miles per hour) and Direction:_____

Inspection By:_____ Other observations_____

Inspection Component	Condition A* or U*	Comments	Corrective Action(s) Proposed	Reference Source
4. Site Interviews				
4A. Contracted Land Manager – Identify any unusual occurrences or problems at FCP.				LM & IC Plan
4B. Site Information/Data Manager – Ensure site data is available and information is being managed as planned.				"
4C. Aquifer Restoration Manager – Verify that Aquifer remediation is progressing as planned and identify any unusual occurrences.				"
4D. Other staff as appropriate – Identify any problems or site issues.				"
4E. Hamilton County/Butler County Sheriff – Identify any concerns or issues.				"
4F. Ross/Crosby Township Police/Fire Departments - Identify any concerns or issues.				"
4G. Ohio "Call Before You Dig" Program Office - Ensure FCP information is properly noted to prevent unauthorized excavation on the site.				"
4H. Stakeholder Groups (e.g., FRESH, Post-Closure Coalition) – Identify any concerns or problems.				"
4I. Adjacent landowners.				

*A = Satisfactory *U = Unsatisfactory (comments and identification on site map required)

Attachment A

ATTACHMENT A

OPERATIONS AND MAINTENANCE MASTER PLAN FOR AQUIFER RESTORATION AND WASTEWATER TREATMENT

OPERATIONS AND MAINTENANCE MASTER PLAN FOR AQUIFER RESTORATION AND WASTEWATER TREATMENT

FERNALD CLOSURE PROJECT

JUNE 2004

U.S. DEPARTMENT OF ENERGY

2505-OM-001

Draft, Revision 2

OMMP Rev 2 Summary 6-25-04

Purpose of Revision:

1) To reflect the revised groundwater Final Remediation Level (FRL) and final effluent discharge standard to the Great Miami River of 30 micrograms per liter (µg/L) as a result of the Explanation of Significant Differences approved by the U.S. Environmental Protection Agency (EPA) on November 30, 2001 (DOE 2001),
   - Global change throughout document

2) To provide updates to information presented in past revisions as a result of 2006 Site Closure Plan,
   - Reflects the step down of treatment facilities, wastewater sources, and engineered wastewater headworks as the site move toward closure
   - Reflects the shutdown of well-based reinjection when CAWWT construction begins (10/04)
   - Reflects new SWRB operational approach where bypassing/overflow will no longer occur after BSL flows are routed to the SWRB (11/04) – *Control: hold water in excavations – pump water to SWRB*
   - Groundwater pumping rates defined through CAWWT construction period (1/05) – *will update later this year after we reach concurrence with the EPAs*
   - Storm water Remediation approach up to removal of SWRB (11/05) – *will update in spring/summer of 2005 after CAWWT stage II design is complete*

3) To reflect changes to operation philosophies resulting from continued refinements in groundwater modeling and wastewater treatment operations, and;

4) To be included as a support plan (Attachment A) for the Draft Comprehensive Legacy Management and Institutional Control Plan (LM&ICP).

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OPERATIONS AND MAINTENANCE MASTER PLAN FOR AQUIFER RESTORATION AND WASTEWATER TREATMENT

FERNALD CLOSURE PROJECT

JUNE 2004

U.S. DEPARTMENT OF ENERGY

Draft, Revision 2

TABLE OF CONTENTS

	Page
List of Acronyms	vi
List of Figures	v
List of Tables	v
1.0 Introduction	1-1
1.1 Scope of ARWWT and Objectives of OMMP	1-1
1.2 Basis and Need	1-2
1.3 Relationship to Other Documents	1-5
1.4 Plan Organization	1-6
1.5 Program Modifications and Revisions	1-7
2.0 Summary of Regulatory Drivers and Commitments	2-1
2.1. General Commitments and Constraints for the ARWWT	2-1
2.1.1 Aquifer Restoration	2-1
2.1.2 Storm Water Management	2-3
2.1.3 Wastewater Treatment	2-4
2.2 Analysis of Regulatory Drivers and Existing Permit Requirements	2-5
2.2.1 Point Source Air Emissions	2-5
2.2.2 Surface Water and Treated Effluent	2-6
2.2.3 Groundwater Restoration	2-6
2.2.4 Hazardous Waste Management	2-7
2.2.5 Existing Environmental Permits and Permit Information Summaries	2-7
3.0 Descriptions of Major ARWWT Components	3-1
3.1 Groundwater Component	3-1
3.1.1 Current Groundwater Restoration Modules	3-2
3.1.1.1 South Plume Module	3-2
3.1.1.2 South Field Module - Phase I	3-3
3.1.1.3 Injection Demonstration Module	3-3
3.1.1.4 Waste Storage Area Extraction System (Phase I) Module	3-4
3.1.2 Future Groundwater Restoration Modules	3-4
3.1.2.1 Waste Storage Area Extraction System Module Phase II	3-4
3.1.3 Groundwater Collection and Conveyance	3-5
3.1.4 Great Miami Aquifer Remedy Performance Monitoring	3-6
3.1.5 Perched Groundwater	3-6
3.2 Other Site Wastewater Sources/Systems	3-7
3.2.1 Storm Water Component	3-7
3.2.1.1 Storm Water Collection and Conveyance	3-7
3.2.1.2 Storm Water Monitoring	3-7

TABLE OF CONTENTS
(Continued)

	Page
3.2.2 Remediation Wastewater Component	3-7
3.2.2.1 Remediation Wastewater Collection and Conveyance	3-7
3.2.2.2 Remediation Wastewater Monitoring	3-8
3.2.3 Sanitary Wastewater Component	3-8
3.2.3.1 Sanitary Wastewater Collection and Conveyance	3-8
3.2.3.2 Sanitary Wastewater Monitoring	3-8
3.3 Treatment Systems	3-8
3.3.1 Advanced Wastewater Treatment (AWWT) Facility	3-9
3.3.1.1 AWWT Phase I	3-9
3.3.1.2 AWWT Phase II	3-10
3.3.1.3 AWWT Expansion	3-10
3.3.1.4 CAWWT Facility	3-10
3.3.2 Interim Advanced Wastewater Treatment (IAWWT) System	3-10
3.3.3 South Plume Interim Treatment (SPIT) System	3-11
3.3.4 Sewage Treatment Plant	3-11
3.4 Ancillary Facilities	3-11
3.4.1 System Headworks	3-11
3.4.1.1 Storm Water Retention Basin (SWRB)	3-11
3.4.1.2 Biodenitrification Surge Lagoon (BSL)	3-12
3.4.1.3 Headworks Sludge Removal Systems	3-12
3.4.1.5 Sanitary Lift Station	3-13
3.4.1.6 Great Miami Aquifer	3-13
3.4.2 SWRB Valve House	3-13
3.4.3 South Field Valve House	3-13
3.4.4 Parshall Flume	3-13
3.5 Current Treatment Performance	3-14
3.6 Current and Planned Discharge Monitoring	3-14
3.6.1 NPDES Monitoring	3-14
3.6.2 Radionuclide and Uranium Monitoring	3-15
3.6.3 IEMP Surface Water and Treated Effluent Monitoring Program	3-17
4.0 Projected Flows	4-1
4.1 Groundwater	4-1
4.1.1 Projected Groundwater Extraction Rates	4-2
4.2 Storm Water	4-2
4.2.1 Storm Water Retention Basin (SWRB)	4-3
4.3 Remediation Wastewater	4-3
4.3.1 Storm Water Sources Previously Discharged to BSL	4-4
4.3.2 Places Wastewater Previously Discharged to the BSL	4-5
4.4 Sanitary Wastewater	4-6

TABLE OF CONTENTS
(Continued)

	Page
5.0 Operations Plan	5-1
5.1 Wastewater Treatment Operations Philosophy	5-1
5.2 Treatment Priorities	5-1
5.3 Hierarchy of Treatment Decisions	5-2
5.4 Wastewater Treatment Operations Decisions	5-3
5.4.1 Operational Period 2: AWWT Phases I and II with SPIT and IAWWT	5-3
5.4.2 Operational Period 3: CAWWT Operations with SPIT and IAWWT	5-4
5.4.3 Operational Period 4: CAWWT Operations after SPIT and IAWWT Shutdown until SWRB Shutdown	5-5
5.4.4 Operational Period 5: CAWWT Operations after SWRB is Shutdown until Capping of the Last Cell	5-6
5.4.5 Operational Period 6: CAWWT Operations after Last Cell is Capped	5-6
5.4.6 Groundwater	5-6
5.4.6.1 Groundwater Treatment Prioritization vs. Bypassing	5-7
5.4.7 Ion Exchange Vessel Rotation	5-7
5.5 Well Field Operational Objectives	5-8
5.6 Operational Maintenance Priorities	5-8
5.7 Operations Controlling Documents	5-9
5.8 Management and Flow of Operations Information	5-10
5.9 Management of Treatment Residuals	5-10
6.0 Operations and Maintenance Methods	6-1
6.1 Management Systems	6-1
6.1.1 Maintenance and Support	6-1
6.1.2 Operations	6-2
6.1.2.1 Process Control	6-2
6.1.2.2 Standard Operating Procedures	6-3
6.1.2.3 Conduct of Operations	6-4
6.1.2.4 Training	6-4
6.1.2.5 Self-Assessments	6-4
6.1.2.6 Oversight	6-5
6.2 Restoration Well Performance Monitoring and Maintenance	6-5
6.2.1 Operational Monitoring and Performance Testing	6-5
6.2.2 Routine Well/Screen Maintenance	6-6
6.3 Treatment Facilities Performance Monitoring and Maintenance	6-7
6.3.1 Treatment Facilities Performance Monitoring	6-7
6.3.2 Treatment Facilities Maintenance Practices	6-8

TABLE OF CONTENTS
(Continued)

	Page
7.0 Organizational Roles, Responsibilities, And Communications	7-1
7.1 Organization Roles and Responsibilities	7-1
7.1.1 DOE Fernald	7-1
7.1.2 Operating Contractor	7-1
7.2 Integration with Other Project Organizations	7-3
7.3 Regulatory Agency Interaction	7-3
References	R-1

APPENDICES

Appendix A Aquifer Restoration and Wastewater Treatment Standard Operating Procedures
Appendix B Calculations Supporting Remediation Wastewater Flows
Appendix C ARWWP Standard Operating Procedures
Appendix D Groundwater Restoration Well Performance Monitoring and Maintenance Plan

LIST OF FIGURES

Figure 1-1 CAWWT Timeline
Figure 3-1 ARWWT Facilities Location Map
Figure 3-2 ARWWT Timeline
Figure 3-3 Current and Future Extraction and Re-Injection Wells for the Groundwater Remedy
Figure 3-4 Current Groundwater Remediation/Treatment Schematic
Figure 3-5 Aquifer Restoration Decision-Making Process
Figure 3-6 Wastewater Treatment Systems Simplified Process Flow Diagram
Figure 3-7 CAWWT Process Flow Diagram
Figure 3-8 Monthly Average Uranium Concentration in the Effluent to the Great Miami River at PF4001
Figure 3-9 Uranium Mass Balance by Treatment System for CY 2002
Figure 3-10 Uranium Mass Balance by Treatment System for CY 2003
Figure 3-11 IEMP Surface Water and Treated Effluent Sample Locations
Figure 3-12 IEMP Surface Water Data Evaluation and Associated Actions
Figure 4-1 Generalized Sitewide Remediation Areas
Figure 5-1A Phase I & II Operations with SPIT and IAWWT after BSL Shutdown
Figure 5-1B CAWWT Operations with SPIT and IAWWT
Figure 5-1C CAWWT Operations after SPIT and IAWTT Shutdown

LIST OF TABLES

Table 1-1 Operational Periods and Associated Key Operational Parameters
Table 2-1 Active Permits to Install & Operate
Table 2-2 Permit Information Summaries
Table 3-1 Status of Wastewater Sources and Treatment Systems
Table 3-2 Well Field Operating Status
Table 4-1 Extraction Rate/Re-Injection Rate Schedule
Table 4-2 Timeline of SWRB Contributing Areas
Table 5-1 Storm Water Retention Basin Levels and Capacities
Table 5-2 Well Field Operational Objectives

LIST OF ACRONYMS

ALARA	as low as reasonably achievable
ARARs	applicable or relevant and appropriate requirements
AR/WM	Aquifer Restoration/Water Management
ARWWT	Aquifer Restoration and Wastewater Treatment
AWWT	Advanced Wastewater Treatment Facility
BRSR	Baseline Remedial Strategy Report
BSL	Biodenitrification Surge Lagoon
CAWWT	Converted Advanced Wastewater Treatment Facility
CAWWT (EW)	Converted Advanced Wastewater Treatment Facility (excavation water)
CAWWT (GW)	Converted Advanced Wastewater Treatment Facility (groundwater)
CAWWT (SW)	Converted Advanced Wastewater Treatment Facility (storm water)
CERCLA	Comprehensive Environmental, Response, Compensation, and Liability Act
CRF	Code of Federal Regulations
D&D	decontamination and demolition
DOE	U.S. Department of Energy
DSDP	Demolition, Soil, and Disposition Project
EPA	U.S. Environmental Protection Agency
EW	excavation water
ESB	Emergency Spill Basin
FFCA	Federal Facilities Compliance Agreement
FPA	former production area
FRL	Final Remediation Level
FS	Feasibility Study
ft/sec	feet per second
gpm	gallons per minute
GW	groundwater
HAL	Health Advisory Limit
HEPA	high-efficiency particulate air
HNT	high nitrate tank
IAWWT	Interim Advanced Wastewater Treatment Facility
IEMP	Integrated Environmental Monitoring Plan
IRDP	Integrated Remedial Design Package
lbs/yr	pounds per year
µg/L	micrograms per liter
mgy	million gallons per year
mg/L	milligrams per liter
MCL	maximum contaminant level
mrem/yr	millirems per year
NESHAP	National Emissions Standards for Hazardous Air Pollutants
NPDES	National Pollutant Discharge Elimination System
OAC	Ohio Administrative Code
OEPA	Ohio Environmental Protection Agency

LIST OF ACRONYMS
(Continued)

OMMP	Operations and Maintenance Master Plan
OSDF	On-Site Disposal Facility
OSP	Operations and Support Project
PLS	Permanent Lift Station
POTW	Publicly Owned Treatment Works
ppb	parts per billion
PTI	permit to install
PTO	permit to operate
RA	remedial action
RCRA	Resource Conservation and Recovery Act
RD	remedial design
RD/RA	remedial design/remedial action
RI/FS	remedial investigation/feasibility study
RWW	remediation wastewater
SCEP	Soils Characterization and Excavation Project
SDF	Slurry Dewatering Facility
SOP	Standard Operating Procedure
SPIT	South Plume Interim Treatment System
STP	sewage treatment plant
SW	storm water
SWL	solid waste landfill
SWRB	Storm Water Retention Basin
TI	technical impracticability
UIC	Underground Injection Control
VOC	volatile organic compound
WAC	Waste Acceptance Criteria
WPASWRC	Waste Pit Storm Water Runoff Control
WPP	Waste Pits Project
WSA	waste storage area
WTO	Water Treatment Operations
WWTS	Wastewater Treatment System

1.0 INTRODUCTION

This document is the Operations and Maintenance Master Plan (OMMP) for Aquifer Restoration and Wastewater Treatment (ARWWT) at the U.S. Department of Energy's (DOE's) Fernald Site. The OMMP is a formal remedial design deliverable, originally prepared to fulfill Task 2 of the Operable Unit 5 Remedial Design (RD) Work Plan (DOE 1996a). It was first issued in November of 1997. The OMMP has undergone one previous revision, which was issued in December of 1999. This is the second revision, and has been to prepared for three primary reasons:

1) to reflect the revised groundwater Final Remediation Level (FRL) and final effluent discharge standard to the Great Miami River of 30 micrograms per liter (µg/L) as a result of the Explanation of Significant Differences approved by the U.S. Environmental Protection Agency (EPA) on November 30, 2001 (DOE 2001a),

2) to provide updates to information presented in past revisions as a result of 2006 Site Closure Plan, and;

3) to reflect changes to operation philosophies resulting from continued refinements in groundwater modeling and wastewater treatment operations.

1.1 SCOPE OF ARWWT AND OBJECTIVES OF OMMP

The scope of ARWWT includes the design, construction, and operation of the principal groundwater, storm water, remediation wastewater, and sanitary wastewater management facilities that support the Fernald site's overall cleanup mission. ARWWT encompasses all of the water-related elements within Operable Unit 5 and the Fernald site's other source-control operable units (Operable Units 1 through 4) that are necessary to meet their storm water, sanitary, and wastewater treatment and discharge needs.

The fundamental objectives of the OMMP are to guide and coordinate the extraction, collection, conveyance, treatment, and discharge of all groundwater, storm water, sanitary, and remediation wastewater generated site-wide over the life of the Fernald site's cleanup program. Compliance with discharge limits includes a plan of the commitments, performance goals, operating schedule, treated water flow rates, direct discharge flow rates, system-by-system sequencing, and other operating priorities. This plan also allows for balanced site-wide water management and provides the approach for the management of treatment residuals (treatment sludges, retention basin sediments, and spent resins/filtration media) that are by-products of the Fernald site's wastewater treatment processes.

The OMMP serves as a comprehensive statement of management policy to ensure that planned modes of operation and maintenance for ARWWT are consistent with regulatory requirements and satisfy the Fernald site's remedy performance commitments for groundwater restoration and wastewater treatment.

The plan establishes the decision logic and priorities for the major flow and water treatment decisions needed to maintain compliance with the Fernald site's National Pollutant Discharge Elimination System (NPDES) permit and Record of Decision-based surface water discharge limits. The plan also provides the overall management philosophy and decision parameters to implement the day-to-day flow routing, critical-component maintenance, and treatment priority decisions. It is not intended to provide detailed, specific operating or maintenance procedures for ARWWT. The plan also serves to inform EPA and the Ohio Environmental Protection Agency (OEPA) of the planned operational approaches and strategies that are intended to meet the regulatory agreements made during the Operable Unit 5 Remedial Investigation/Feasibility Study (RI/FS) (DOE 1995a and 1995b) process and documented in the Operable Unit 5 decision documents; the Operable Unit 5 Record of Decision (DOE 1996b), the Operable Unit 5 Explanation of Significant Differences, and the Operable Unit 5 Remedial Design Fact Sheet for Fernald Site Wastewater Treatment Updates (DOE 2004).

The plan serves to coordinate and schedule wastewater conveyance and treatment needs with other site projects throughout the duration of the remediation process at the Fernald site. As such, it provides the basis for development of more detailed internal operating procedure documents (e.g., Standard Operating Procedures, Standing Orders, and Preventive Maintenance Plans) that are required for execution of work at the Fernald site. The existing detailed procedural documents that govern the performance of water-related operations and maintenance activities at the Fernald site are expected to be updated (revised, combined, or eliminated) as required to conform with the general strategies, guidelines, and decision parameters defined in this plan.

1.2 BASIS AND NEED

The need for the OMMP arose as DOE and regulators realized that the various water and wastewater flows that originate from Fernald site remediation activities are in direct competition with one another for treatment resources. The wastewater treatment capacities at the Fernald site must, therefore, be prioritized so that: 1) discharge limits can be maintained; 2) a range of flow conditions at various time intervals can be accommodated; and 3) the detrimental effects of exceptional operating circumstances can be effectively managed. The need for treatment (and the accompanying hierarchy of treatment priorities) will vary over the span of the site remedy as new projects come on line, others are completed, and aquifer restoration activities progress.

It was recognized during the development of the Operable Unit 5 Record of Decision, that the monthly average concentration discharge limit for total uranium (established at 20 parts-per-billion [ppb] in the Operable Unit 5 Record of Decision and revised to 30 ppb in the Operable Unit 5 Explanation of Significant Differences) could probably be met under average operating conditions, but that maintaining

the limit may not be achievable during periods of exceptional operating conditions. It was further recognized that the application of the discharge limit was not considered as a required component of the remedy to ensure protectiveness, but rather as an appropriate performance-based objective that appeared reasonably attainable through the application of an appropriate level of water treatment. It was recognized that the performance-based discharge limit must be able to accommodate exceptional operating conditions anticipated to occur over the duration of the remedy. Two exceptional operating conditions were actually cited in the Operable Unit 5 Record of Decision that would permit relief allowances from the total uranium monthly average concentration discharge limit, when necessary, for:

- Storm water bypasses during high precipitation events
- Periodic reductions in treatment plant operating capacity that are necessary to accommodate scheduled maintenance activities.

It was agreed, at the time the Record of Decision was signed, that the OMMP would define the operating philosophy for: 1) the extraction/re-injection and treatment systems; 2) establishment of operational constraints and conditions for given systems; and 3) establishment of the process for reporting and instituting corrective measures to address exceedances of discharge limits. The OMMP also contains details of the manner in which exceptional operating conditions are to be accommodated and reported in the demonstration of discharge limit compliance.

The OMMP will be modified during the course of the remedy to accommodate changes to the treatment and well field systems or the retirement of individual restoration modules from service, once area-specific cleanup levels are achieved. The plan is intended to serve as a living guidance document to instruct operations staff in implementing required adjustments to the system over time. The OMMP will thus be evaluated periodically to ensure the most recent instructions regarding treatment priorities and flow routing decisions are available to system operators. Proper notifications for reporting bypasses and maintenance shutdowns of the system, and the reporting and application of corrective measures to address exceedances of discharge limits also are identified in the OMMP.

With site closure in 2006, several water treatment flows will be eliminated or reduced (i.e., remediation wastewater, sanitary wastewater, storm water runoff) from the scope of the treatment operation. Elimination/reduction of these flow streams provides an opportunity to reduce the size of the water treatment facility that will remain to service the aquifer restoration after site closure. Reducing the size of the treatment facility prior to site closure in 2006 will reduce the amount of impacted materials that may need future off-site disposal.

Between October 2003 and March 2004, DOE conducted a series of meetings with public stakeholders, the EPA, and the Fernald Citizen's Advisory Board to identify a more cost effective water treatment facility that would serve as a long-term replacement for the existing Advanced Wastewater Treatment (AWWT) facility. The interactions led to support for a plan to carve down the AWWT facility to permit the 1,800 gallons per minute (gpm) Phase II expansion system to remain as the long-term groundwater treatment facility. The converted 1,800 gpm AWWT facility (CAWWT) will provide 1200 gpm capacity for groundwater and about 600 gpm of storm water capacity (including carbon treatment) to handle the last remaining storm water and remediation wastewater flows. Once those flows have ceased, the CAWWT will provide a dedicated long-term groundwater treatment capacity of up to 1,800 gpm. During the time period that the AWWT is being "carved down" into the CAWWT, groundwater pumping will need to be reduced, and groundwater re-injection will need to be stopped in order to meet discharge limits at the Parshall Flume. The reduced operational flow rates are presented in Section 4. Figure 1-1 provides the timeline for the conversion of the AWWT facility and associated activities.

In addition to decreasing the size of the water treatment facility, operational approaches to the aquifer remedy are also under evaluation to determine if a more efficient way of remediating the aquifer can be found. Scenarios under evaluation include:

- Stopping well-based re-injection.
- Induced infiltration of water through the Storm Sewer Outfall Ditch.

A design evaluation that contains additional groundwater modeling of these two possible operational approaches, and plans for the field testing of the two approaches, will be issued for review at the same time that this revision of the OMMP is issued for review. The design evaluation will define flow rates for the time periods following start up of the CAWWT. Once agreement has been reached as to which approach the site should pursue, the OMMP will be updated to reflect the new, agreed upon design. Groundwater flow rates currently presented in Section 4 will carry the project through the CAWWT Stage I construction period (Operational Period 2 in Table 1-1).

The remaining operational periods and associated key operational parameters for ARWWT are provided in Table 1-1. Operational Period 1 will be in place as this draft of the OMMP (Revision 2) is being reviewed and will therefore be governed by Revision 1 of the OMMP. This OMMP specifies wastewater treatment operations protocol through Operational Periods 2, 3, and 4 - up until the time the Storm Water Retention Basin (SWRB) is taken out of service. The OMMP will be revised prior to shutdown of the SWRB to provide the operational approach for the remaining storm water/remediation wastewater flows after the SWRB is taken out of service.

1.3 RELATIONSHIP TO OTHER DOCUMENTS

The OMMP functions in tandem with several other major ARWWT design support plans. The environmental monitoring activities conducted in support of aquifer restoration performance decisions are being conducted and reported through the Integrated Environmental Monitoring Plan (IEMP) (DOE 2003a). Information obtained through the IEMP will be used to: 1) appraise groundwater restoration progress; 2) assess the need for changing groundwater extraction or re-injection flow rates; and 3) assess the durations of groundwater extraction and/or re-injection activities over the life of the remedy.

The initial design flow rates, planned installation sequence, detailed design basis, and overall restoration strategy for the aquifer restoration modules comprising the groundwater remedy were developed in the Baseline Remedial Strategy Report (BRSR) for Aquifer Restoration (DOE 1997a). The overall restoration strategy has been modified as a result of information gained from the ongoing remedy performance/operations monitoring and pre-design monitoring conducted in support of the Waste Storage Area Phase I Module and the South Field Extraction System Phase II Module.

The Re-Injection Demonstration Test Report (DOE 2000) provided the recommendation that the groundwater remedy incorporate the use of re-injection. The South Field Phase II design report specified the use of re-injection both along the Fernald site southern property boundary and in the South Field area. Although it is determined not feasible to maintain long-term operations of the groundwater injection wells beyond 2004, DOE is committed to exploring alternate efficient ways for continued groundwater reinjection. DOE will be working with the EPA and OEPA to determine the feasibility of continuing re-injection via infiltration of clean groundwater through the base of site drainage ditches. As noted above, the work will be specified in a test plan to be submitted to the EPAs in July 2004.

The Remedial Action (RA) Work Plan (DOE 1997b) for Aquifer Restoration (submitted to EPA and OEPA as Task 10 of the Operable Unit 5 RD Work Plan) conveyed the enforceable RA construction schedule for the initial restoration modules brought on-line in 1998 (the Re-injection Demonstration Module, the South Field Extraction System Module, and the South Plume Optimization Module). It also contained the planning-level RA construction schedule for the remaining modules to be brought online in later years. With the completion and start-up of the Waste Storage Area Phase I Module in 2002 and the South Field Phase II Module in 2003, all of the RA Work Plan specified schedules have been met. The only module remaining to be installed is the Waste Storage Area Phase II Module scheduled for installation in 2005.

The OMMP functions in tandem with several other RD or design support plans prepared by other project organizations outside ARWWT. The Soils Characterization and Excavation Project (SCEP) prepared the Sitewide Excavation Plan (DOE 1998) and continues to prepare a series of area-specific detailed design plans (termed Integrated Remedial Design Packages [IRDPs]) that define the approach and commitments for management of storm water, intercepted perched groundwater, and sediment during soil remediation activities. The Waste Pits Project (WPP) has developed design documents that define the management of storm water and remedial wastewater within that project's boundaries, and the plan for coordinating the treatment of the streams by the ARWWT. The On-site Disposal Facility (OSDF) Project has developed design documents that define the management of storm water and leachate within the boundaries of that project, and the planned hand-offs for delivering these streams for treatment to ARWWT. The Silos Project will produce similar design documentation to coordinate the management and delivery of their process remedial wastewater for treatment by ARWWT. Lastly, the facility-specific implementation plans developed by the Demolition, Soil, and Disposition Project (DSDP) present the coordination strategy for wastewater generated by decontamination and demolition (D&D) activities for treatment by ARWWT. Each of these project organizations is responsible for ensuring that their respective regulatory requirements and commitments for effective management of storm water and remedial wastewater within their project boundaries are met and integrated with ARWWT.

1.4 PLAN ORGANIZATION

The plan is generally organized around the major wastewater streams being managed by ARWWT: groundwater, storm water, remediation wastewater, and sanitary wastewater. The sections and their contents are as follows:

Section 1.0 Introduction: presents an overview of the plan, its objectives, and its relationship to other documents, and its organization.

Section 2.0 Summary of Regulatory Drivers and Commitments: discusses the applicable or relevant and appropriate requirements (ARARs) compliance crosswalk and provides a summary of the other commitments and guidelines that have been activated for ARWWT by the Operable Unit 5 Record of Decision.

Section 3.0 Description of ARWWT Major Components: identifies the major collection, conveyance, and treatment components comprising the Fernald site's system for managing the major wastewater streams, the treatment capacities that are available, and a schedule of major ARWWT activities throughout the aquifer restoration process.

Section 4.0 Projected Flows: provides an estimate of flow generation rates and durations for each of the major wastewater streams. Estimates of the summary yearly flows developed are used in Section 5.0 to evaluate the treatment systems discussed in Section 3.0.

Section 5.0 Operations Plan: establishes the operations philosophy, treatment priorities and hierarchy, treatment operational decisions, well field operational objectives and decisions, maintenance priorities, controlling documentation, management and flow of operations information to successfully operate the groundwater and wastewater systems to achieve regulatory requirements and commitments.

Section 6.0 Operations and Maintenance Methods: addresses the general methods, guidelines, and practices used in managing equipment operation and maintenance; discusses some of the dedicated organizational resources and management systems that will help to assure meeting the requirements in the Record of Decision, describes the key parameters used to monitor the performance of the groundwater and wastewater facilities, and describes the principal features and maintenance needs for the overall operation.

Section 7.0 Organizational Roles, Responsibilities, and Communications: this section presents the organizational roles and responsibilities with respect to implementation of this OMMP. Also presented are information needs and communications protocol for coordination with other Fernald site project organizations outside ARWWT and interaction with the EPA and OEPA.

Appendix A ARWWT Standard Operating Procedures

Appendix B Groundwater Restoration Well Performance Monitoring and Maintenance Plan

1.5 PROGRAM MODIFICATIONS AND REVISIONS

The OMMP will remain in place for the duration of the Fernald site's remediation activities. Periodic reviews of the OMMP will be conducted to respond to needed changes in program emphasis or the addition of new components, as appropriate. As noted in Section 1.2, updates/revisions to the OMMP will be required when the groundwater restoration approach is refined and agreed upon and prior to the time that the Storm Water Retention Basin is taken out of service.

TABLE 1-1
OPERATIONAL PERIODS AND ASSOCIATED KEY OPERATIONAL PARAMETERS

Operational Period	Groundwater Treatment Capacity (gallons per minute)	Storm Water/Remediation Wastewater Treatment Capacity (gallons per minute)	Groundwater Pumping Rate (gallons per minute)	Re-injection (gallons per minute)	Storm Water/Remediation Wastewater Headworks
1) Pre CAWWT Construction Shut down: Present until 9/04	2000+	Up to 1100 gpm	~5800	1325	SWRB/BSL
2) CAWWT Stage I Construction Period: 9/04-1/05	200+	Up to 1100 gpm	~3000	0	SWRB/BSL to just SWRB in 11/04
3) CAWWT Operations w/SPIT & IAWWT: 2/05 – 7/05	1400+	Up to 900 gpm	~4800	0	SWRB
4) CAWWT Operations: 8/05 – Until the SWRB is Shut Down for D&D in 11/05.	1200+	Up to 600 gpm	~4100	0	SWRB
5) CAWWT Operations 11/05 - until Capping of Last Cell in 3/06	1200+	Up to 600 gpm	~4100	0	Tanks at CAWWT, or Soil excavation, or in open Cell for OSDF leachate/storm water
6) CAWWT Operations after last cell is capped (Storm water and remediation wastewater treatment no longer required)	1800	Not required	4000 –5000	0	Not required

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Figure 1-1
CAWWT Timeline

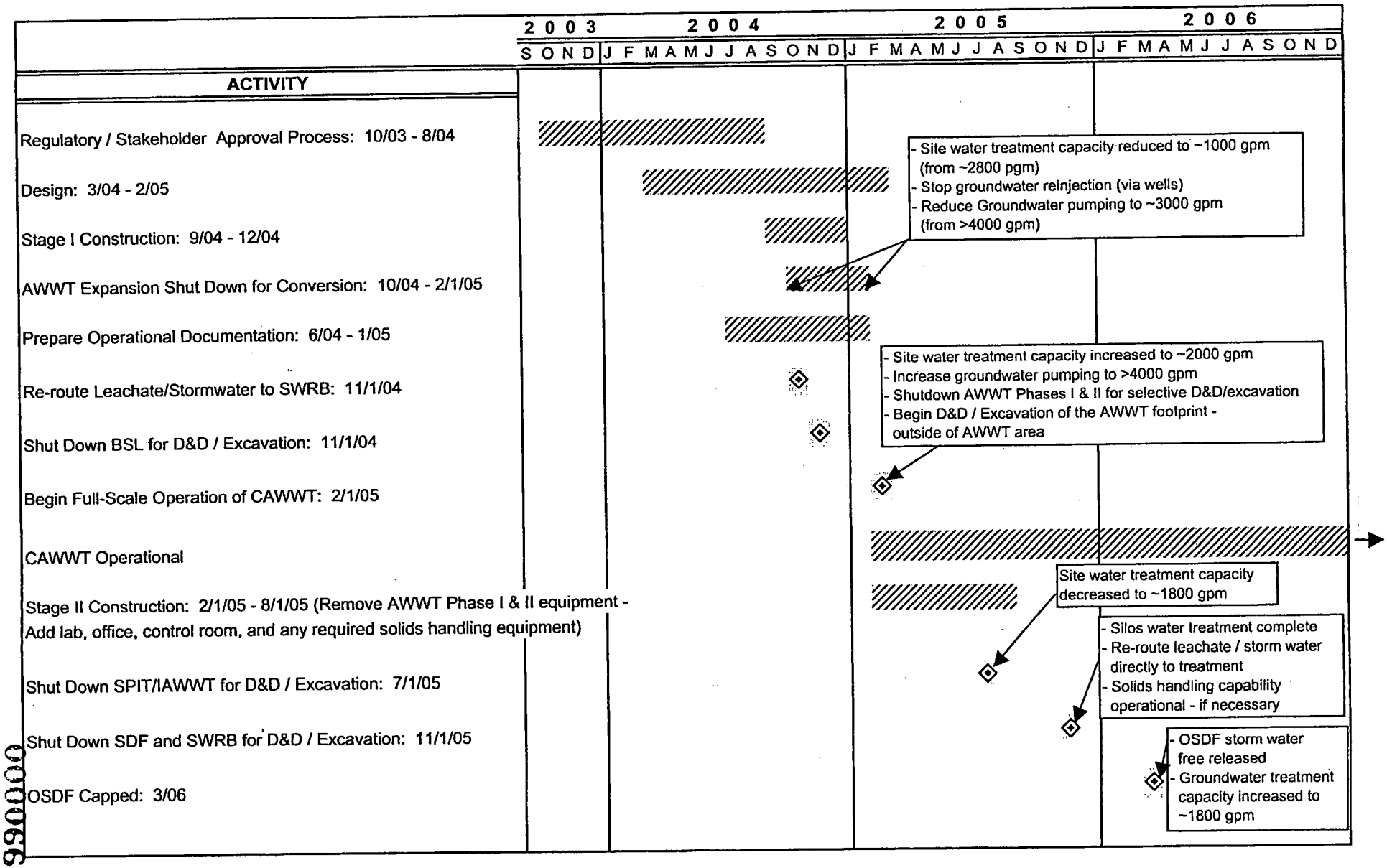

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Fig 1-1 Stakehldr Timeline r2c 6-04 06/28/2004 9:43 AM

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2.0 SUMMARY OF REGULATORY DRIVERS AND COMMITMENTS

Section 2.1 summarizes the Fernald site's pertinent regulatory-based requirements, commitments, and operating constraints that have a bearing on either the implementation of or the reporting obligations for the OMMP activities. A review and listing of pertinent requirements was conducted to help ensure that the scope of the OMMP: 1) satisfies the regulatory obligations for operations and maintenance activities that have been activated by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) process; and 2) meets the expectations of other pertinent criteria that have been developed through the RD process.

Section 2.2 provides the formal permit crosswalk required for inclusion in the OMMP by the RD Work Plan and discusses additional ARARs and To Be Considered requirements. The suite of ARARs and To Be Considered requirements in the Fernald site's approved CERCLA Operable Unit 5 Record of Decision was examined to identify the subset with specific operations and maintenance requirements or permitting issues affecting the OMMP. The Fernald site's existing compliance agreements issued outside the CERCLA process, such as the NPDES permit and existing Air and Wastewater Permits to Install (PTI), Permits to Operate (PTO), and Permit Information Summaries also were reviewed.

2.1 GENERAL COMMITMENTS AND CONSTRAINTS FOR THE ARWWT

General commitments and constraints for the ARWWT can be divided into those applicable to aquifer restoration, storm water management, and wastewater treatment. The general commitments, operating constraints, and performance goals that have originated as part of the post-Record of Decision remedial design process were identified for inclusion in this section.

2.1.1 Aquifer Restoration

The general remedy performance commitments and constraints which have been agreed to with EPA and OEPA regarding aquifer restoration are summarized in the following list. These commitments and constraints were derived from the Operable Unit 5 Record of Decision, the Operable Unit 5 Explanation of Significant Differences, and various remedial design/remedial action (RD/RA) documentation as noted:

- Aquifer Restoration Approach - The Fernald site has received EPA and OEPA approval for the aquifer restoration approach contained in the Waste Storage Area Phase I Module Design (DOE 2001b) and the South Field Extraction System Phase II Module (DOE 2002). In 2004 the aquifer restoration approach is being further refined based on discussions with the EPA, OEPA, and public stakeholders. The refined approach will continue to maintain the commitments specified in the Operable Unit 5 Record of Decision.

- Aquifer Cleanup Levels - Targeted groundwater FRLs were presented in the Operable Unit 5 Record of Decision. In general, the FRLs were based on maximum contaminant levels (MCLs) for drinking water (or 10^{-5} incremental lifetime cancer risk or 0.2 hazard index when no MCL was available). Groundwater remediation is expected to continue until all the constituent-specific FRLs have been achieved or, if necessary, until a technical impracticability (TI) waiver is justified in the event the FRLs cannot be achieved. Alternative best available technologies will be considered prior to requesting a TI waiver.

- Discharge Limits - During site remediation, significant amounts of both treated and untreated water will be discharged to the Great Miami River. Treatment will be applied to storm water, remediation wastewater, and recovered groundwater to the extent necessary to limit the total mass of uranium discharged through the Fernald site outfall to the Great Miami River to no more than 600 pounds per year. This mass-based discharge limit became effective upon issuance of the Operable Unit 5 Record of Decision. Additionally, the necessary treatment will be applied to these streams to limit the concentration of total uranium in the blended effluent to the Great Miami River to no greater than 30 ppb. The 30 ppb discharge limit for uranium will be based on a monthly average and became effective December 1, 2001 replacing the 20 ppb standard to which the Fernald site was subject beginning January 1, 1998.

  Up to 10 days per year are allowed by the Record of Decision for emergency bypass due to storm events. Uranium contained in these bypass events will only be counted in the annually discharged mass, but not in the monthly average concentration calculations. When bypass days in excess of the 10 allowed are required, both the uranium mass and flow weighted concentration of the bypassed water are to be counted toward the 600 pound annual limit and the 30 ppb monthly average discharge. Required relief from the discharge limits is also provided by the Record of Decision to accommodate scheduled treatment plant maintenance activities. Approval by the EPA must be obtained in advance by notification of these planned maintenance periods. The notification must be accompanied by a request for the uranium concentrations in the discharge not to be considered in the monthly averaging performed to demonstrate compliance with the 30 ppb total uranium limit. The Fernald site will make every reasonable effort to prevent bypass of storm water during treatment plant shutdowns for maintenance, including scheduling maintenance shutdowns during the times when dry weather is expected. The NPDES permit will govern all remaining nonradionuclide discharges to the Great Miami River. Many of the gravity-fed storm sewer lines in the former production area have been removed as a consequence of site remediation. Removal of these lines allows for much more control of the storm water flow into the SWRB. Therefore, bypassing of storm water will no longer occur beginning in the fall of 2004.

- Groundwater Treatment Capacity – Groundwater treatment capacity will be fluctuating somewhat from now until the site closure (scheduled for 2006). In the spring of 2004 DOE received EPA, OEPA, and public stakeholder concurrence to reduce the site's water treatment infrastructure. The reduced infrastructure is warranted because the site's water treatment needs are diminishing as a result of the accelerated site remediation and ongoing reduction of uranium concentration in the pumped groundwater. At the time of site closure, a dedicated groundwater treatment capacity of up to 1800 gpm will be available for long-term groundwater treatment.

- Groundwater Treatment Decisions – Groundwater treatment decisions are made based on individual well uranium concentrations. The higher concentration wells go to treatment and the lower concentration wells bypass treatment and are discharged directly to the Great Miami River outfall line. The piping networks that convey on-property extracted groundwater have, or will have as appropriate, double headers, one connected to the main line to treatment and the other to

the main discharge line. This design feature is not applicable to the off-property South Plume Module. The extracted groundwater from the South Plume Module is sent to either the treatment facilities or directly to the discharge outfall based on the uranium concentration in the combined flow from the 6 wells comprising this Module. The combined treated and untreated discharge will comply with the 30 ppb discharge limit and the 600 pound per year mass-based limit as described above under Discharge Limits.

- Extraction Rate - The net groundwater extraction rate should not exceed the recharge rate of the regional aquifer or cause excessive water table drawdown. Therefore, based on groundwater modeling, 4000 gpm was established as the limit for the net extraction rate in the Operable Unit 5 Feasibility Study (FS) Report (DOE 1995b). This limit has been raised to approximately 5000 gpm based on subsequent, refined groundwater modeling and aquifer water level monitoring data. The maximum pumping rate for each individual well should not exceed 500 gpm in order to prevent excessive local drawdown and improve uranium mass removal efficiencies. Hydraulic impacts to the groundwater contamination under the Paddys Run Road Site south of the existing South Plume recovery wells should also be minimized; reversing groundwater flow from the Paddys Run Road Site into the South Plume Recovery System needs to be prevented.

- Injection Rate and Quality - Injection technology has been utilized as part of the aquifer restoration approach to reduce groundwater drawdown and to increase the groundwater flushing rate through the plume. Updated groundwater modeling in 2003 indicated that continued re-injection via existing wells will only shorten the remaining remedy duration by 3 years; therefore re-injection via wells is being stopped in the fall of 2004. However, DOE is exploring the possibility of continuing re-injection via site drainages and will be working with EPA and Ohio EPA over the next year to determine its feasibility.

2.1.2 Storm Water Management

The requirements for controlling storm water runoff (and associated sediment loads) at the point of origin are beyond the scope and intent of this document and are the specific responsibility of the source-control projects at the Fernald site. The decision to provide pretreatment must be made in concert with ARWWT recognizing surface water FRLs, NPDES limits, and hydraulic capacity. As site remediation is progressing, storm water is becoming more manageable. As noted above in the discharge limits discussion, many of the gravity fed storm sewers have been disrupted and/or removed as a consequence of remediation, thus allowing for better control of storm water flow. With the removal of the storm sewers, water must be pumped to the SWRB from the various excavation areas of the site. In times of heavy or sequential precipitation events, the excavations in the uncertified areas will provide additional storage capacity above and beyond that provided in the SWRB.

The ARWWT is responsible for:

- Providing treatment for designated streams, upon delivery at the ARWWT treatment headworks
- Coordinating with other site projects to ensure that pumping of storm water to the SWRB does not cause it to reach a level where treatment bypassing or overflow of the basin occurs
- Sediment clean out of the ARWWT treatment headworks
- Coordination and review to ensure similar strategies and criteria for source control in other projects.

In general, all storm water management activities conducted sitewide need to adhere to the commitments and design criteria contained in the Fernald site Storm Water Pollution Prevention Plan.

2.1.3 Wastewater Treatment

The ARWWT is responsible for the following commitments for wastewater treatment:

Leachate Treatment

Leachate from the OSDF is currently pumped to the Biodenitrification Surge Lagoon (BSL) for holding prior to treatment in the AWWT. To support site closure, BSL operations are scheduled to end in November 2004 with the lagoon D&D occurring shortly thereafter. When the BSL goes out of service, leachate will be re-routed to the SWRB for holding prior to treatment. Since the Ohio Administrative Code (OAC) 3745-27-19, Operational Criteria for a Sanitary Landfill Facility, requires treatment of leachate, a new operational plan for the SWRB is required. Currently, overflow from the SWRB is an NPDES permitted outfall, and the Operable Unit 5 Record of Decision allows water from the SWRB to bypass treatment when the basin is in danger of overflowing and when the treatment plants are down for maintenance. As noted above in the discharge limits discussion, the site has much more control of the flow to the SWRB as a result of removal of the gravity-fed storm sewer system; therefore, a new operational plan for managing the SWRB will be in place in the fall of 2004 to ensure that neither treatment bypassing of water draining to the basin nor overflow of the basin will occur from that point on. The revised operational plan is provided in Section 5.0.

Outfall Uranium Concentration and Uranium Mass Loading

- Coordinate the accurate projection of influent quantity, quality, and timing for all the remedial wastewater sources to be received from other generator projects
- Strive to maintain high mass removal efficiency of the treatment facilities through regularly scheduled maintenance activities
- Help coordinate the identification of cost-effective pretreatment at sources of wastewater when appropriate.

Minimize the System Downtime

- Incorporate preventive maintenance considerations into the system design
- Operate within the design envelope
- Establish effective preventive maintenance procedures
- Prepare for potential corrective maintenance needs.

Manage Treatment Residuals within the terms of the Operable Unit 5 Record of Decision

- Characterize residuals for compliance with OSDF waste acceptance criteria
- Arrange for the transport and off-site disposal of residuals not attaining onsite waste acceptance criteria
- Pursue treatment techniques to treat the residuals to attain waste acceptance criteria in the event offsite disposal capacity becomes unavailable or cost prohibitive.

2.2 ANALYSIS OF REGULATORY DRIVERS AND EXISTING PERMIT REQUIREMENTS

The following section provides a summary of the regulatory drivers governing activities initiated under this OMMP, including ARARs and To Be Considered criteria, DOE Orders, Fernald site legal agreements, and existing environmental permits. This section has been organized based on criteria related to: 1) point source air emissions; 2) surface water and treated effluent discharges; 3) groundwater restoration activities; 4) hazardous waste management requirements; and 5) substantive permitting requirements mandated by existing environmental permits and permit information summaries.

The information provided fulfills the commitment made in Section 2.3 of the RD Work Plan to provide a compliance crosswalk that demonstrates how these requirements will be met. The format of the compliance crosswalk is based on mutually agreed format described in the June 12, 1995, letter from DOE to EPA (DOE-1055-95).

2.2.1 Point Source Air Emissions

Any emissions from sources associated with future modifications or expansions to AWWT facilities or other wastewater treatment units will be compared to the following requirements to make sure that activities are conducted in compliance with applicable requirements. Any continuous emission monitoring that may be required for National Emissions Standards for Hazardous Air Pollutants (NESHAP) Subpart H point sources will be described in future compliance crosswalks submitted in the

appropriate plans. Future point source air emissions associated with activities within the scope of the OMMP will be evaluated against the following regulatory drivers:

- 40 Code of Federal Regulations (CFR) Part 61, NESHAP Subpart H, which specifies that all radiological emissions (except radon) from the Fernald site must not cause any member of the general public to receive a dose equivalent in excess of 10 millirem per year (mrem/yr). In addition to the 10 mrem/yr site-wide standard, NESHAP Subpart H requires that an application for approval be filed with EPA for those sources that exceed a 0.1 mrem/yr dose equivalent to members of the public. Continuous emission monitoring is required for stacks or vents that have the potential, under normal operating conditions but without emission control devices, to cause a member of the public to receive a dose equivalent in excess of 0.1 mrem/yr. Demonstration of source-specific compliance with the 0.1 mrem/yr dose standards is achieved through computer modeling. Site-wide radiological emissions from the entire site are reported annually in the annual Fernald site NESHAP Subpart H report.

- OAC 3745-31 and OAC 3745-35, Permits to Install and Permits to Operate, require the installation of best available technology when installing, modifying, and operating air contaminant sources. Such requirements associated with any future expansions or modifications to the AWWT or other wastewater treatment units will be included in the project specific design submittals for these projects.

2.2.2 Surface Water and Treated Effluent

The Fernald site's wastewater treatment systems are subject to substantive permitting requirements for wastewater treatment units. Treated wastewater effluent is discharged through the Parshall Flume to the Great Miami River. The site discharge is fully subject to discharge permitting requirements. The following regulatory drivers govern these surface water and treated effluent discharges associated with Fernald site site-wide wastewater treatment units:

- Fernald site NPDES Permit (OEPA Permit No. 1IO00004*FD) triggers a variety of operational and maintenance requirements designed to ensure discharges of treated effluent are conducted in compliance with the terms and conditions of the permit. These requirements include process control sampling and maintenance activities at sampling stations and treatment units.

- OAC 3745-31, Wastewater PTIs are required for new installations or modifications to existing wastewater treatment units. Wastewater PTIs are issued provided the newly installed/modified treatment unit will not adversely impair water quality or cause a violation of applicable effluent standards. All near-term projects requiring a PTI have already been addressed. Compliance with the substantive PTI requirements associated with future projects will be demonstrated in their corresponding project-specific design packages.

2.2.3 Groundwater Restoration

The regulatory drivers governing groundwater-related operation and maintenance activities include only those required as part of the Underground Injection Control (UIC) Program. The injection wells installed under the Injection Demonstration, and under subsequent aquifer restoration modules, must comply with

the substantive requirements of this program. This policy is also cited as a To Be Considered requirement in the Operable Unit 5 Record of Decision. The OEPA has primacy for this program, and has issued a policy for those Class V injection wells installed for purposes of groundwater remediation, as described below:

- OEPA Policy 5X26 Aquifer Remediation Projects states that such wells do not need a PTI/PTO if the owner/operator complies with the policy. Since groundwater reinjection via wells will no longer occur beginning in the fall of 2004 this policy is no longer applicable. However, if reinjection via wells were to resume in the future the policy would be followed.

2.2.4 Hazardous Waste Management

Small quantities of wastewater that are known to contain one or more Resource Conservation and Recovery Act (RCRA) listed hazardous waste constituents will be treated in the on-site wastewater treatment system (AWWT Phase II/CAWWT). The DOE and OEPA negotiated a regulatory mechanism under the Mixture Rule Exclusion found at OAC 3745-51-03(A)(2)(e) allowing that wastewaters containing listed constituents could be appropriately managed through existing Fernald site wastewater treatment systems and exempt from associated RCRA listing. Compliance with this exclusion eliminates the need for pre-treatment of wastewaters containing listed constituents and further eliminates the associated listing that would have otherwise been applied to treatment plant residuals (e.g., sludges). This policy was articulated in DOE letter DOE-0678-98 dated April 15, 1998 and approved by OEPA on May 14, 1998.

2.2.5 Existing Environmental Permits and Permit Information Summaries

Tables 2-1 and 2-2 list the environmental permits and permit information summaries, respectively, that are applicable to ARWWT activities initiated under this plan. These tables identify the status of the permits for various wastewater treatment operations and list their corresponding substantive requirements. Cross references to the appropriate Standard Operating Procedures or site documents that describe the manner in which these requirements are addressed in detail are also provided in the tables.

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TABLE 2-1

ACTIVE PERMITS TO INSTALL AND OPERATE

Permit No.	Description of Source	Effective Date	Substantive OMMP Requirements	Cross Reference[a]
Wastewater Permits to Install				
05-0944	Sewage Treatment Plant Ultraviolet Disinfection Unit	June 28, 1984	• Lamps will be cleaned periodically.	SOP 43-C-368
05-1043	SWRB	November 18, 1987	• Periodic assessment of sediment depths and sediment clean out once six inches of deposition has occurred. • Water collected in basin chambers will be removed by means of floating outlet structures.	Installation of Sludge Removal System addresses these requirements
05-2872	Changes to BSL	December 16, 1987	• Periodic assessment of sediment depths and sediment clean out once 500,000 gallons of sediment has occurred. • Sediment removal schedule will be extended if measured sediment is less than 500,000 gallons.	Installation of Sludge Removal System addresses these requirements
05-5722	Fernald site AWWT Facility (Phases I and II)	December 3, 1992	• PTI has been withdrawn. AWWT is currently considered part of a CERCLA Response Action. Substantive permit requirements include the following bulletized items. • Maximum process rate for the AWWT will be 557,118 lbs/hr. The allowable limit for particulate is 0.894 lbs/hr and from uranium the rate is 1.34E-08 lbs/hr.	SOP 43-C-340
Air Permits to Install and Operate				

[a]See Section 6.0 for a discussion of ARWWT Standard Operating Procedures.

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TABLE 2-2

PERMIT INFORMATION SUMMARIES[a]

Description of Source	Submittal Date	Substantive Requirements	Cross Reference[b]
Permit Information Summaries			
AWWT Slurry Dewatering Facility	December 7, 1995	• Filter cake will be containerized and managed as low-level waste. • All chemical storage tanks (caustic, acid, sludge conditioners) must be equipped with submerged fill devices. • Residual particulate and radiological emissions must be controlled via HEPA filtration devices.	SOP 43-C-358
AWWT Multi-Media Filter Project	November 12, 1996	• Backwash from the carbon and multi-media filters will be collected and discharged to the headworks of the AWWT Facility.	SOP 43-C-340
AWWT Expansion Project	December 20, 1996	• Tanks associated with the multimedia filtration and ion exchange columns operate under pressure in a closed system.	SOP 43-C-367
Sludge Removal Project	July 28, 1998	• Ensure BSL and SWRB sludges are removed to maintain necessary hydraulic capacity and the sludges are managed efficiently.	SOP 43-C-371

[a]Previously submitted to fulfill substantive permitting requirements for various CERCLA response/removal action pursuant to the requirements of CERCLA 121(e), 40 CFR 300, National Oil and Hazardous Substances Pollution Contingency Plan, and Paragraph XIII.A of the Amended Consent Agreement (DOE 1991).
[b]See Section 6.0 for a discussion of ARWWT Standard Operating Procedures.

3.0 DESCRIPTIONS OF MAJOR ARWWT COMPONENTS

The major operating system components of Operable Unit 5 aquifer restoration and wastewater treatment (ARWWT) required to accomplish the associated Operable Unit 5 remedy commitments and goals are described in this section. The existing and currently proposed Fernald site conveyance and treatment system components for managing the major wastewater streams are identified as are treatment capacities. This section also describes key linkages between the components. Figure 3-1depicts the ARWWT facilities as well as remediation wastewater/storm water sources overlayed on a picture of the site taken during an April 2004 flyover.

Figure 3-2 provides a current schedule of major ARWWT activities throughout the aquifer restoration process. With the award of the Closure Contract to Fluor Fernald and a change in the funding profile for the Fernald Site to accelerate Fernald site closure by 2006, the ARWWT is contracturally required to having all necessary infrastructure for groundwater remediation installed by September 2006. Therefore, Figure 3-2 varies from schedules presented in the Operable Unit 5 RA Work Plan and the BRSR, to present the most recent projection of when major elements of the ARWWT will begin operation and, as necessary, be shut down and decommissioned in support of site closure.

The closure contract requires that all site infrastructure be removed and dispositioned with the exception of that required for groundwater remediation, the OSDF, and administrative type facilities to support long-term stewardship. To accomplish these objectives, certain facilities associated with the existing wastewater treatment system infrastructure will be removed from service and adjustments to the flow paths of remaining wastewater streams will be needed. However, the required treatment will continue to be provided for these wastewater streams. Table 3-1 provides a description of the status of all remediation wastewater sources and treatment system infrastructure. The OMMP text and figures contained within present the schedule developed based on the new 2006 baseline.

3.1 GROUNDWATER COMPONENT

The remediation of the Great Miami Aquifer will be achieved by completing area-specific groundwater restoration modules. These modules were specified in the following documents:

- the RD/RA Work Plans for Operable Unit 5
- the Baseline Remedial Strategy Report for Aquifer Restoration
- the Design for the Remediation of the Great Miami Aquifer in the Waste Storage and Plant 6 Areas (DOE 2001b)
- the Design for Remediation of the Great Miami Aquifer South Field Phase II Module (DOE 2002).

During 2003, new information became available (refer to Comprehensive Groundwater Strategy Report [Fluor Fernald, Inc. 2003a]) that allowed for more refined groundwater modeling predictions of when aquifer restoration would be completed. The updated modeling predictions and groundwater remedy performance monitoring data both indicated the aquifer restoration time frame would likely be extended beyond the dates previously predicted. The updated modeling also indicated that the use of groundwater reinjection via wells did not greatly reduce the time required to remediate the aquifer. As reflected in Figure 3-2, aquifer restoration activities are predicted to be necessary until at least the year 2020. As noted in Sections 1 and 2, the DOE is currently working with the EPAs to determine the configuration of the long-term groundwater remedy. This section describes currently operating and proposed modules. The modules are presented in two categories: currently operating modules (Section 3.1.1) and future modules (Section 3.1.2).

3.1.1 Current Groundwater Restoration Modules

Groundwater restoration modules currently in operation are:

- South Plume/South Plume Optimization
- South Field Extraction System Phase I (including three supplemental wells)
- South Field Extraction System Phase II
- Re-Injection Demonstration
- Waste Storage Area Extraction System Phase I.

The geographical locations of each of these modules and associated wells are provided in Figure 3-3. A description of each of the modules is provided in the following subsections.

3.1.1.1 South Plume Module

Five extraction wells were installed in 1993 at the leading edge of the off-property South Plume as part of the South Plume removal action to gain an early start on groundwater restoration. The South Plume removal action well system began pumping in August 1993. The primary intent of the original five well system was to prevent further off-property migration of contamination within the groundwater plume. Two additional extraction wells came online in August 1998 for the active restoration of the central portion of the off-property plume. These two new wells, known as the South Plume Optimization Module have now been incorporated into the South Plume Module for purposes of remedy performance tracking and reporting. Figure 3-3 shows the locations of the wells and Table 3-2 provides the operating status of the South Plume Module.

3.1.1.2 South Field Module - Phase I

The South Field Extraction System Module consists of Phase I and Phase II. South Field Extraction System Phase I Module includes 10 extraction wells. In 1996, as part of an EPA-approved early start initiative, the 10 extraction wells were installed on Fernald site property in the vicinity of the south field/storm sewer outfall ditch. These wells are removing groundwater contamination in an on-property area of the Southern Uranium Plume where uranium contamination levels are highest (Figure 3-3).

Since the installation of the 10 original extraction wells of the South Field Extraction (Phase I) Module three new extraction wells have been added to the module, three of the original wells have been shut down, and one of the original wells has been converted to a re-injection well. The three extraction wells that were shut down are all located in the upgradient area of the plume where total uranium concentrations in the Great Miami Aquifer are now below the FRL. An additional consideration in removing two of these three wells was to accommodate soil remedial activities in the vicinity of the wells.

The three new wells added to the South Field Phase I Module were installed at locations where total uranium concentrations were considerably above the groundwater FRL, in the eastern, downgradient portion of the South Field plume. Two of the three new wells were installed in late 1999 and began pumping in February 2000. The third well was installed in 2001 and will become operational in 2002.

Phase II components of the South Field became operational in 2003. The components include:

- Four additional extraction wells, one in the southern waste unit area, and three along the eastern edge of the on-property portion of the southern uranium plume.
- One additional re-injection well in the southern waste unit area.
- A converted extraction well, which was converted into a re-injection well.
- An injection pond, which is located in the western portion of the Southern Waste Units Excavations.

Table 3-2 provides the operational status of the currently configured South Field Extraction System Module (Phase I and Phase II components).

3.1.1.3 Injection Demonstration Module

Groundwater reinjection via wells is scheduled to stop in September 2004 to support the construction of the CAWWT facility. All re-injection wells will remain in place as potential monitoring points for the groundwater remedy performance monitoring program. Re-injection well locations are shown on Figure 3-3 and Table 3-2 shows the operational status of the re-injection wells.

3.1.1.4 Waste Storage Area Extraction System (Phase I) Module

The Waste Storage Area Extraction system targets contaminants in the Great Miami Aquifer underlying the waste storage area (Operable Units 1 and 4). The Design for Remediation of the Great Miami Aquifer in the Waste Storage Area and Plant 6 Areas separates this system into two distinct modules. Phase I addresses the plume of contamination defined in the vicinity of the Pilot Plant Drainage Ditch. Phase II is deferred until after waste pit area excavations have been completed and the area is accessible for well drilling and construction activities.

The Waste Storage Area Extraction System Phase I module consists of one 12-inch diameter well and two 16-inch diameter extraction wells complete with submersible pumps with variable speed drives, well houses, electrical power, instrumentation and controls, fiber optic communications, and dual discharge headers (one for treatment and one for direct discharge). Initiation of operation of this module was May 8, 2002. The easternmost well in this module (Extraction Well 33063 or EW28) will be taken out of service then plugged and abandoned in July 2004 to make way for soil remediation activities. The well will be replaced in 2005 after soil remediation is completed.

The Design for Remediation of the Great Miami Aquifer in the Waste Storage Area and Plant 6 Area concluded that the uranium concentrations in the Great Miami Aquifer beneath Plant 6 had naturally attenuated to concentrations below 20 ppb. While the current data indicate that no extraction wells and infrastructure will be needed for the Plant 6 area, monitoring of the Plant 6 area will continue until aquifer restoration certification is completed and approved by EPA and OEPA.

3.1.2 Future Groundwater Restoration Modules

- Only Phase II of the waste storage area remains to be installed.

The geographical location of this module is provided in Figure 3-3. The RA Work Plan established the Remedial Action Schedule for the Waste Storage Area Module (Table 3-2), which was met with the installation and start-up of the Waste Storage Area Phase I Module in 2002. As noted on Figure 3-2 the Waste Storage Area Phase II module will become operational in 2005. A description of this planned module is provided below.

3.1.2.1 Waste Storage Area Extraction System Module Phase II

Once the waste pit area is accessible (i.e., after the waste pit material and contaminated soil have been excavated and real-time data indicates the area is "clean"), construction of the Waste Storage Area Extraction System Phase II module can be initiated within this area (Figure 3-3). The construction as currently planned includes installation of the two extraction wells sized to pump 100 gpm each. The

exact number and location of the extraction wells will be determined based on the future groundwater modeling predictions using future uranium plume characterization. Modeling conducted in support of the Design for Remediation of the Great Miami Aquifer in the Waste Storage Area and Plant 6 Area recommended that further evaluation for the need of dual piping (treatment and bypass) would be needed as the modeling indicated treatment for these extraction wells would not be required. Therefore, the specific infrastructure required for Phase II will be determined based on future groundwater modeling predictions of the uranium content of the extracted groundwater. Once completed, the construction will be inspected and accepted, and systems testing will be conducted. After successful testing and standard start-up review, operation of the module will begin.
The schedule dates for this module is as follows:

- Well installation Contract Award: April, 2005
- Infrastructure Contract Award: April, 2005
- Complete Construction: November 2005
- Commence Operations: December 2005.

These dates are contingent on the completion of the source operable unit and soil remedial activities in this area. If these dates must be revised, due to schedule changes during Operable Unit 1 or Operable Unit 5 soil remediation activities, then a revised schedule will be provided.

3.1.3 Groundwater Collection and Conveyance

An extensive system of collection and conveyance piping systems is required for the remediation of the Great Miami Aquifer. These piping systems were specified in the various module-specific design documents. Figure 3-4 provides an overview of the current well field piping. New collection and conveyance systems will not be installed until the soil remediation activities in those areas have been completed through pre-certification via real-time monitoring. This will avoid the need to maintain additional corridors of soil contamination. This is particularly important as it may be necessary to maintain these pipelines in service through groundwater certification. Construction of these modules prior to soil remediation in these areas would delay portions of the soil cleanup unnecessarily.

As described in Section 2, the piping network that conveys on property extracted groundwater from the individual extraction wells has or will have as appropriate, double headers, one connected to the main line to treatment and the other to the main discharge line as shown in Figure 3-4. The double headers allow for treatment/bypass decisions to be made on an individual well basis on-property. This design feature is not applicable to the off-property South Plume Module which was largely in place prior to the design of the on-property piping network. Since individual well bypass/treatment lines are not available on the South Plume wells, treatment/bypass decisions for the six wells comprising this system are made based on the uranium concentration in the combined flow from all the wells as indicated on Figure 3-4.

3.1.4 Great Miami Aquifer Remedy Performance Monitoring

Section 3 of the IEMP provides for the routine remedy performance monitoring of the Great Miami Aquifer. The details of how this remedy performance data are being evaluated and the associated decision making process are located in Section 3.7 of the IEMP. Figure 3-5 illustrates the overall framework for the groundwater remedy performance decision-making process. If it is determined that aquifer restoration program expectations (as identified in the IEMP) are not being met, then the design and operation of the aquifer restoration system will be evaluated to determine if a change needs to be implemented. A change to the operation of the aquifer restoration system would be implemented by a modification to this OMMP. A groundwater monitoring change, if found to be necessary, would be implemented through the IEMP review and approval process. If additional characterization data is needed (e.g., to determine the nature of a newly detected FRL exceedance) a modification to the IEMP would be implemented, or a new sampling plan would be prepared depending upon the anticipated size of the activity.

Prior to operating new modules additional monitoring wells are installed to help monitor the performance of the module. Project specific plans for the additional monitoring wells are provided to the EPAs for review and approval. The new extraction wells are also monitored for uranium concentration on a frequent basis just after start-up as specified in start-up documentation. The site-wide groundwater data collected via the IEMP will be utilized to assess the performance of the site-wide groundwater remedy, which is comprised of several individual modules. The data derived from the additional monitoring wells and new extraction well uranium monitoring is integrated with the IEMP groundwater monitoring such that area-wide interpretations can be made. Changes to the scope of the routine monitoring identified in the IEMP may be necessary based on the findings of the sampling conducted in the new monitoring and extraction wells. These changes would be accommodated as necessary in the annual updates or biennial revisions.

The details of the mid-year and annual reporting of groundwater remedy performance information are also provided in the IEMP, Section 3.7. The reporting subsection provides the specific information to be reported in the mid-year report and in the comprehensive annual report.

3.1.5 Perched Groundwater

As specified in the Operable Unit 5 Record of Decision, the remediation of perched groundwater will be accomplished by the excavation and dewatering of soil containing the contaminated water. These remediation activities will be completed by the Demolition, Soils, and Disposal Project and are therefore not within the scope of this document. The ARWWT will, however, receive water from the SCEP as a result of the excavation dewatering efforts and from storm water runoff collection, as discussed in Section 4.0.

Unless otherwise identified, the term "groundwater" will be used throughout the remainder of this document to mean groundwater from the Great Miami Aquifer.

3.2 OTHER SITE WASTEWATER SOURCES/SYSTEMS

3.2.1 Storm Water Component

3.2.1.1 Storm Water Collection and Conveyance

As indicated in Figure 3-1, the existing storm water collection system for the former production area has been disrupted by soil remediation and the majority of storm water now collects in excavations that must be pumped to the remaining storm sewer lines that still gravity-drain to the SWRB. As noted in previous sections the disruption of the storm sewers allows for more control of the flow to the basin. The anticipated flows volumes and schedules for storm water requiring treatment are detailed in Section 4.

Areas which are remediated outside of the former production area such as areas 1 and 2 (see Figure 4-1) and construction of the OSDF have or will require the construction of new storm water collection and conveyance systems. These systems have been and will continue to be designed and constructed by the Demolition, Soil, and Disposal Project. The ARWWT has and will continue to be actively involved in design review of these facilities to ensure that existing hydraulic limitations are not exacerbated. Their design flows have been included in this OMMP, as described further in Section 4.0. Other systems may be required as remediation progresses.

3.2.1.2 Storm Water Monitoring

Analysis of the discharge from the SWRB will provide data to observe trends in overall influent contamination. Unusual or unanticipated trends will result in further review of influent streams.

The majority of the uncontrolled site runoff (that runoff not requiring treatment for uranium removal) flows to Paddys Run via four existing drainage pathways. Monitoring of these pathways and other locations where uncontrolled surface water leaves the Fernald site currently exists under the IEMP sampling program. This monitoring will continue as described in Section 4 of the IEMP. Information collected will be reported semi-annually as part of the IEMP quarterly meetings/reports.

3.2.2 Remediation Wastewater Component

3.2.2.1 Remediation Wastewater Collection and Conveyance

All remedial wastewaters will typically be directed to the BSL for subsequent treatment in the AWWT Phase II until the BSL is decommissioned (currently scheduled to occur in November 2004). Once the lagoon is removed from service, all remaining flows that formerly went to the lagoon will be routed to the SWRB as indicated in Figure 1-1. As detailed in Sections 4.0 and 5.0, once the former BSL flows are routed to the basin, they will be treated through the AWWT Phase II or in times of higher flows be treated in AWWT Phase I and the Interim Advanced Wastewater Treatment System (IAWWT) until CAWWT comes on line (scheduled for February 2005). Once CAWWT comes online it will be the preferred treatment system for all flows going to the basin. In times of high flow to the basin, the

IAWWT will also be used as noted in Section 5. The AWWT Slurry Dewatering Facility (SDF) is also used for managing remediation wastewater primarily associated with facility decontamination and decommissioning activities.

Each of the source projects will be responsible for: constructing new collection or conveyance systems, coordinating with ARWWT to utilize existing systems to transfer their wastewaters, or transporting flows by tanker truck or dumpster to the appropriate facility.

3.2.2.2 Remediation Wastewater Monitoring

All projects that require pre-treatment for remediation wastewater will require personnel to monitor discharges sent to the headworks of the ARWWT facilities.

Each contributing project will be required to monitor the flow of wastewater from their project(s) to the existing headworks so that actual flows can be checked for consistency against anticipated flows. This information will be used to determine if flows are greater than anticipated and if adjustments to wastewater treatment facilities will be necessary.

3.2.3 Sanitary Wastewater Component

3.2.3.1 Sanitary Wastewater Collection and Conveyance

The extensive system of sanitary sewers installed at the Fernald site has been largely removed from portions of the former production area as a result of site remediation efforts. The remainder of the sanitary sewers will be removed as remediation progresses. The sewage treatment plant is scheduled to be removed from service in June 2005 for D&D in July 2005. Remaining site personnel will use portable chemical toilets or holding tanks.

3.2.3.2 Sanitary Wastewater Monitoring

Monitoring of the effluent from the sewage treatment plant is conducted per the requirements of the NPDES permit. Uranium concentrations in the sewage treatment plant effluent are also monitored to track the impact this flow stream has on the Fernald site's ability to maintain site effluent discharge limits to the Great Miami River.

3.3 TREATMENT SYSTEMS

As noted in Section 1, with site closure in 2006, several water treatment flows will be eliminated or reduced (i.e., remediation wastewater, sanitary wastewater, storm water runoff) from the scope of the treatment operation (Table 3-1). Elimination/reduction of these flow streams provides an opportunity to reduce the size of the water treatment facility that will remain to service the aquifer restoration after site closure. Reducing the size of the treatment facility prior to site closure in 2006 will reduce the amount of

impacted materials that may need future off-site disposal. This section reflects the current water treatment systems and the new CAWWT system. The various facility shutdown dates in support of the 2006 site closure are provided in Figure 3-2 and Table 3-1.

3.3.1 Advanced Wastewater Treatment (AWWT) Facility

The original AWWT, consisting of Phases I and II, is located in the southwest corner of the former production area and was placed into operation in January 1995. The AWWT was expanded to incorporate an additional capacity dedicated to groundwater treatment. The expanded groundwater treatment capacity came online in April 1998. The two original AWWT systems and the expansion system are all operated from a central control room.

3.3.1.1 AWWT Phase I

Figure 3-6 shows a simplified process flow diagram of the AWWT Phases I and II treatment processes. The Phase I system consists of the following unit processes:

- Flow equalization and pH adjustment with caustic (when required) in preparation for the downstream coagulation process
- Coagulation with alum and polymer, followed by clarification for reduction of suspended solids, uranium, and some unspecified assumed reduction in other radionuclides and heavy metals. Other coagulant chemicals may be tested as part of process optimization efforts.
- Filtration using multimedia filters to remove suspended solids from the clarifier overflow. The filters are cleaned by backwashing.
- pH adjustment with sulfuric acid if required (not used presently)
- Two trains of three ion-exchange resin vessels (each train) to remove uranium. The wastewater flows through two ion exchange resin vessels in lead/lag series with the third vessel available to be placed into service when needed.
- Final pH adjustment (if required - not presently used), filtration, and discharge. Both the Phase I and Phase II treated streams are combined in the pH mixing/recycle tank, filtered using multi-tubular filters, and discharged.

The Phase I operation has been prioritized to treat storm water collected in the SWRB. In periods of low storm water flow this system also treats groundwater. This system typically operates at 500 gpm providing an annual treatment capacity of up to approximately 260 million gallons.

3.3.1.2 AWWT Phase II

The AWWT Phase II was installed for treatment of previous production wastewaters and site-contaminated remediation wastewater. The AWWT Phase II system is currently configured to allow concurrent treatment of site remediation wastewater, storm water, and groundwater. This system consists of the same unit treatment as the Phase I system, except that carbon filtration is included in the Phase II system to provide treatment of volatile organic compounds (VOCs) that may be present in the remediation wastewaters. Only one train of three ion exchange vessels is present in AWWT Phase II. The inflow to the Phase II system flows through two 80,000-gallon equalization tanks to accommodate fluctuating incoming flow streams. This system typically operates at 300 gpm providing an annual treatment capacity of up to approximately 155 million gallons.

3.3.1.3 AWWT Expansion

As prescribed in the Operable Unit 5 Record of Decision, the existing capacity of the AWWT facility was expanded to the maximum achievable within the confines of Building 51, to enhance the Fernald site's ability to treat groundwater. The unit processes of the AWWT expansion system include aeration, granular multimedia filtration, and ion exchange. The treated effluent from this facility is the source of water for aquifer re-injection. The aeration step is included to help remove iron, thereby reducing biofouling of the re-injection well screen. This system typically operates at 1800 gpm providing an annual treatment capacity of up to approximately 945 million gallons.

3.3.1.4 CAWWT Facility

As noted in Section 1, the AWWT Expansion system is being "converted" to the long-term replacement facility for the existing AWWT facility. The CAWWT will initially provide 1200 gpm capacity for groundwater and 600 gpm of storm water/remediation wastewater capacity (including carbon treatment) to handle the last remaining storm water /remediation wastewater flows. Once those flows have ceased, CAWWT will provide a dedicated long-term groundwater treatment capacity of up to 1800 gpm. The CAWWT process flow diagram is provided in Figure 3-7. The unit processes of the CAWWT system include granular multimedia filtration and ion exchange on all 3 trains and activated carbon filtration on train 3, the storm water/remediation wastewater treatment train.

3.3.2 Interim Advanced Wastewater Treatment (IAWWT) System

The IAWWT is located just north of the SWRB. Currently, either basin water or groundwater may be treated by the IAWWT system before it is discharged to the Great Miami River. The IAWWT system consists of two trailer-mounted treatment systems. Before the influent enters these two trailer systems, it is pumped through granular multimedia filters for suspended solids removal. Each trailer unit currently has two feed pumps and two ion exchange vessels in series (lead, lag). The third vessel acts as a "trap" for any resin that may pass through the strainers in the lag vessel. The treated effluent is discharged

through the Fernald site outfall line to the Great Miami River. Backwash from the multimedia filters is routed to the SWRB for subsequent treatment in the AWWT Phase I system as discussed in Section 3.3.1.2 and described in further detail in Section 3.7.2. This system typically operates at 300 gpm providing an annual treatment capacity of up to approximately 155 million gallons.

3.3.3 South Plume Interim Treatment (SPIT) System

The system consists of granular multimedia filtration for particulate removal and ion exchange for uranium removal. The SPIT system uses three ion exchangers in series (lead, lag, and one standby). The treated groundwater is discharged through the Fernald site outfall line to the Great Miami River. Multimedia filter backwash is routed to the SWRB for subsequent treatment in Phase I. The SPIT system will remain dedicated to the treatment of groundwater at the above-stated capacity. This system typically operates at 200 gpm providing an annual treatment capacity of up to approximately 105 million gallons.

3.3.4 Sewage Treatment Plant

The new sewage treatment facility was constructed using relocated equipment from the out-of-service biodenitrification (activated sludge) effluent treatment system and the old sewage treatment plant and was placed into operation in April 1998. The main components of the new sewage treatment plant are comminution, aeration, clarification, sludge thickener, and an ultraviolet disinfection system.

3.4 ANCILLARY FACILITIES

A number of facilities exist that are supplementary to the operation of the various treatment systems. These include system headworks for equalizing the flows to these systems, groundwater flow routing facilities, wastewater collection and transfer facilities, sludge processing facilities, and discharge monitoring facilities. These facilities are described below.

3.4.1 System Headworks

Headwork facilities exist for support of the various wastewater treatment facilities. In general, these facilities provide for flow equalization prior to discharging to the various treatment systems. Details of the headworks follow.

3.4.1.1 Storm Water Retention Basin (SWRB)

The SWRB, located south of the former production area, primarily receives storm water runoff from the former production area (Figure 3-1). When the BSL is removed from service (scheduled for October 2004) the remaining flows, formerly routed to the lagoon, will be routed to the SWRB. These flows are anticipated to consist of OSDF leachate and storm water from the silos and waste storage areas. The schedule for the flows to the SWRB is detailed in Section 4.0. As indicated in Section 2, to maintain compliance with leachate treatment ARARs, once leachate is routed to the SWRB a new operational plan

will be required to: 1) prevent pumping water from the SWRB directly to the Great Miami River (storm water bypass) and 2) prevent overflow of water from the SWRB to the Storm Sewer Outfall Ditch. This operational plan is provided in Section 5.0. The SWRB allows for flow equalization and settling of suspended solids. It has a retention capacity of approximately 10 million gallons. The basin consists of an east chamber and a west chamber. The basin consists of a primary bottom bentonite liner and an upper flexible synthetic membrane liner. An underdrain system beneath the synthetic liner is used to monitor and collect leakage through the synthetic liner. The discharge can currently be routed to the AWWT Phases I and II, IAWWT, or directly to the Fernald site outfall line to the Great Miami River. The west basin contains an engineered overflow that passes collected storm water to Paddys Run via the Storm Sewer Outfall Ditch. As indicated above once leachate is routed to the SWRB, bypassing to the Great Miami River and overflowing to the Storm Sewer Outfall Ditch will no longer be permitted to occur.

3.4.1.2 Biodenitrification Surge Lagoon (BSL)

The BSL is located in the southeast section of the waste storage area (Figure 3-1). It is an 8-million-gallon, man-made lagoon that currently receives storm water runoff from the waste pit area perimeter, OSDF leachate, WPP Storm Water Management Pond, and wastewater discharges from the Waste Pit Area Wastewater Treatment System installed and operated by Shaw Environmental, the waste pit remediation contractor.

The lagoon has two synthetic membrane liners and an underdrain collection system beneath each membrane liner. The bottom of the lagoon is lined with a 12-inch thick layer of bentonite. Wastewater is pumped from the lagoon to the AWWT Phase II facility from a pump station located at the southeast corner of the lagoon.

3.4.1.3 Headworks Sludge Removal Systems

Each headworks facility is equipped with the ability to remove collected sediments with a hydro-dredge system. Because the SWRB consists of two chambers (east and west), two dredges are used to avoid continuously moving a dredge from one chamber to the other. The dredges became operational during the summer of 1999.

As required, the dredges will remove the sediment and discharge it into a mixing tank. The mixing tank contents will be slowly discharged into their respective headworks pump pits to be routed to the AWWT. The suspended solids will be settled out at the AWWT clarifiers and sent to the SDF (Section 3.4.5) for dewatering in preparation for disposal.

3.4.1.4 Sanitary Lift Station

All sanitary flow is collected in the Sanitary Lift Station, which has a limited storage volume. Pumps automatically transfer accumulated wastewater to the sewage treatment plant when a certain storage level is reached.

3.4.1.5 Great Miami Aquifer

No specific headworks exist for groundwater. However, because this flow can be adjusted by regulating the extraction wells, the aquifer itself serves as the headworks for groundwater.

3.4.2 SWRB Valve House

The SWRB valve house is located just north of the SWRB west chamber. The valve house contains an extensive array of valves to allow diversion of storm water flow from the SWRB and groundwater flow to the various treatment facilities. This facility also serves as the point of convergence for the effluent from the treatment systems prior to discharge through the Fernald site outfall pipeline. The valves also allow for untreated water from the SWRB to be discharged directly to the Great Miami River to assist in preventing the SWRB from overflowing to the Storm Sewer Outfall Ditch and Paddys Run, due to heavy rainfall or other operational difficulties. Flow monitoring and sampling equipment are also provided in the valve house.

3.4.3 South Field Valve House

As part of the South Field Extraction System Phase I construction, a new south field valve house was constructed, upstream of the SWRB Valve House. The primary purpose of this valve house is to receive the combined South Plume Recovery System and South Plume Optimization System groundwater. It directs all or portions of the combined flow toward treatment and/or to untreated discharge prior to combining with other groundwater flows.

3.4.4 AWWT Slurry Dewatering Facility (SDF)

The AWWT SDF is adjacent to the AWWT facility. The primary purpose of the SDF is the processing (dewatering) of waste slurries and sludges from the AWWT facilities. The dewatering of miscellaneous site waste sludges (i.e., those from the SWRB, sewage treatment plant, etc.) and treatment of miscellaneous wastewaters (i.e., D&D wastewater, wastewater from waste management activities) are also at this facility.

The SDF has a design treatment capacity of approximately 30,000 gallons per day of slurry. The process consists of slurry conditioning (pH adjustment, coagulation/flocculation, filter aid addition), thickening, and pressure filtration. The dewatered waste material is packaged for on- or off-site disposal.

3.4.5 Parshall Flume

Downstream of the effluent aeration facility, the combined flows pass through a Parshall flume and an associated outfall monitoring station for Fernald site discharge flow measurement and monitoring.

3.5 CURRENT TREATMENT PERFORMANCE

The performance of the several ARWWT treatment systems measured against the overriding goal of meeting Operable Unit 5 Record of Decision discharge standards relative to uranium as well as NPDES effluent limits has been satisfactory. The uranium mass loading limit of 600 pounds per year (lbs/yr) has been met every year since the requirement became effective in January 1998. As depicted on Figure 3-8, the monthly average concentration has been met every month since January 1998 with the exception of five months. The Fernald site has been in compliance with NPDES effluent limits well in excess of 99 percent of the time since January 1995; the date the AWWT Phases I and II were placed into service. Figures 3-9 and 3-10 provide treatment system/groundwater uranium mass balances for years 2002 and 2003 respectively.

3.6 CURRENT AND PLANNED DISCHARGE MONITORING

Currently, discharge monitoring is completed under two sampling programs. Conventional pollutants are monitored under the NPDES. Radionuclides and total uranium are monitored under the Federal Facilities Compliance Agreement (FFCA). These two programs have been incorporated into the IEMP sampling program as described in Section 4 of the IEMP. These monitoring programs are described briefly in the subsections below.

3.6.1 NPDES Monitoring

There are nine locations monitored under the current NPDES Permit; six of which relate to permitted Fernald site wastewater/storm water discharge outfalls to State of Ohio waters, two related to upstream and down stream monitoring (relative to the Fernald site outfall line) of the Great Miami River; and one internal location (see Figure 3-11). The permit (Ohio EPA Permit No. 1IO00004*FD) is administered by OEPA and granted to the DOE at the Fernald site. The effluent pollutant limitations, monitoring requirements, and reporting requirements are specified in the permit for each of the nine monitored locations.

Discharges through Outfall 4001 enter the Great Miami River at River Mile 24.73. The sampling and monitoring location for this outfall is the Parshall flume chamber immediately downstream from Manhole 176B. This outfall is the primary Fernald site wastewater discharge outfall consisting of discharges from the AWWT facilities, IAWWT, SPIT, sewage treatment plant, untreated groundwater, and untreated storm water.

Discharge through Outfall 4002 enters Paddys Run at River Mile 2.50. The sampling and monitoring location for this outfall is the SWRB overflow spillway (location 4002O on Figure 3-11). Discharge at this outfall only occurs when the accumulation of storm water in the SWRB exceeds the hydraulic capacity of the SWRB.

Discharges through Outfalls 4003, 4004, 4005, and 4006 are untreated storm water runoff drainage from site areas into Paddys Run. Runoff from eastern and southern areas of the site drains through Outfall 4003, which is just north of Willey Road. Runoff from the area north and west of the inactive flyash pile drains through Outfall 4004, which is just west of the flyash pile. Runoff from the western area of the site drains through Outfall 4005, which is just south of the K-65 Silos. Runoff from areas north of the site drains through Outfall 4006, which is north of Waste Pit 5.

Location 4801 is a location upstream of the Fernald site outfall line in the Great Miami River and is collected from the Venice Bridge (RM 26.2). This location serves as the background location under the IEMP. Location 4902 is the location down stream from the Fernald site outfall line and is collected from the new New Baltimore Bridge (RM 21.4).

Internal sampling station 4601 is the sampling of final effluent from the sewage treatment plant at the Ultraviolet Disinfection Building.

3.6.2 Radionuclide and Uranium Monitoring

The Fernald site conducts a surface water sampling and analytical program for certain specific radionuclides which are potentially present in the regulated liquid effluent and in the uncontrolled storm water runoff from the site. Details of this program are provided in Section 4 of the IEMP. The program consists of uranium analysis of a daily flow-proportional composite sample of the site effluent and grab sampling at quarterly intervals. The monthly samples are analyzed for total uranium, radium-228 and technetium-99, while the quarterly samples are analyzed for lead-210, radium-226 and strontium-90.

The daily total uranium analysis of the site effluent to the Great Miami River is used to track compliance with Operable Unit 5 Record of Decision established limits. Since the issuance of the Operable Unit 5 Record of Decision in January 1996, the Fernald site is obligated to limit the total mass of uranium discharged through the Fernald site outfall to the Great Miami River to 600 lbs/yr.

This daily effluent uranium analysis is also used to demonstrate compliance with the monthly average uranium concentration of 30 ppb uranium in the site discharge to the river. The original requirement for compliance with a monthly average concentration became effective January 1, 1998, as established in the Operable Unit 5 Record of Decision. The Operable Unit 5 Record of Decision established this

concentration at 20 ppb uranium, which was the compliance standard from January 1998 through November 2001. The monthly average concentration limit changed from 20 ppb to 30 ppb beginning December 1, 2001 as a result of EPA approval of the ESD for Operable Unit 5 in November 2001. This Operable Unit 5 ESD changed the total uranium groundwater FRL from 20 ppb to 30 ppb as well as established the new monthly average concentration discharge standard. The 600 lbs/yr limit was unaffected by this ESD and remains in effect.

The Operable Unit 5 Record of Decision does allow relief from this monthly average concentration requirement during periods of excessive precipitation and for scheduled maintenance. (Excessive precipitation is an amount of precipitation combined with the projected weather forecast, that causes water levels in the basin to threaten the limit of the holding capacity of the basin.) The uranium concentration in the effluent to the river on up to 10 storm water bypass days a year may be deleted when calculating the monthly average. Section 9.1.5 of the Operable Unit 5 Record of Decision stipulates that notification will be provided to EPA and OEPA within seven days of the implementation of such a direct bypass. The purpose of the bypass is to minimize the possibility of SWRB overflow to Paddys Run. As noted in Section 2.0 and above in Section 3.4.1.1, many of the gravity-fed storm sewer lines in the former production area have been removed as a consequence of site remediation. Removal of these lines allows for much more control of the storm water flow into the SWRB. Therefore, bypassing of storm water will no longer occur beginning in the fall of 2004.

The average monthly uranium concentration is calculated by multiplying each daily flow by the uranium concentration of the flow-weighted composite sample for that respective day. The sum of the values obtained by multiplying the flow times the concentration is then divided by the sum of the flows for the month. The result is a flow-weighted average monthly uranium concentration. The daily flow-weighted concentrations are then multiplied by 8.35 (lb/gal) to obtain the daily pounds of uranium discharged. The sum of the daily masses for the year is used to compare against the 600-lbs/yr limit.

If the average monthly uranium concentration exceeds the 30 ppb limit, the excursion will be reported to the agencies. If a sequence of months (i.e., not a random occurrence) indicate an exceedance of the 30 ppb monthly average, and there has not been above average rainfall, then corrective measures will need to be evaluated. Depending on the reason for the sequence of exceedances, corrective actions could include: modifications to parts of the Fernald site wastewater system, segregation of the South Plume Optimization wells discharged from the combined South Plume Optimization/South Plume Recovery System header to reduce the concentration of uranium in flow bypassing treatment, or other such actions.

The need for corrective measures will be discussed with the EPA and OEPA in periodic meetings/reports. (Summary reporting of how the Fernald site is doing with respect to compliance with the 30-ppb uranium discharge limit and the use of bypass days will be included in the meetings/reports.) In the event that corrective measures are deemed necessary, the situation will be outlined to the EPAs in order to reach consensus regarding what action (if any) is required.

3.6.3 IEMP Surface Water and Treated Effluent Monitoring Program

Significant portions of the current and past programs (NPDES and FFCA) have been incorporated into the IEMP. Section 4 of the IEMP describes these two programs in more detail and also how these two programs have been integrated into the IEMP surface water and treated effluent sampling program. The IEMP also provides for additional monitoring above that required by the NPDES permit and the FFCA. This additional monitoring is performed as a supplement in order to monitor surface water and treated effluent for potential site impacts to various receptors during remediation. Figure 3-11 shows the current NPDES, FFCA, and the IEMP treated-effluent and surface-water sampling locations. In addition to identifying the sampling program requirements, the IEMP provides a comprehensive data evaluation and associated decision-making and reporting strategy for surface-water and treated-effluent. Figure 3-12 depicts the IEMP treated-effluent and surface-water data evaluation strategy and associated actions.

TABLE 3-1

STATUS OF WASTEWATER SOURCES AND TREATMENT SYSTEMS

Note: This table is provided for information only and the dates herein are subject to change.

Status of Remediation Wastewater Sources	
Source	Status
WPP Dryer Operations	Dryer Operations ongoing; scheduled to end August 2004
WPP Excavation/Loading Activities	Waste pit material/soil excavations ongoing; scheduled to end April 2005
Former Production Area Excavations	Excavation dewatering ongoing; scheduled to end March 2005
Former Production Area Storm Water Runoff	Runoff treated, as necessary, until soil clean-up levels attained and certified by EPA and OEPA; scheduled to be complete April 2006
Silo 3 Remediation	Operations begin June 2004; scheduled to be complete September 2004
Radon Control System Condensate	Operations ongoing through August 2005; removed from service for D&D coinciding with the completion of Silos 1 and 2 remediation facility operations
Accelerated Waste Retrieval	Silos 1 and 2 sluicing operations begin August 2004; complete February 2005. Operations supporting Silos 1 and 2 remediation facility scheduled to be complete August 2005
Silos 1 and 2 Remediation	Initiation of operations scheduled to begin September 2004. Operations scheduled to be complete August 2005
D&D of Facilities and Structures	D&D activities or all legacy structures and constructed remediation facilities scheduled to be complete March 2006
Groundwater Remediation	Ongoing through June 2006; ongoing post closure
On-Site Disposal Facility Leachate	Ongoing through June 2006; ongoing post closure. Last cell capped March 2006 resulting in leachate generation being reduced to between 1 and 10 gpm. Beginning November 2004, leachate will be redirected from the BSL to the SWRB. Leachate will be treated through AWWT Phase I and AWWT Phase II during the CAWWT conversion process. Leachate will be discharged directly to CAWWT when the SWRB is removed from service in October 2005

TABLE 3-1
(Continued)

Wastewater Treatment and Control Systems	
System	Status
AWWT Phase 1	Operational through February 2005; removed from service for D&D beginning March 2005
AWWT Phase 2	Operational through February 2005; removed from service for D&D beginning March 2005
AWWT Expansion (Phase III)	Operational through September 2004, removed from service and modified to CAWWT beginning October 2004
CAWWT	Operational February 2005; treating all remaining storm water and remediation wastewater through June 2006; groundwater treatment (and perhaps OSDF leachate) only beginning July 2006 and continuing thereafter until determined unnecessary by DOE in consultation with EPA and OEPA
IAWWT	Operational through June 2005; removed from service for D&D July 2005
South Plume Interim Treatment System	Operational through June 2005; removed from service for D&D July 2005
AWWT Slurry Dewatering Facility	Operational through October 2005; removed from service for D&D November 2005
SWRB	Operational through October 2005; beginning November 2004, the SWRB will be operated to prevent any overflow to Paddys Run or bypassing to the Great Miami River due to the significant reduction in flows coming to the SWRB by gravity. Removed from service for D&D November 2005
BSL	Operational through October 2004; removed from service for D&D November 2004. All remaining flows formerly coming to the BSL will be routed to the SWRB after the BSL is removed from service. These remaining flows will consist of storm water only
Final Aeration Tank	Operational through July 2004; removed from service for D&D August 2004
Shaw Environmental Waste Pits Wastewater Treatment System (WWTS)	Operational through September 2004; removed from service coinciding with the completion of waste pit dryer operations September 2004
Waste Pits Storm Water Management Pond	Operational through April 2005; removed from service for D&D May 2005 coinciding with the completion of soil excavation activities in the waste pit area. From July 2004 through September 2004, will serve as the collection point for wastewaters requiring treatment through the Shaw WWTS replacing the clearwell. From October 2004 through April 2005 discharge rerouted to SWRB.
Waste Pit Area Runoff Control Sump	Operational through April 2005; removed from service for D&D/excavation May 2005 coinciding with the excavation activities in the silos/waste pits area (beginning September 2004 through end of operations discharge rerouted to SWRB/CAWWT)
Sewage Treatment Plant	Operational through June 2005, removed from service for D&D July 2005. Remaining site personnel to use portable chemical toilets or holding tanks

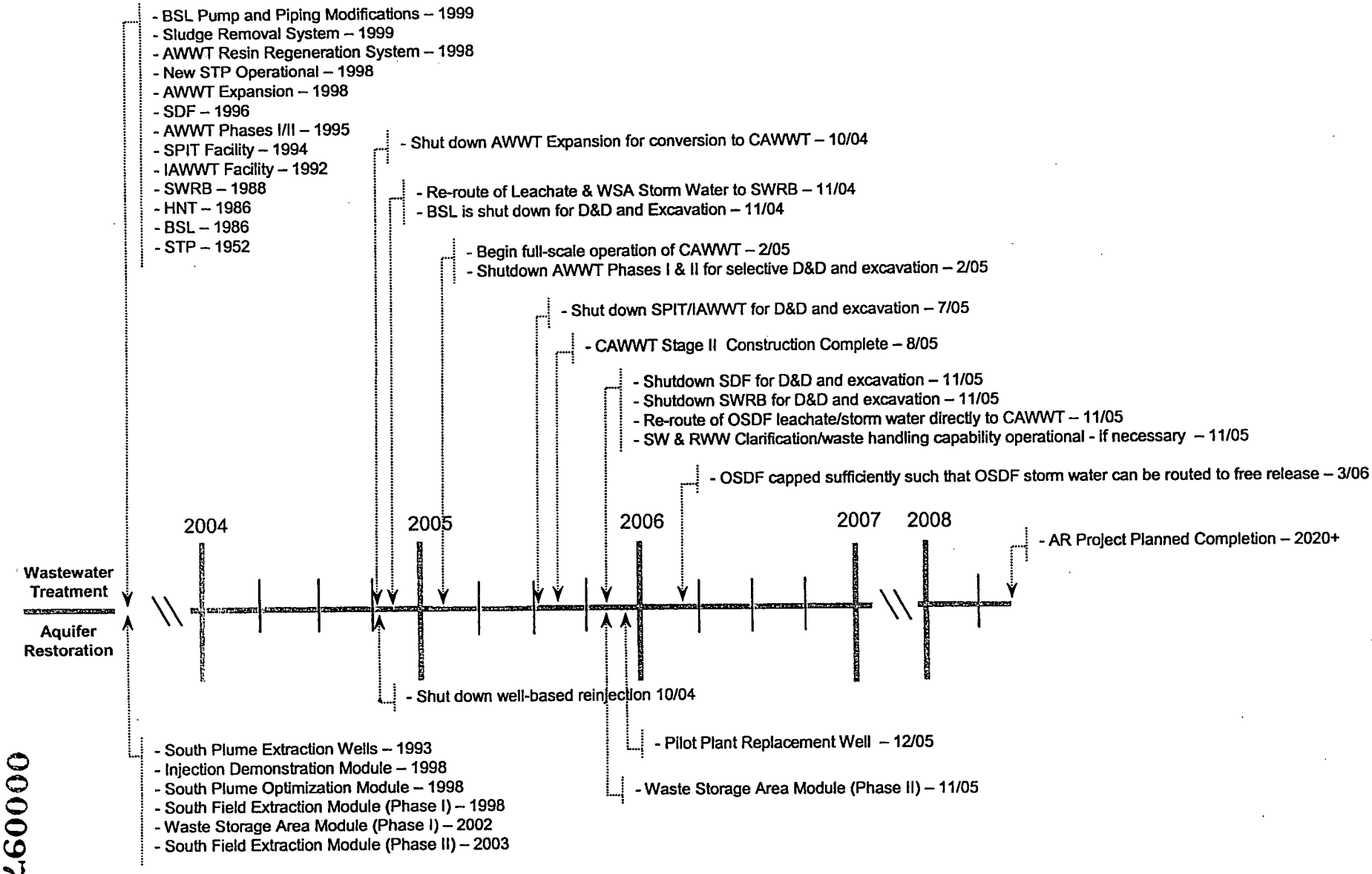
TABLE 3-2
WELL FIELD OPERATING STATUS

Module	Operations Identification	SED Identification	Date of Initial Operation	Current Status	Notes
South Plume	RW-1	3924	08/27/93	Active	
South Plume	RW-2	3925	08/27/93	Active	
South Plume	RW-3	3926	08/27/93	Active	
South Plume	RW-4	3927	08/27/93	Active	
South Plume	RW-5	3928	08/27/93	Inactive	Turned off 9/11/94, not needed
South Plume	RW-6	32308	08/09/98	Active	
South Plume	RW-7	32309	08/09/98	Active	
SouthField	EW-13	31565	07/13/98	Inactive	Turned off 5/22/01
SouthField	EW-14	31564	07/13/98	Inactive	Turned off 12/19/01
SouthField	EW-15	31566	07/13/98	Inactive	Turned off 8/7/98, replaced by EW-15A
SouthField	EW-15a	33262	07/26/03	Active	
SouthField	EW-16	31563	07/13/98	Inactive	Turned off 12/19/02, Converted to IW16
SouthField	EW-17	31567	07/13/98	Active	
SouthField	EW-18	31550	07/13/98	Active	
SouthField	EW-19	31560	07/13/98	Active	
SouthField	EW-20	31561	07/13/98	Active	
SouthField	EW-21	31562	07/13/98	Inactive	Turned off 3/13/03, replaced by EW-21A
SouthField	EW-21A	33298	07/29/03	Active	
SouthField	EW-22	32276	07/13/98	Active	
SouthField	EW-23	32447	02/02/00	Active	
SouthField	EW-24	32446	02/02/00	Active	
SouthField	EW-25	33061	05/07/02	Active	
SouthField	EW-30	33264	07/25/03	Active	
SouthField	EW-31	33265	07/25/03	Active	
SouthField	EW-32	33266	07/25/03	Active	
WSA	EW-26	32761	05/08/02	Active	
WSA	EW-27	33062	05/08/02	Active	
WSA	EW-28	33063	05/08/02	Active	
Re-Injection	IW-8	22107	09/02/98	Inactive	Turned off 12/31/01
Re-Injection	IW-8A	33253	11/07/02	Active	
Re-Injection	IW-9	22108	09/02/98	Inactive	Turned off 3/1/02
Re-Injection	IW-9A	33254	11/07/02	Active	
Re-Injection	IW-10	22109	09/02/98	Active	
Re-Injection	IW-10A	33255	5/22/03	Active	
Re-Injection	IW-11	22240	09/02/98	Active	
Re-Injection	IW-12	22111	09/02/98	Inactive	In standby
Re-Injection	IW-16	31563	07/27/03	Active	Well used to be extration well (EW16)
Re-Injection	IW-29	33263	07/27/03	Active	
Re-Injection	Inj. Pond		07/27/03	Active	

FIGURE 3-1 ARWWT FACILITIES LOCATION MAP

Figure 3-2

ARWWT Timeline



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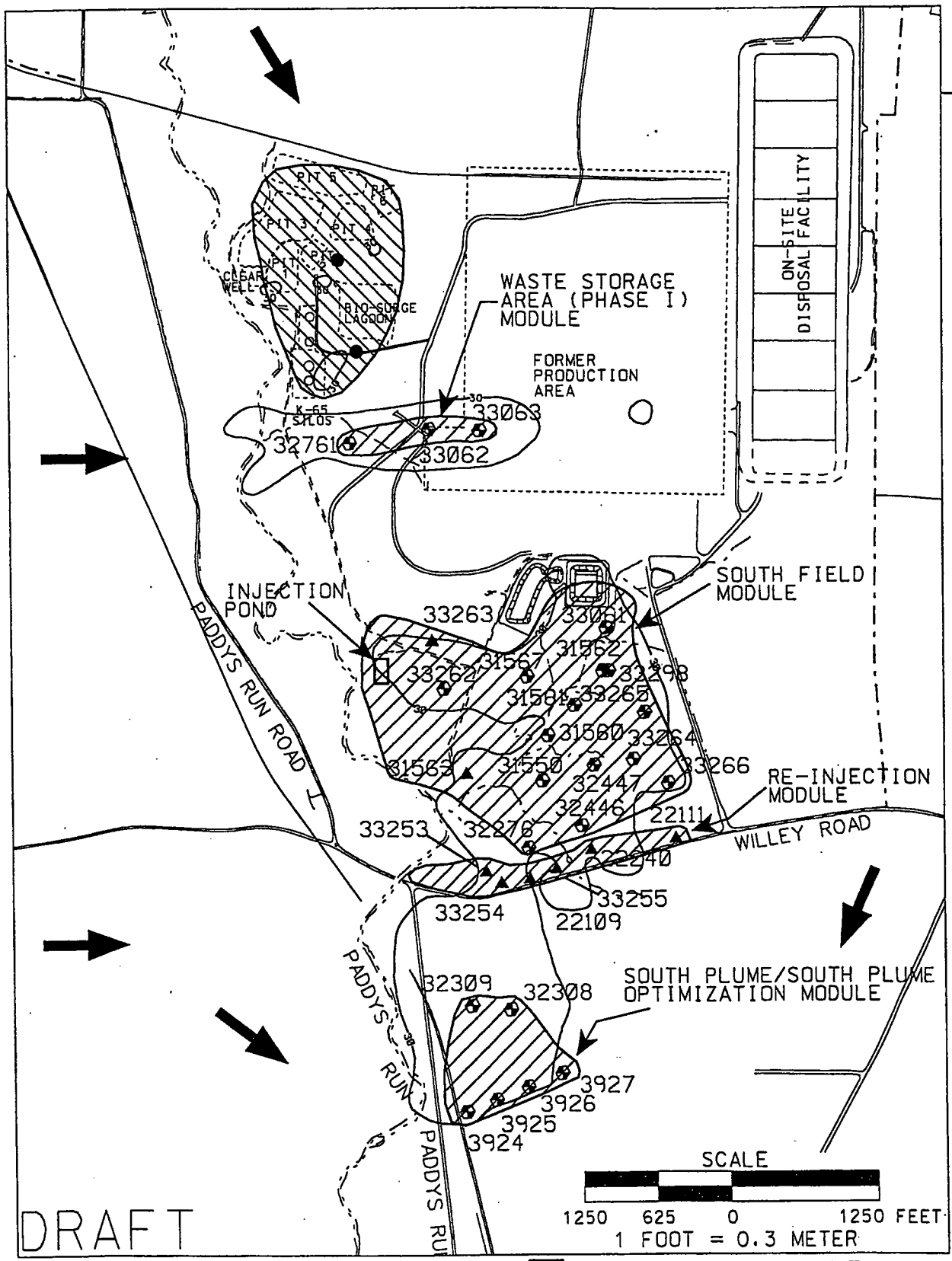

LEGEND:

- FERNALD SITE BOUNDARY
- EXTRACTION WELL
- RE-INJECTION WELL
- FUTURE EXTRACTION WELL
- CURRENT ACTIVE MODULE
- FUTURE MODULE
- 30 $\mu g/L$ TOTAL URANIUM PLUME FROM SECOND HALF 2003
- REGIONAL GROUNDWATER FLOW DIRECTION

V:\5fcp1\dgn\DMNP\2004-DMNP\04-cmp-03.dgn

STATE PLANAR COORDINATE SYSTEM 1983

25-JUN-2004

FIGURE 3-3. CURRENT AND FUTURE EXTRACTION AND RE-INJECTION WELLS FOR THE GROUNDWATER REMEDY

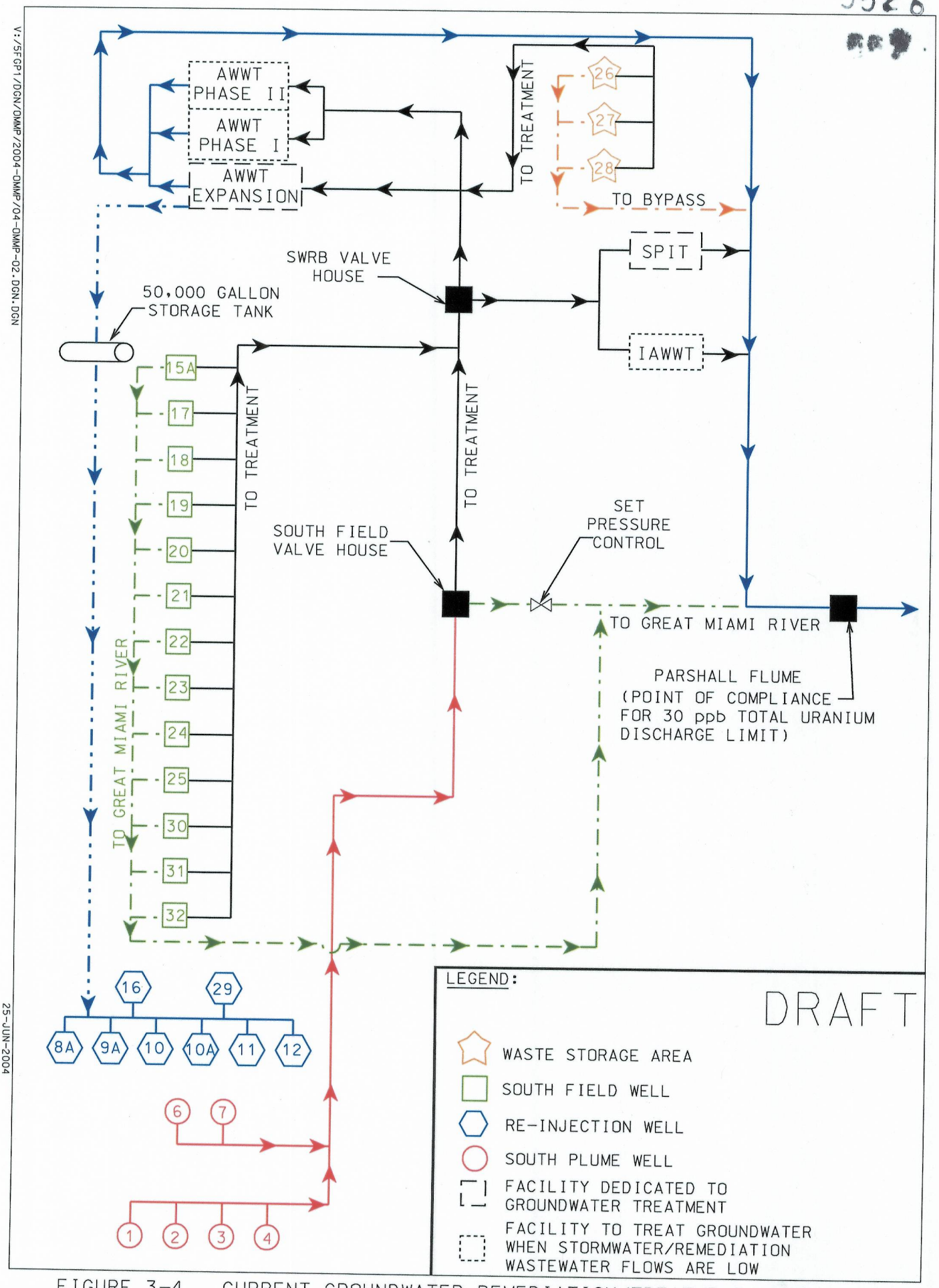

FIGURE 3-4. CURRENT GROUNDWATER REMEDIATION/TREATMENT SCHEMATIC

V:/5FGP1/DGN/OMMP/2004-OMMP/04-OMMP-02.DGN.DGN
25-JUN-2004

FIGURE 3-5
AQUIFER RESTORATION DECISION-MAKING PROCESS

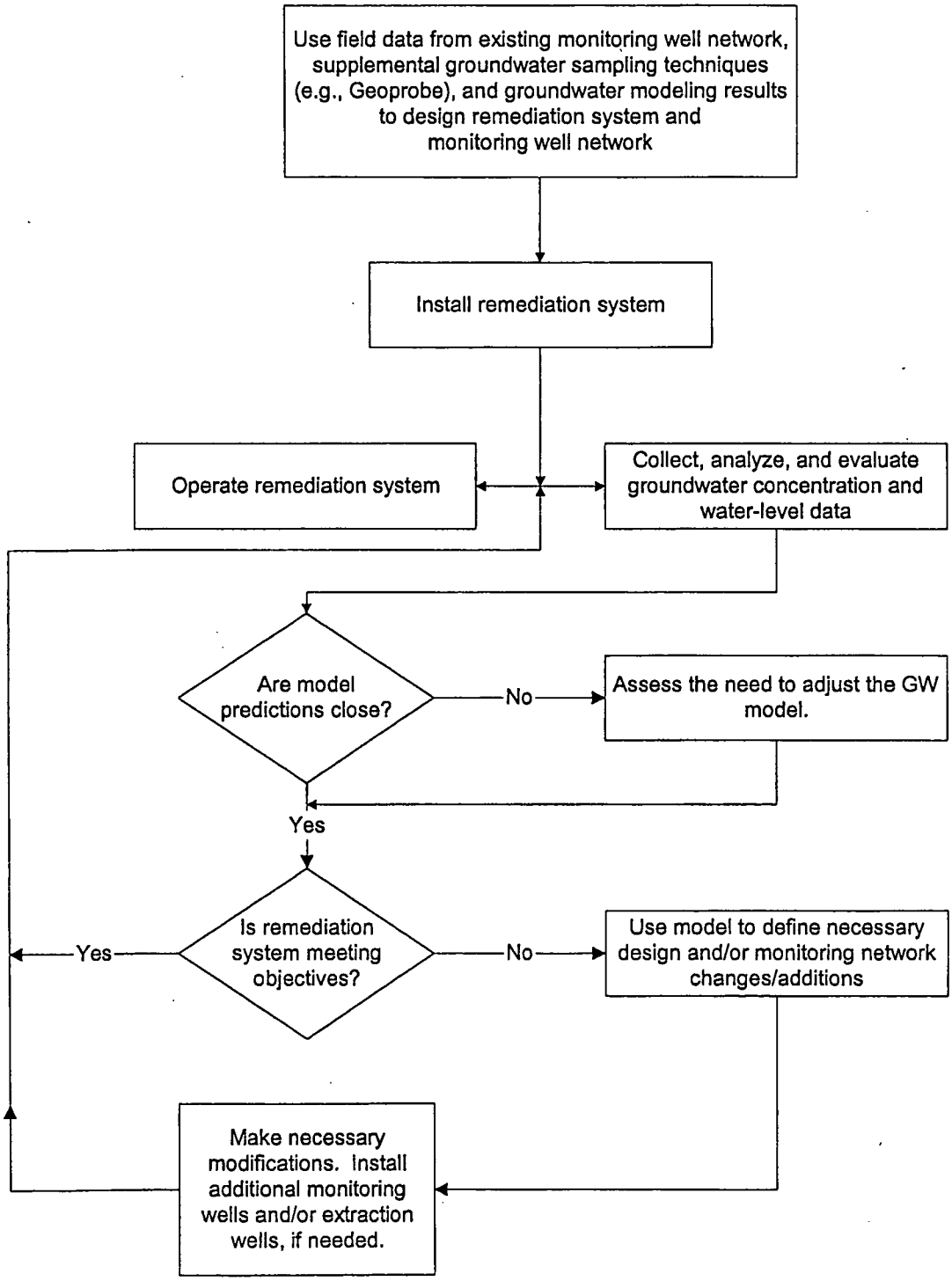

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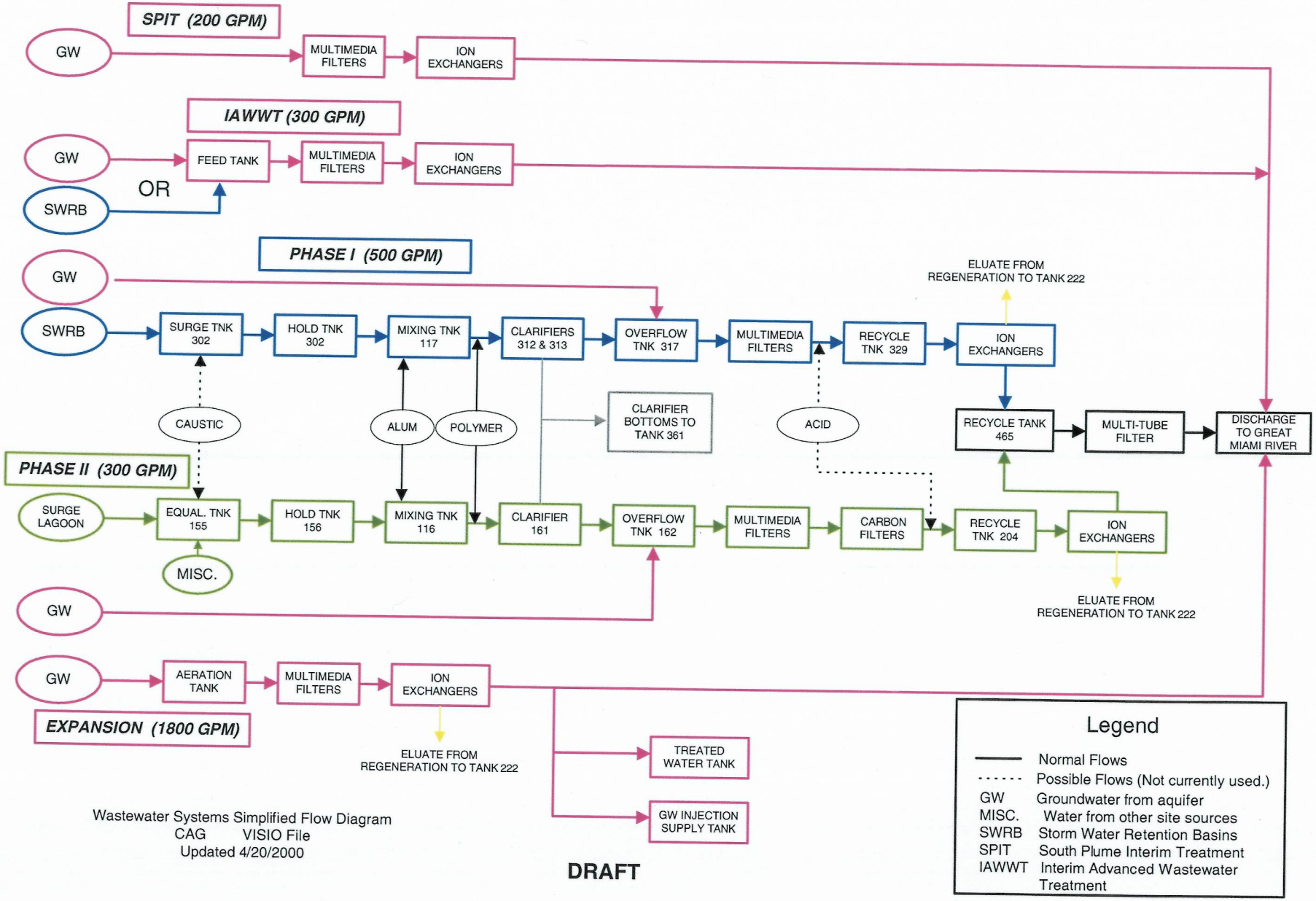
FIGURE 3-6 WASTEWATER TREATMENT SYSTEMS SIMPLIFIED PROCESS FLOW DIAGRAM



Wastewater Systems Simplified Flow Diagram
CAG VISIO File
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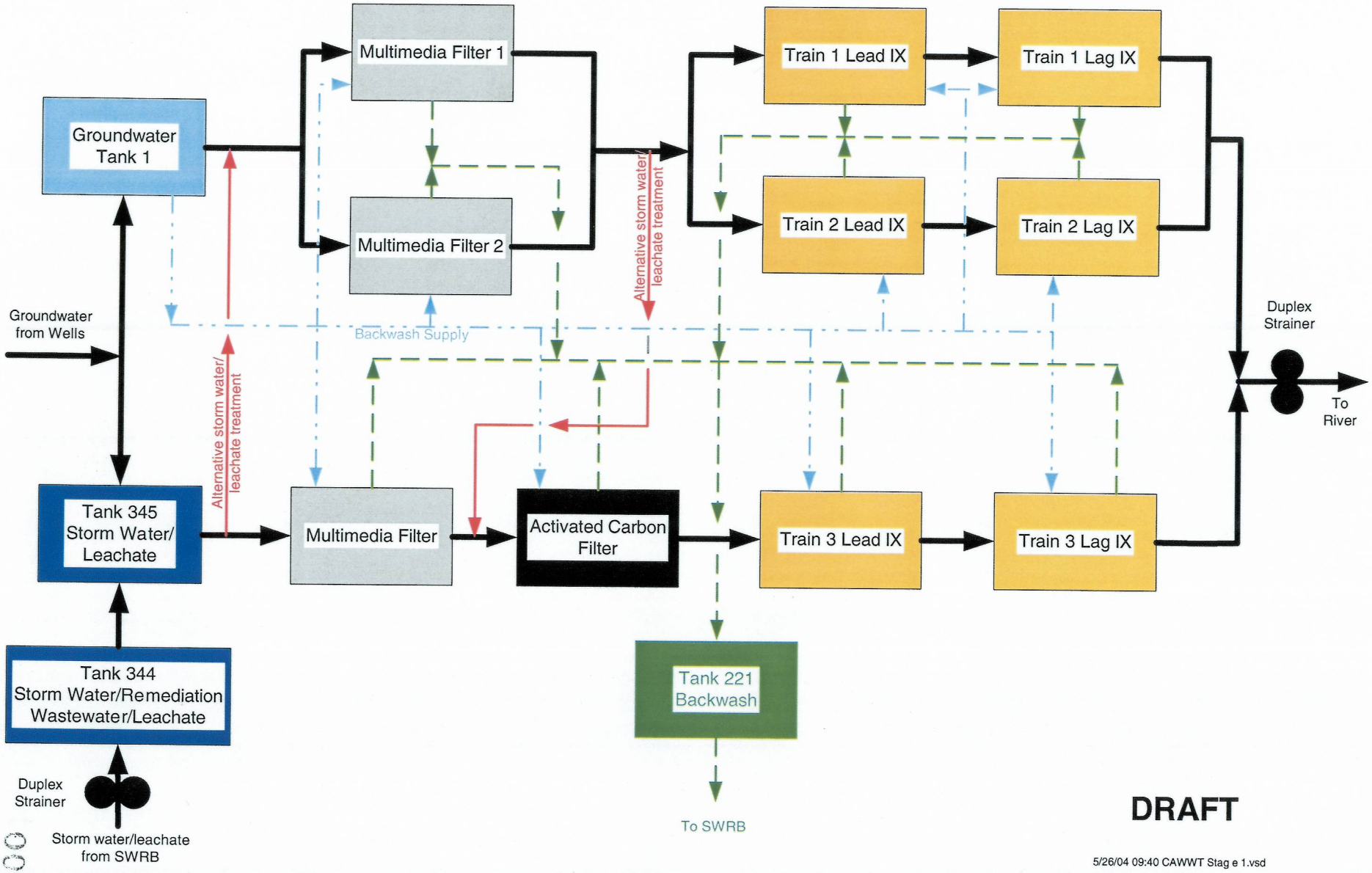
Figure 3-7 CAWWT Process Flow Diagram



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5/26/04 09:40 CAWWT Stag e 1.vsd

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Figure 3-8
Monthly Average Uranium Concentration in the Effluent to the Great Miami River at PF4001

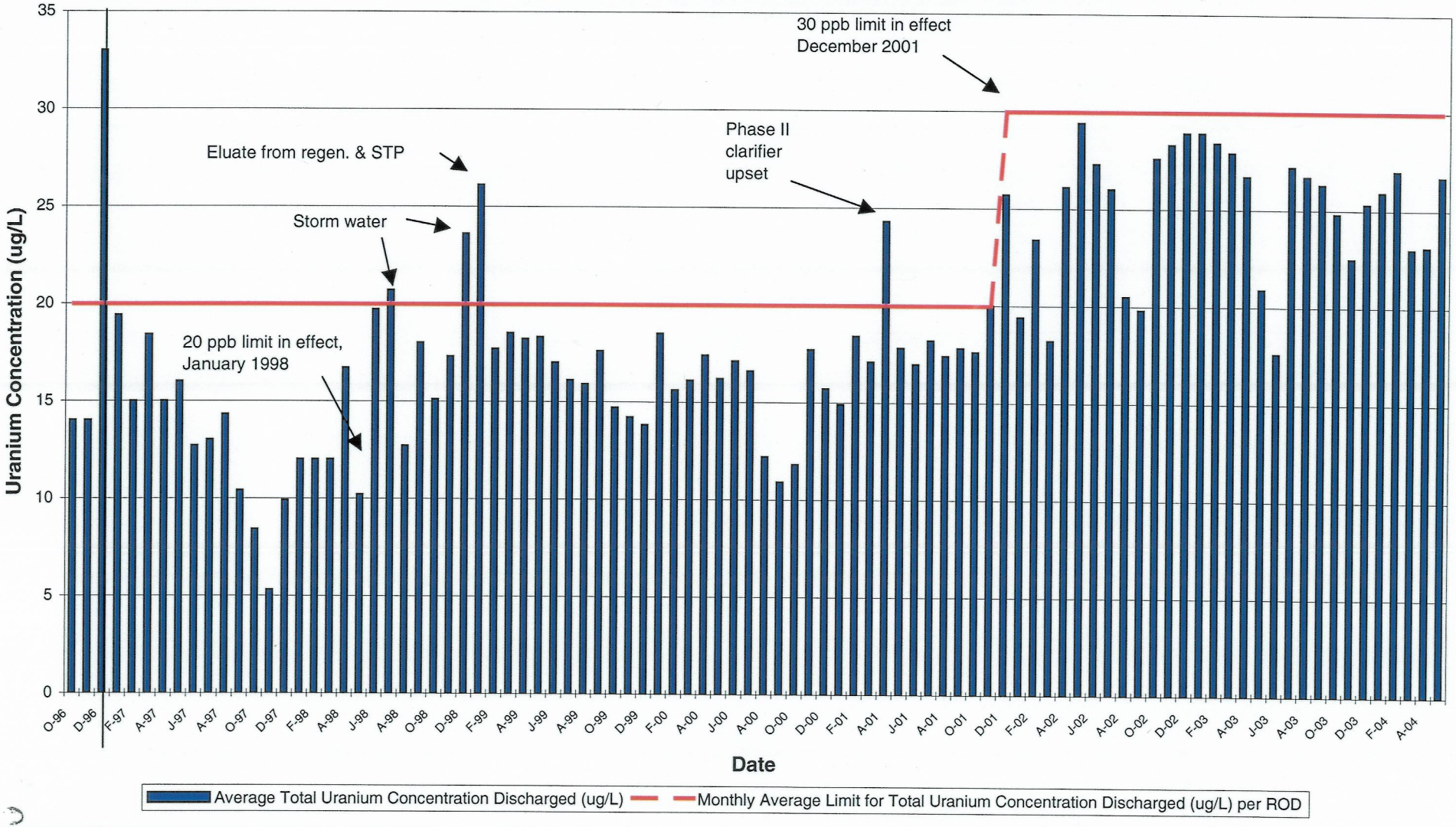

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Figure 3-9 Uranium Mass Balance by Treatment System for CY 2002

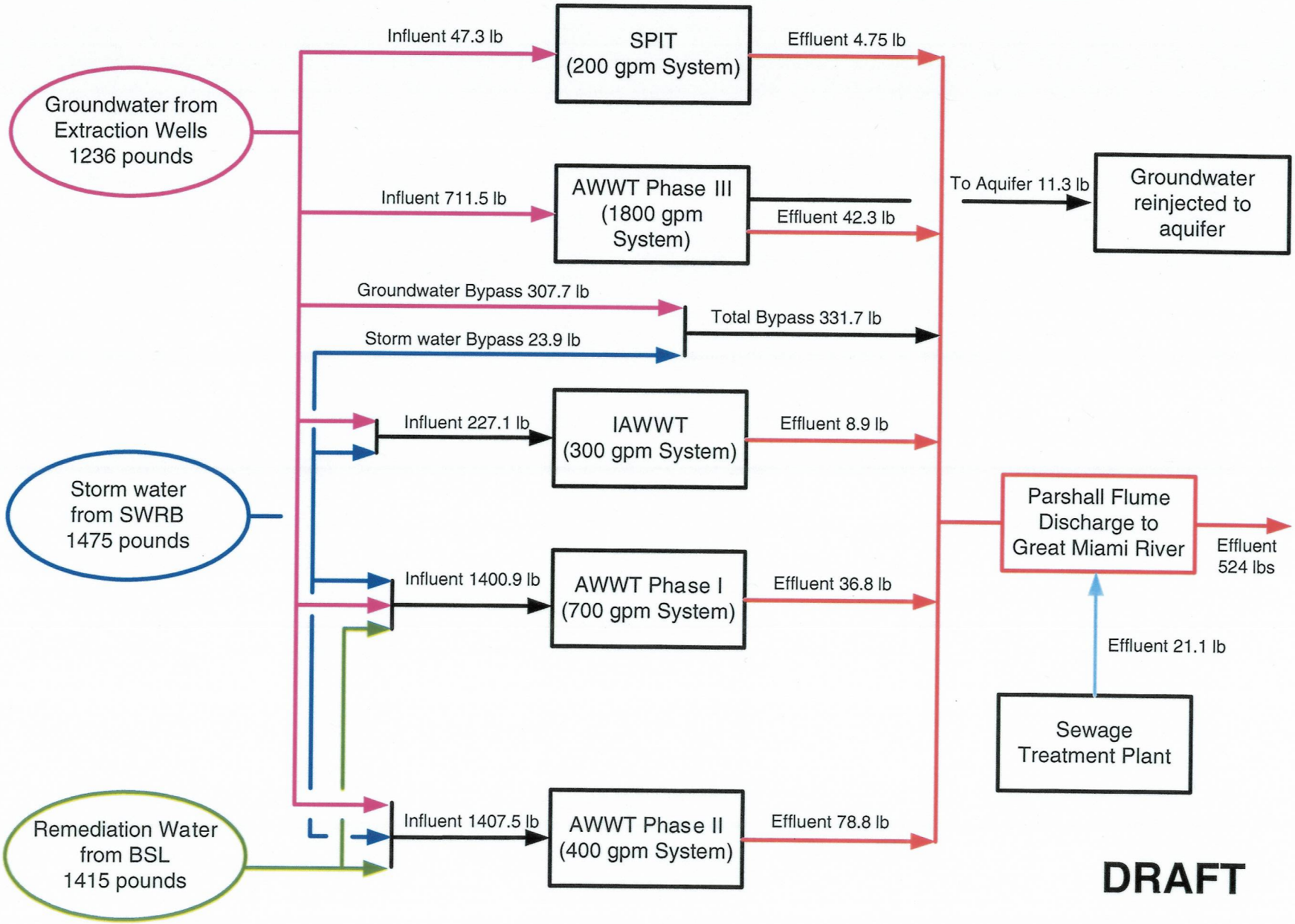

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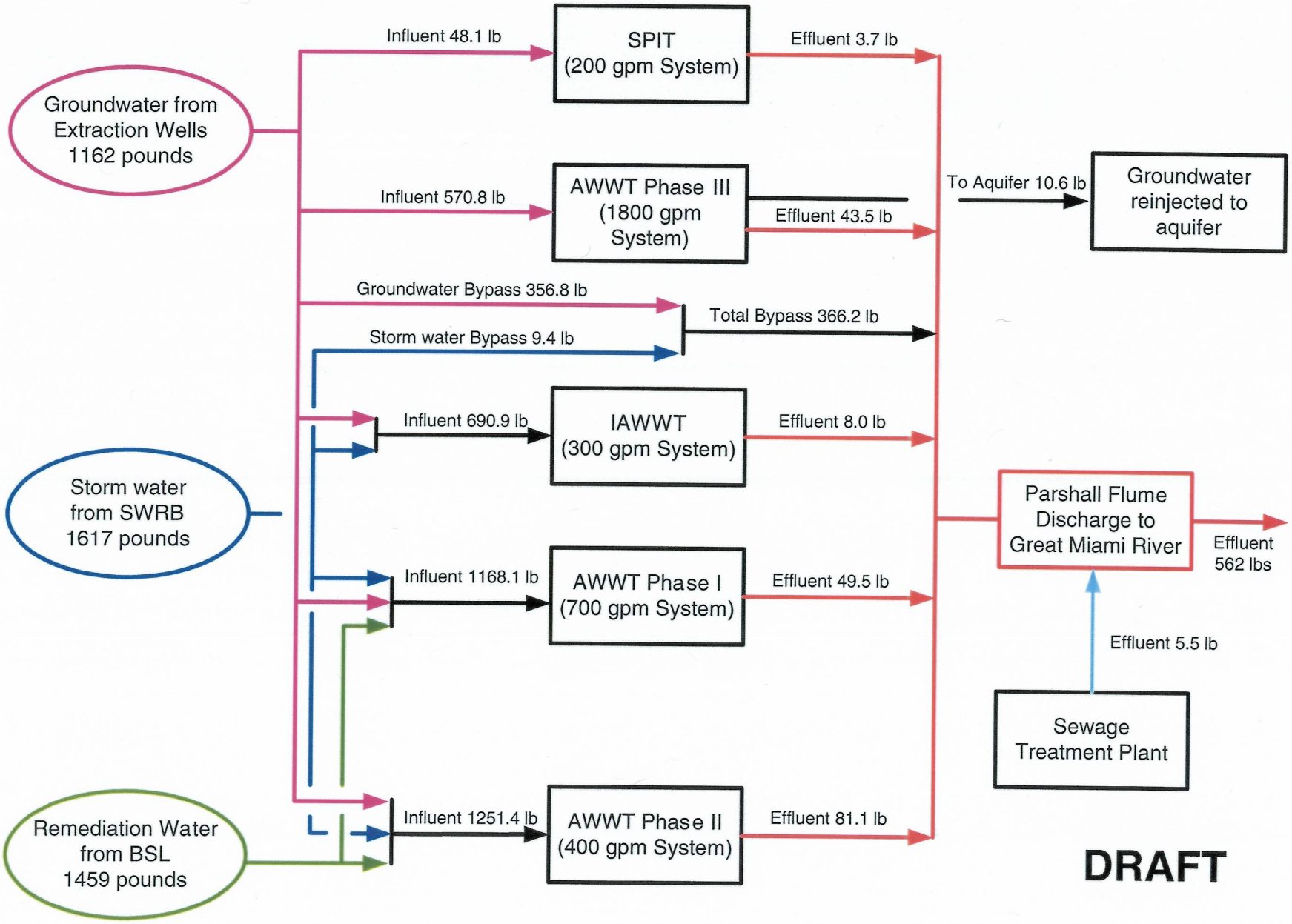
Figure 3-10 Uranium Mass Balance by Treatment System for CY 2003



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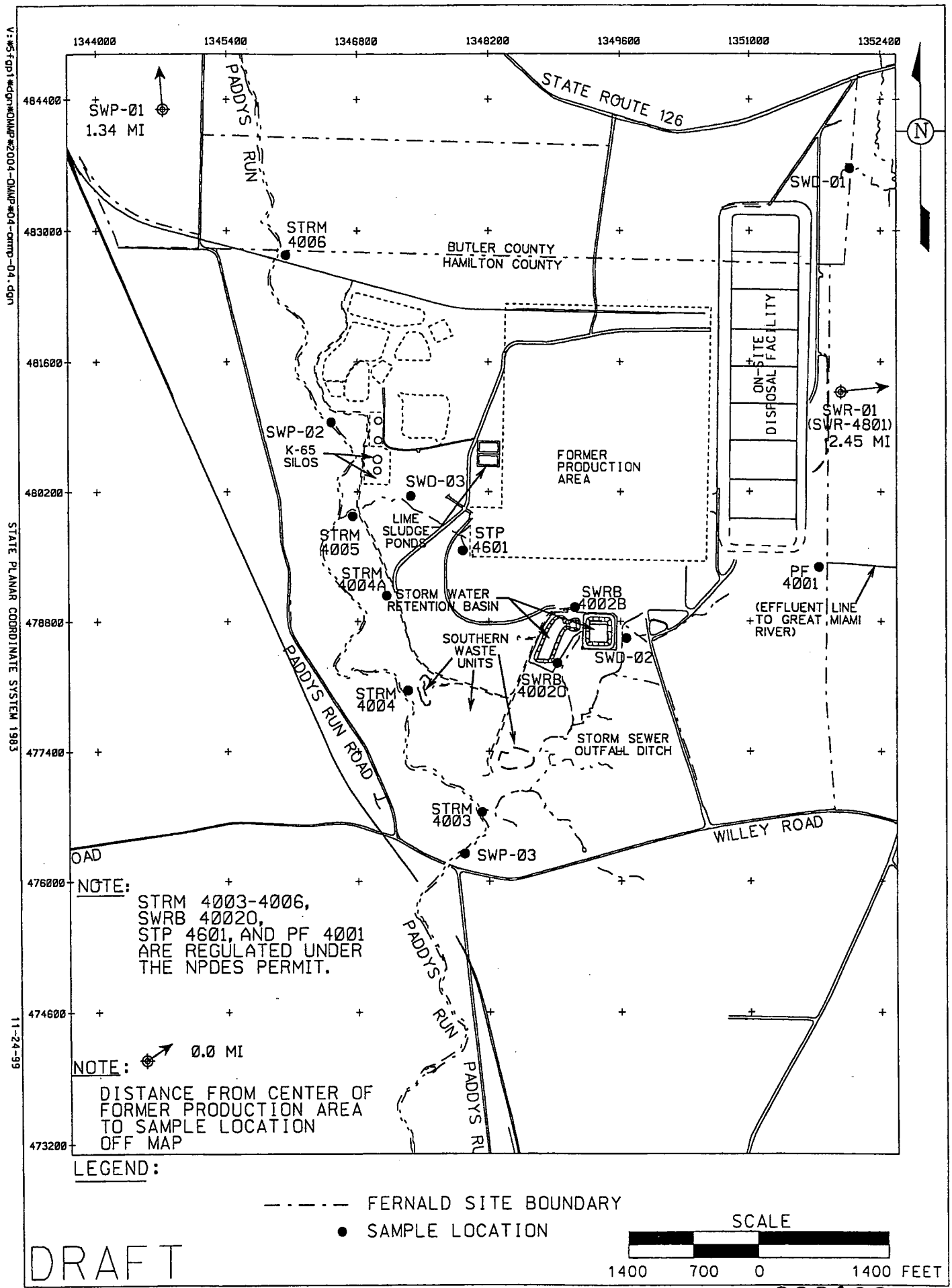
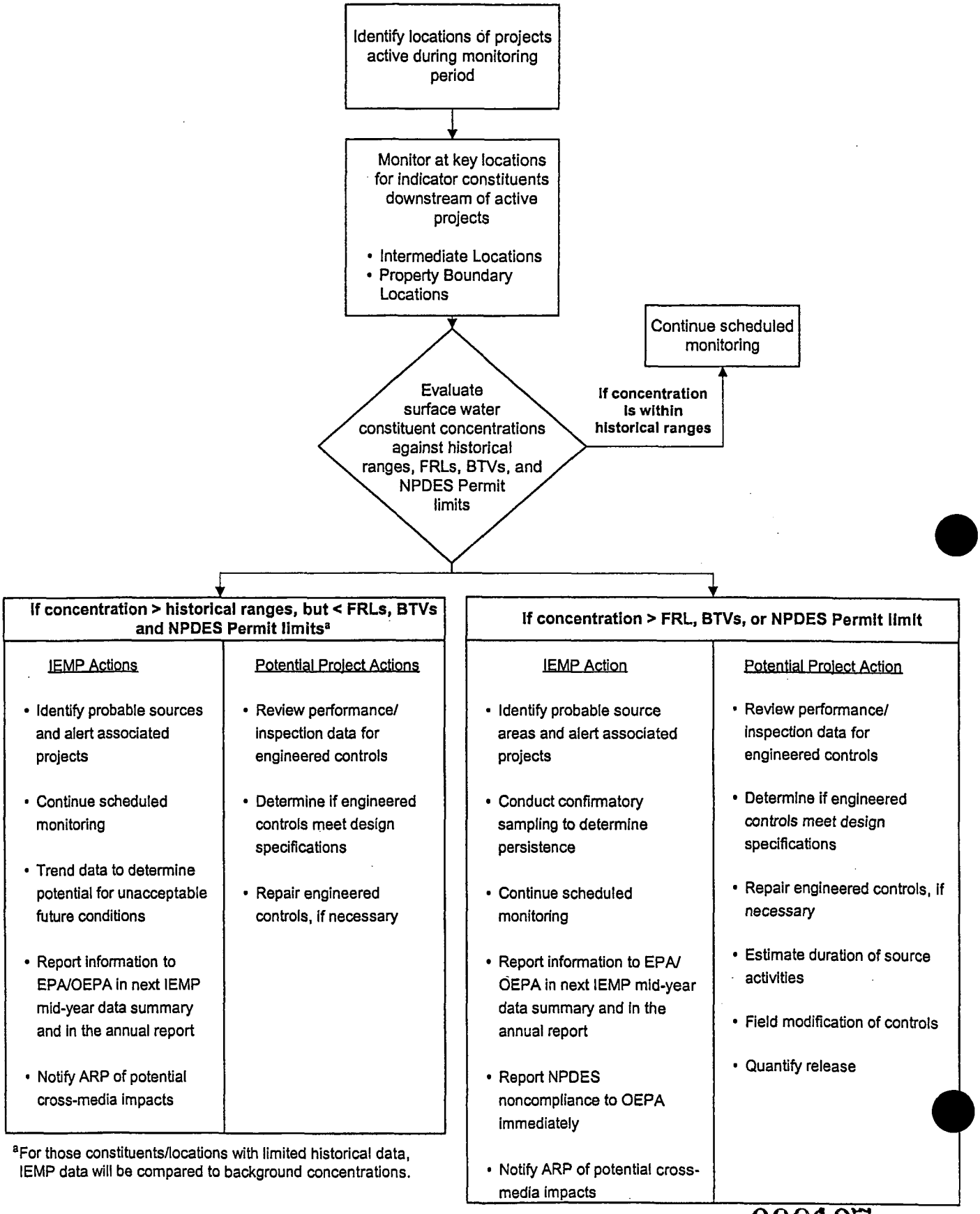


FIGURE 3-11. IEMP SURFACE WATER AND TREATED EFFLUENT SAMPLE LOCATIONS

FIGURE 3-12
IEMP SURFACE WATER DATA EVALUATION AND ASSOCIATED ACTIONS



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

4.0 PROJECTED FLOWS

Wastewater is classified as groundwater, storm water, remediation wastewater, or sanitary wastewater. Sources of wastewater and their relative generation rates, duration, and head works discharge locations related to treatment requirements are presented in this section. Summary flow projections developed for these sources of wastewater are used in Section 5.0 to allocate and evaluate the treatment systems discussed in Section 3.0.

This section addresses the latest understanding of flows for the four types of wastewater and are summarized as follows:

- The overall groundwater pumping rate is based upon available groundwater treatment capacity, achieving discharge limits at the Parshall Flume, maintaining capture of the 30 µg/L uranium plume and volume of re-injected groundwater. Groundwater pumping rates are initially defined for each individual extraction well in remedy design documents. Individual extraction well rates are subject to change over the life of the remedy based on changing remediation conditions. Any pumping rate changes made are done so within the limitations of the operational protocols outlined in the OMMP. Groundwater pumping rates are reduced beginning when CAWWT construction starts. The reduction is due to the decrease in treatment capacity during the construction period. Once the CAWWT facility is up and running, pumping rates will be increased somewhat to utilize the dedicated groundwater treatment capacity of 1200 gpm. The long-term overall pumping rate is to be determined by the design evaluation discussed Section 1.2.

- Peak storm flows to the SWRB have been dramatically reduced due to the large soil excavations in the former production area (reference Figure 3-1). These changes have effectively increased the storage capacity available to hold storm water runoff and eliminated the need for bypass of storm water to prevent overflow of the SWRB. Temporary storage within these excavations allows all storm water to be prioritized and routed to treatment without the threat of SWRB overflow. As the soil excavations have progressed, a corresponding reduction in the storm water runoff coefficient has also served to reduce runoff volumes and peak flow rates.

- Remediation wastewater flow projections have been dramatically reduced as nearly all of the site remediation is complete. When the BSL is taken out of service in the fall of 2004, remediation wastewater flows will be limited to OSDF leachate, D&D wastewater, and Silos Project wastewater.

- Sanitary wastewater flow projections have been reduced for the current period based on actual flows experienced in 2004. The sewage treatment plant is planned to be operational through June of 2005. After that time, any remaining sanitary wastewater flows will likely be dealt with by bulk hauling to a Publicly Owned Treatment Works (POTW).

4.1 GROUNDWATER

Extracted groundwater will be the largest wastewater flow requiring treatment during the remediation of the Fernald site. Unlike storm water and remediation wastewater, groundwater extraction rates can be controlled. Groundwater flows are defined such that discharge limits at the Parshall Flume, and capture

of the 30 μg/L uranium plume are achieved. The objective is to pump as aggressively as possible, without exceeding discharge limits. Because groundwater flows can be controlled, pumping rates are periodically adjusted to accommodate other flow streams, such as storm water. During construction of the CAWWT facility (see Figure 1-1), groundwater treatment rates will be temporarily reduced in order to prioritize treatment of storm water in times of excessive rainfall.

4.1.1 Projected Groundwater Extraction Rates

This section provides the groundwater extraction/ rates currently planned for the aquifer remedy through construction of the CAWWT facility. As discussed above, during construction of the CAWWT facility groundwater treatment capacity will be limited and groundwater re-injection via wells will no longer take place. The individual groundwater remediation modules currently comprising the aquifer remedy are presented in Section 3.1. Figure 3-3 depicts the locations of all existing extraction wells. Table 4-1 provides the extraction rate schedule for each of the wells currently operating. The combined pumping rate during the CAWWT construction period is anticipated to average approximately 4500 gpm. When storm water treatment needs dictate, the groundwater extraction rate will be reduced, possibly to as low as 3,000 gpm.

Throughout the duration of groundwater remediation the pumping rates may be modified within system design and operational constraints, as necessary. These rate modifications will be made to maintain, to the degree possible, the aquifer restoration objectives outlined in the remedy design.

4.2 STORM WATER

At the present time, storm water runoff is collected in both the SWRB and the BSL for treatment in AWWT Phases I and II. Contaminated storm water runoff requiring treatment is collected from the former production area (Figure 4-1: Areas 3, 4, and 5), the OSDF, and waste pits area (Figure 4-1, Area 6). After the BSL is removed from service in November of 2004, storm water runoff from the waste pit area runoff collection pond and the Storm Water Management Pond (Figure 3-1) will be redirected to flow to the SWRB for treatment. Table 4-2 shows the projected fluctuation of contributing drainage areas to the SWRB. As noted above, the effective retention volume for storage of storm water has been substantially increased from the previous ~10.2 million gallons in the SWRB due to the large excavation areas within the former production area. The net effect of this change eliminates the need for storm water bypass or the threat of overflow of the SWRB. Table 4-2 shows a short period of time (approximately eight months) when the contributing area for storm water runoff requiring treatment will increase when compared to the current contributing area. However, these areas will be pumped to the SWRB from upstream surface impoundments. This represents a major difference in operational control as compared to past operational practices and provides enhanced control of the SWRB.

The various deep excavations within the uncertified areas of the former production area will be utilized as necessary to store storm water from areas undergoing active excavation or certification. Transfer pumping of accumulated storm water between these excavations will be utilized, as necessary, prior to discharge to the SWRB to ensure that overflow of the SWRB does not occur. Additionally, the pumping rates from these areas to the SWRB will be limited to ensure that bypass or overflow of the SWRB will not occur, while systematically prioritizing pumping from the impoundments such that soil remediation and certification activities can proceed. The pumping of these areas and the management of the SWRB will be as detailed in Section 5. Table 4-2 also shows how the site storm water runoff coefficient has decreased with time as buildings and paved areas are replaced by soil. This reduction in the runoff coefficient provides additional runoff volume reduction and peak flow attenuation.

4.2.1 Storm Water Retention Basin (SWRB)

The SWRB will continue to serve as the primary head-works for storm water treatment in either the existing AWWT and IAWWT through January 2005 and the planned CAWWT storm/process wastewater treatment train until November of 2005. As noted in previous sections, the SWRB is scheduled to be shut down in November 2005 in support of site closure. By November 2005 all areas draining by gravity to the SWRB are scheduled to have been remediated. After the SWRB is shut down, any remaining storm water flows requiring treatment will be pumped from the excavation areas directly to treatment.

The existing pump pit located at the SWRB will remain after removal of the SWRB. This facility will remain in service to provide a discharge point for miscellaneous batch type wastewater flows requiring treatment in CAWWT. Examples include wastewater from well development/rehabilitation or other minor trucked flows from satellite sources.

4.3 REMEDIATION WASTEWATER

Remediation wastewater/storm water includes existing or planned flows that are treated in the existing AWWT Phase II. Historically, the BSL has served as the primary head-works for flows to be sent to this treatment system. After November of 2004, the BSL will no longer be available and streams destined for treatment in AWWT Phase II will need to be sent directly to this system or rerouted to the SWRB.

Flows that have historically been discharged to the BSL for subsequent treatment in AWWT Phase II are categorized as "remediation wastewater," but can be generally classified as either storm water runoff or process wastewater in origin. The storm water runoff sources that were discharged to the BSL were primarily sent there as a convenience due to the location of this impoundment. After the BSL is removed from service, these flows will be rerouted to the SWRB and are included in Table 4-2. These flows include discharges from the Waste Pit Area Storm Water Runoff Control (WPASWRC) sump ("Cement Pond" on Figure 3-1) and the Storm Water Management Pond as described below.

As remediation of the site has progressed, the volume and number of process wastewater streams have declined. The process wastewater streams remaining after shutdown of the BSL include OSDF leachate/storm water, D&D wastewater, and Silos wastewater discharges, as described below.

The BSL will not be available to serve as the headworks to AWWT Phase II for a brief period between November 2004 and February 2005. During this period, the SWRB will serve as the main headworks to AWWT Phases I and II. Treatment of water from the SWRB will be prioritized through AWWT Phase II in order to address potential VOC treatment concerns. However, during wet weather, Phase I, Phase II, and IAWWT will be utilized to treat the discharge from the SWRB as detailed in Section 5.

4.3.1 Storm Water Sources Previously Discharged to BSL

The following storm water sources were previously discharged to the BSL. These flows are strictly considered to be "storm" water in origin and do not have VOC-related concerns associated with them.

Waste Pit Area Storm Water Runoff Control (WPASRC) Facility

The WPASRC Facility, commonly known as the Cement Pond (Figure 3-1) manages runoff from the area surrounding the waste pits area. This facility also collects area runoff from around the Silos Project. It was constructed in 1992 as an Operable Unit 1 Removal Action and was designed to control runoff from a 25-year storm. The primary objective was to minimize discharges of contaminated storm water runoff directly to Paddys Run where they could become a source to increase groundwater contamination as a result of infiltration into the Great Miami Aquifer. The system collects contaminated storm water runoff from the perimeter of the waste pit area using drainage trenches, culverts, topographic features, and two (east and north) Inlet Runoff Control Structures. Flow is directed to a concrete detention sump and will be discharged to the SWRB for treatment in AWWT Phases I and II or IAWWT until CAWWT is brought on line. After CAWWT is on line this water will be treated through the process wastewater train (600 gpm) of the CAWWT and IAWWT if necessary (until June 2005). Rerouting of the discharge from this facility will be included as a utility re-route as part of the soils remediation effort that removes the BSL from service.

The concrete detention sump has dimensions of 5,600 square feet by 10 feet high, giving an effective hold capacity of 360,000 gallons. Four pumps, each capable of discharging approximately 700 gpm, transfer collected water through a force main to the BSL. The four pumps are actuated by automatic level controllers placed within the pump pit area at the east end of the concrete sump. The design of the detention facility requires three pumps to operate. The fourth pump serves as a backup in the event of a failure of one of the other three. A fuel-fired generator is mounted nearby to provide emergency electrical power to the pumps, if required.

The East Inlet Runoff Control Structure is located immediately west of the northwest corner of the BSL and is designed to provide detention of peak storm water runoff flowing to the WPASRC concrete detention sump. The North Inlet Runoff Control Structure is similar in design and function to the East Structure. It is located in the northwest corner of the waste pits area. Orifices installed in each runoff control structure detain peak storm water flows. Each structure has a manual bypass valve in parallel with the orifice to maintain flow if the orifice becomes obstructed. As the soils remediation effort within the waste pit area progresses, these inlet control structures will likely be modified or removed as the upstream drainage areas are remediated.

Pumping of the storm water from this structure will be closely coordinated with soils remediation efforts such that the water levels in the SWRB are maintained at satisfactory levels and such that soil excavation and certification sampling efforts are optimized. It is anticipated that this structure will be operated in conjunction with the Storm Water Management Pond to best manage soil excavation activities in the waste pit area. This may require transfer pumping of flows between storage structures and uncertified areas such that soil excavation and certification can proceed to the extent possible during wet weather.

Storm Water Management Pond

Runoff from areas surrounding the pit remediation activities is directed to the Storm Water Management Pond (Figure 3-1), which is designed to accommodate the 25-year, 24-hour storm event. This water was previously expected to be "clean" and be discharged to Paddys Run. However, based on uranium content, it is currently sent to the BSL for treatment in AWWT Phase II. These waters are anticipated to require collection and treatment through the soils remediation efforts in the waste pit and BSL areas, and are planned to be routed to the SWRB for treatment. As indicated above, this facility will be utilized in conjunction with the WPASRC facility to optimize soil excavation and certification efforts while maintaining acceptable SWRB levels.

4.3.2 Process Wastewaters Previously Discharged to the BSL

The wastewater sources described below were previously discharged to the BSL for treatment in AWWT Phase II. These streams will be rerouted to the SWRB after the BSL is taken out of service in November 2004 for treatment in Phases I and II of the AWWT until such time as the CAWWT system is brought on-line. This configuration is anticipated to exist until the SWRB soil remediation is initiated in November 2005. At that time, these wastewater sources will be routed directly to the CAWWT process wastewater treatment train.

On-Site Disposal Facility (OSDF) Project

Wastewater from the OSDF Project is estimated to average 30 gpm annually. This flow is a combined flow of leachate and active cell runoff. Leachate from the OSDF results from the percolation of storm

water through and out the bottom of the cells through installed under drains. The flow is at its maximum when a cell is under construction and uncapped. As evidenced by Cells 1, 2, and 3, the flow will steadily decrease after the cells are capped. The leachate collects in the Permanent Lift Station (PLS) pump sump and is currently transferred to the BSL. This flow will be rerouted to discharge to the SWRB after the BSL is taken out of service in November 2004. Leachate will flow directly to the SWRB until it is removed from service in November 2005, at which time the leachate will be routed directly to the influent tankage at the CAWWT facility.

The PLS discharge capacity is limited by the installed pump capacity to a flow of approximately 220 gpm. The OSDF design allows excess flow to be temporarily stored in the cells. This limited pumping capacity ensures that the OSDF leachate/storm water flow will not exceed the 600 gpm proposed CAWWT treatment capacity.

Silos Project Wastewater

Effluent from the Silos Project was originally to be discharged to the former High Nitrate Tank for eventual treatment in AWWT Phase II. However, this tank was decommissioned as part of the silos infrastructure construction effort. This will require that the process wastewater be piped directly to AWWT Phase II and then to the CAWWT facility. Although actual quantities of Silos wastewater to be treated are unknown, it is anticipated that the bulk of the process wastewater generated by the Silos Project will consist of excess waste from the sluicing of silo material from Silos 1 and 2. During this phase, it is estimated that up to 3 million gallons of wastewater may require pretreatment for radium and lead. The current plan is to provide pretreatment of these wastewaters in either the existing SDF or in a new, modular treatment system installed at the silos project. It is anticipated that this water will be intermittently transferred to pretreatment at the subsequent downstream AWWT/CAWWT treatment system at approximately 25–40 gpm. In addition, wastewater will be generated during the D&D of the Silos Project. It is anticipated that this water will be pretreated and subsequently treated at the AWWT/CAWWT treatment system similar to the wastewater discussed above.

4.4 SANITARY WASTEWATER

The existing sanitary flow averages of 8-10.5 million gallons per year (mgy) (15-20 gpm). This includes some infiltration of contaminated perched water, as discussed in Section 3.2.3. Existing flows are expected to decrease as the Operable Unit 3 remedial actions progress, buildings are shut down, and existing operations cease.

TABLE 4-1

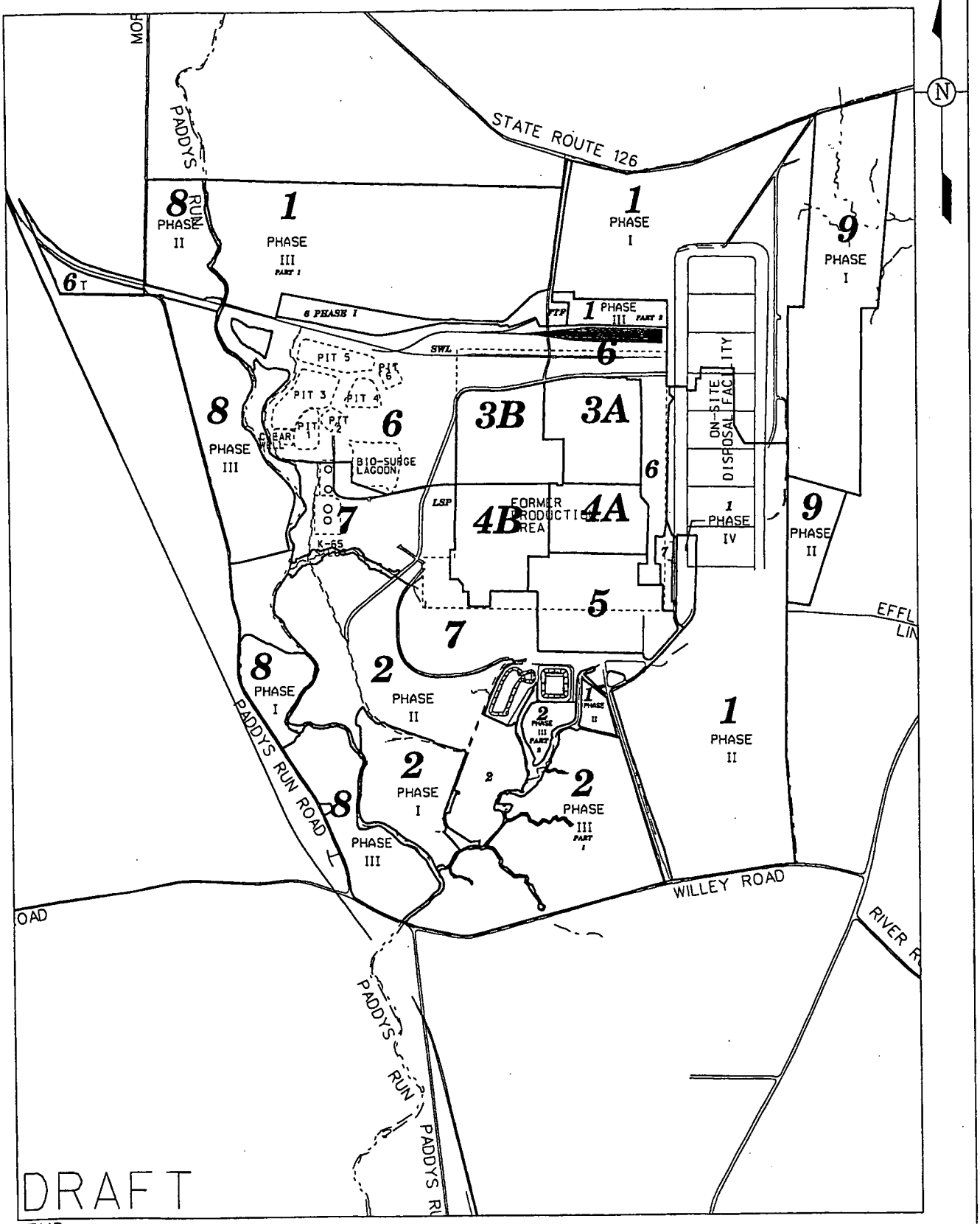
EXTRACTION RATE/RE-INJECTION RATE SCHEDULE

System ID	Location	Ops. Well ID	SED Well ID	Pumping Rates (+) = pumping (-) = injecting (gpm)	
				1/1/04 to 10/1/04	CAWWT Construction Period
I	Waste Pits	WSA-1	32761	300	0
I	Waste Pits	WSA-2	33062	400	0
I	Waste Pits	WSA-4	33063	0	0
	System Totals	Pumped		700	0
II	South Field	EW-15a	33262	200	100
II	South Field	EW-17	31567	275	275
II	South Field	EW-18	31550	200	200
II	South Field	EW-19	31560	200	200
II	South Field	EW-20	31561	200	200
II	South Field	EW-21a	33298	290	100
II	South Field	EW-22	32276	300	300
II	South Field	EW-23	32447	300	300
II	South Field	EW-24	32446	300	100
II	South Field	EW-25	33061	300	300
II	South Field	EW-30	33264	300	100
II	South Field	EW-31	33265	300	300
II	South Field	EW-32	33266	200	200
	System Totals	Pumped		3365	2675
II	Fence Line Injectors	IW-8a	33253	-200	0
II	Fence Line Injectors	IW-9a	33254	-200	0
II	Fence Line Injectors	IW-10	22109	-200	0
II	Fence Line Injectors	IW-10a	33255	-200	0
II	Fence Line Injectors	IW-11	22240	-200	0
II	Fence Line Injectors	IW-12	22111	0	0
II	SF Injector	IW-16	31563	-200	0
II	SF Injector	IW-29	33263	-100	0
II	Injection Pond	Inj-Pond		-100	0
	System Totals	Injected		-1400	0
IV	South Plume	RW-1	3924	300	300
IV	South Plume	RW-2	3925	300	300
IV	South Plume	RW-3	3926	300	300
IV	South Plume	RW-4	3927	400	400
IV	South Plume	RW-6	32308	300	300
IV	South Plume	RW-7	32309	300	300
	System Totals	Pumped		1900	1900
	Total Pumping			5965	4575
	Total Injecting			-1400	0
	Net Extraction			4565	4575

TABLE 4-2

TIMELINE OF SWRB CONTRIBUTING AREAS

Area Description	Date	Approx. Composite Runoff Coefficient	Discharge Method Gravity=G (%) Pumped = P (%)	Incremental Area (acres)	Total Area to SWRB (acres)
Historical Drainage Area	Sep-99	0.60	G=~80% P=~20%	n/a	173
Current Contributing Area	Jun-04	<0.60	G=~40% P=~60%	n/a	136
Area 3A - Removed from SWRB	Sep-04	<0.60	G=~30% P=~70%	(24.1)	111.9
Area 3B - Removed from SWRB	Sep-04	<0.60	P (100%)	(23.2)	88.7
OSDF - Added to SWRB	Nov-04	<0.60	P (100%)	26.8	115.5
WSA and Silos - Added to SWRB	Nov-04	<0.50	P (100%)	53.4	168.9
Area 4A - Removed from SWRB	Mar-05	<0.50	P (100%)	(17.3)	151.6
Cell 5 - Removed from SWRB	Jun-05	<0.50	P (100%)	(6.4)	145.2
Area 4B - Removed from SWRB	Jul-05	<0.50	G=~20% P=~80%	(24.6)	120.5
Cell 6 - Removed from SWRB	Aug-05	<0.50	P (100%)	(6.4)	114.1
Remaining portions of FPA - Removed	Sep-05	<0.50	G=~20% P=~80%	(46.7)	67.4



LEGEND:

- FERNALD SITE BOUNDARY
- 1 REMEDIATION AREA
- REMEDIATION AREA BOUNDARIES

SCALE

1500 750 0 1500 FEET

FIGURE 4-1. GENERALIZED SITEWIDE REMEDIATION AREAS

V:\5fgp1\dgn\OMMP\2004-OMMP\04-ommp-01.dgn
STATE PLANAR COORDINATE SYSTEM 1983
25-JUN-2004

5.0 OPERATIONS PLAN

This section contains the operations philosophy, treatment priorities, hierarchy of decisions, management and flow of operations information, and management of treatment residuals necessary to successfully operate the groundwater extraction and wastewater treatment systems in order to achieve regulatory requirements and commitments. The operational time periods covered by this section are (all dates are subject to change):

Operational Period 2	AWWT Phases I and II Operations with SPIT and IAWWT after BSL Shutdown (September 2004 to January 2005)
Operational Period 3	CAWWT Operations with SPIT and IAWWT after Phases I and II Shutdown (February 2005 to July 2005)
Operational Period 4	CAWWT Operations after SPIT and IAWWT Shutdown until SWRB Shutdown (August 2005 until November)
Operational Period 5	CAWWT Operations after SWRB is Shutdown until Capping of the Last Cell (November 2005 until March 2006) (to be addressed in a future revision)
Operational Period 6	CAWWT Operations after site storm water treatment needs are ended (March 2006 to end of groundwater treatment) (to be addressed in a future revision)

5.2 WASTEWATER TREATMENT OPERATIONS PHILOSOPHY

The primary goals of wastewater treatment operations and maintenance are to: 1) meet effluent discharge requirements; 2) minimize bypassing of untreated groundwater and storm water; and 3) maintain treatment headwork capacities. In keeping with the principles of ALARA (as low as reasonably achievable), this requires making the correct decisions in applying treatment to maximize the quantity of uranium removed from wastewater prior to its discharge to the Great Miami River. Maximizing uranium removal should result in compliance with the objectives as outlined in Section 2.0. Other regulatory discharge requirements, such as NPDES, must also be met. Influent streams to treatment and effluent streams from treatment as well as other process control sampling around specific unit operations (e.g., ion exchangers, carbon beds) are sampled for uranium and other appropriate constituents to provide information needed to help ensure that the objectives are met. Sampling under the NPDES permit and the IEMP is performed to verify requirements and effluent limits for discharges to the Great Miami River are met.

5.2 TREATMENT PRIORITIES

As discussed in Section 3, wastewater treatment systems include the AWWT systems (Phases I, II, and Expansion), the IAWWT system, the SPIT system, and the STP. The effluents from these systems, along with bypassed (untreated) groundwater and storm water, combine at the Parshall Flume to form the Fernald site's regulated discharge to the Great Miami River.

The priority for treatment will always be the stream with the highest uranium concentrations. After the BSL is taken out of service, the highest remaining uranium concentration will exist in the SWRB. The SWRB typically contains water with a uranium concentration of approximately 200 to 500 ppb.

Groundwater from the Great Miami Aquifer recovery wells contains the lowest concentration of uranium of the two remaining wastewater streams. Groundwater sent to treatment typically contains a uranium concentration of 60 to 70 ppb.

During Operational Periods 2, 3 and 4, the maximum possible treatment capacity will be available for treating storm water from the SWRB. The following table shows treatment capacities during each stage.

	Capacity Available for Storm Water Treatment		Capacity Dedicated to Groundwater Treatment		Additional Capacity Available for Groundwater Treatment during "Dry" Weather	
Op. Period 2	Phase I	500 gpm	SPIT	200 gpm	Phase I	500 gpm
	Phase II	300 gpm			Phase II	100 gpm
	IAWWT	300 gpm			IAWWT	300 gpm
Op. Period 3	CAWWT (SW)	600 gpm	SPIT	200 gpm	CAWWT (SW)	400 gpm
	IAWWT	300 gpm	CAWWT (GW)	1200 gpm	IAWWT	300 gpm
Op. Period 4	CAWWT (SW)	600 gpm	CAWWT (GW)	1200 gpm	CAWWT (SW)	400 gpm
Op. Period 5	CAWWT (SW)	600 gpm	CAWWT (GW)	1200 gpm	CAWWT (SW)	600 gpm

5.3 HIERARCHY OF TREATMENT DECISIONS

Figures 5-1A through 5-1C provide logic charts listing operational decisions that must be made for the wastewater treatment systems. These decisions are typically made using guidance provided by management and engineering support staff. The shift supervisor is responsible for operations and direction of maintenance activities at all of the groundwater extraction facilities, all uranium treatment systems and ancillary facilities. The purpose of Figures 5-1A through 5-1C is to provide a consistent logic for operations of all wastewater treatment facilities and a tool for the shift supervisors to ensure they are operating the facilities in the manner most likely to achieve regulatory requirements.

Shift supervision is provided 24 hours per day, seven days per week, 365 days per year. As the supervisor of all operations and maintenance activities that occur on a particular shift, the shift supervisors are responsible for ensuring that treatment and monitoring equipment is operated, maintained and repaired as necessary so that maximum prioritized treatment throughput is achieved at all times. Operations and maintenance are performed in accordance with all appropriate standard operating

procedures, standards, and specifications. All shift supervisors, operators, and maintenance personnel have been trained to understand the logic flow chart in Figures 5-1A through 5-1C. They are expected to use their best judgment and experience to respond to situations where the flow chart cannot be applied. Additionally, process engineering support personnel are on-call to provide assistance in problem solving.

5.4 WASTEWATER TREATMENT OPERATIONS DECISIONS

The logic flow charts in Figures 5-1A through 5-1C are explained in detail in this section. The logic flow charts will be followed as written by the supervisors. Any variance from the flow chart will be directed in writing by management. For example, the flow chart directs DSDP can resume pump storm water and excavation water from uncertified excavations when the sum of the SWRB levels drops to 8 feet. If no more precipitation is in the forecast and the levels in the SWRB are dropping continuously, management may provide written guidance allowing DSDP to resume pumping before the levels drop to 8 feet. Table 5-1 contains information for the East SWRB, West SWRB, and the Emergency Spill Basin (ESB) that show how many gallons the basins are holding at different levels and what the remaining capacity of the basins is at those levels. Several examples are included to show how the remaining capacity of the total SWRB depends on the level in the individual basins.

5.4.1 Operational Period 2: AWWT Phases I and II with SPIT and IAWWT

This is the time period of greatest available treatment capacity for storm water and the time of greatest need for storm water treatment. Phase I, Phase II, and IAWWT are all available for storm water treatment for a total of 1100 gpm capacity. Figure 5-1A lists treatment decisions to be made during the second half of Operational Period 2 after the BSL is shutdown. During periods of relatively dry weather, Phase II will be used for SWRB storm water treatment of 200 to 300 gpm. This allows leachate from the OSDF, storm water from the waste storage area, and excavation water from the former production area to be treated through the Phase II carbon filters.

The level in the SWRB will be measured as the sum of the levels of the East and West Basins. When the level in the SWRB reaches a sum of 10 feet, Phase I will be used to start treating storm water from the SWRB along with Phase II. Since the Phase I system can treat storm water and groundwater at the same time, the proportion of storm water treated in Phase I will be increased as the level in the SWRB continues to increase. By the time the level in the SWRB reaches 13 feet, Phase I will be treating only storm water. At that time, the total amount of storm water being treated will be approximately 800 gpm.

When the level in the SWRB reaches a sum of 13 feet, IAWWT will switch from treating groundwater to treating storm water. This will increase storm water treatment to about 1100 gpm. When the level reaches 13 feet, DSDP and Operations and Support Project (OSP) management will be notified that a

shutdown of pumping storm water and excavation water from uncertified portions of the former production and waste storage areas into the SWRB is possible.

When the level in the SWRB reaches a sum of 15 feet, DSDP management will be notified to stop pumping all storm and excavation water into the SWRB. Water will be collected in the excavations for pumping after the SWRB levels drop to a sum of less than 8 feet.

When the level in the SWRB reaches a sum of 18 feet, OSP Water Treatment Operations (WTO) will turn the leachate system pumps off. Water will collect in the cells for pumping after the level in the SWRB drops below a sum of 15 feet. Management will be notified that leachate pumping has been stopped.

After the leachate pumps have been turned off, the only flow into the SWRB will be gravity flow from storm sewers in the former production area that cannot be shut off and direct rainfall into the SWRB. If the SWRB begins to overflow, samples will be collected per the NPDES permit and management will be notified of the emergency situation at the SWRB.

5.4.2 Operational Period 3: CAWWT Operations with SPIT and IAWWT

The second time period covered by this document occurs after construction on CAWWT is complete and is operating. The flow rate assumptions for this time period are: CAWWT (SW) is treating up to ~600 gpm storm water; CAWWT (GW) system is treating ~1200 gpm groundwater; SPIT is treating ~200 gpm groundwater; and IAWWT is treating ~300 gpm of either storm water or groundwater. Figure 5-1B lists treatment decisions for this time period.

CAWWT (SW) is the primary system used for storm water treatment. During periods of relatively dry weather, CAWWT (SW) will treat approximately 200-300 gpm storm water and 300-400 gpm groundwater. As the level in the SRWB begins to increase due to precipitation, CAWWT (SW) will treat more storm water and less groundwater until it is treating 600 gpm storm water.

When the level in the SWRB reaches a sum of 10 feet, IAWWT will switch from treating about 300 gpm groundwater to treating about 300 gpm storm water. This will increase storm water treatment to about 900 gpm, the maximum available storm water treatment. If the levels in the SWRB continue to increase, DSDP and OSP management will be notified that a shutdown of pumping storm water and excavation water from uncertified portions of the former production and waste storage areas into the SWRB is possible.

When the level in the SWRB reaches a sum of 12 feet, DSDP management will be notified to stop pumping all storm and excavation water into the SWRB. Water will be collected in the excavations for

pumping after the SWRB levels drop to a sum of less than 8 feet. Pumping from the excavations will be stopped earlier than in the previous case because less treatment capability exists. It is necessary to gain control of the basin levels as quickly as possible to prevent an overflow.

When the level in the SWRB reaches a sum of 18 feet, OSP WTO will turn the leachate system pumps off. Water will collect in the cells for pumping after the level in the SWRB drops below a sum of 15 feet. Management will be notified that leachate pumping has been stopped.

After the leachate pumps have been turned off, the only flow into the SWRB will be gravity flow from storm sewers in the former production area that cannot be shut off and direct rainfall into the SWRB. If the SWRB begins to overflow, samples will be collected per the NPDES permit and management will be notified of the emergency situation at the SWRB.

5.4.3 Operational Period 4: CAWWT Operations after SPIT and IAWWT Shutdown until SWRB Shutdown

The third time period covered by this document occurs after D&D of SPIT and IAWWT, and the only treatment system remaining is the CAWWT. Figure 5-1C shows treatment decisions for this operational period.

CAWWT (SW) is the only treatment system for storm water. During periods of relatively dry weather, CAWWT (SW) will treat approximately 200-300 gpm storm water and 300-400 gpm groundwater. As the level in the SRWB begins to increase due to precipitation, CAWWT (SW) will treat more storm water and less groundwater until it is treating 600 gpm storm water.

When the level in the SWRB reaches a sum of 10 feet, DSDP and OSP management will be notified that a shutdown of pumping storm water and excavation water from uncertified portions of the former production area and waste storage area into the SWRB is possible.

When the level in the SWRB reaches a sum of 12 feet, DSDP management will be notified to stop pumping all storm and excavation water into the SWRB. Water will be collected in the excavations for pumping after the SWRB levels drop to a sum of less than 8 feet. Pumping from the excavations will be stopped earlier than in the previous case because less treatment capability exists. It is necessary to gain control of the basin levels as quickly as possible to prevent an overflow.

When the level in the SWRB reaches a sum of 18 feet, OSP WTO will turn the leachate system pumps off. Water will collect in the cells for pumping after the level in the SWRB drops below a sum of 15 feet. Management will be notified that leachate pumping has been stopped.

After the leachate pumps have been turned off, the only flow into the SWRB will be gravity flow from storm sewers in the former production area that cannot be shut off and direct rainfall into the SWRB. If the SWRB begins to overflow, samples will be collected per the NPDES permit and management will be notified of the emergency situation at the SWRB.

5.4.4 Operational Period 5: CAWWT Operations after SWRB is Shutdown until Capping of the Last Cell
Operations during this period will be defined in a future revision of the OMMP.

5.4.5 Operational Period 6: CAWWT Operations after Last Cell is Capped
Operations during this period will be defined in a future revision of the OMMP.

5.4.6 Groundwater
During CAWWT construction, groundwater treatment capacity will be 1300 gpm. Most of this treatment capacity (1100 gpm) will be made available for the treatment of storm water, should it be needed. This leaves 200 gpm (from the SPIT system) dedicated to the treatment of groundwater. If the construction time period is relatively dry and large volumes of storm water treatment are not required, all but 200 of the 1100 gpm made available for the treatment of storm water can be used for the treatment of groundwater. A capacity of 200 gpm will always be dedicated to storm water (Phase II system). Therefore, during the CAWWT construction time period, the range of treatment capacity available for groundwater will be from 200 gpm up to 1100 gpm.

During CAWWT construction, it is anticipated that groundwater extraction wells will be operated at an overall target extraction rate of 4,575 gpm using the individual well pumping rates listed in Table 4-1. Groundwater modeling and particle path interpretations indicate that at the pumping rates listed in Table 4-1, the uranium plume will be captured, and discharge limits will be met at the Great Miami River, provided that a 700 gpm treatment capacity is available for groundwater. October through February is seasonally dry, so it is anticipated that a groundwater treatment capacity of 700 gpm is a realistic target. If a 700-gpm-treatment capacity is used for groundwater, 675 gpm will still be available for the treatment of storm water and remediation wastewater. Storm water/remediation wastewater treatment will take precedence over groundwater treatment. If the capacity available for groundwater treatment falls below 700 gpm, then pumping will be reduced. If pumping rates need to be reduced, meeting discharge limits at the Great Miami River will take precedence over maintaining capture of the 30 μg/L uranium plume, with the exception of the South Plume. Capture at the leading edge of the South Plume in the South Plume Recovery Wells will not be compromised by this approach, and will continue to be maintained. It is anticipated that if lower pumping rates are needed, the need will be short term and will have little effect on the long-term results of the groundwater remedy.

Once the CAWWT is up and running, and use of the SPIT and IAWWT facilities is discontinued, a capacity of 1200 gpm will be dedicated to the treatment of groundwater. With this higher capacity, more aggressive pumping scenarios can, and will be pursued. Many issues currently surround the future of the groundwater remedy (i.e., discontinuing the use of well-based re-injection, induced infiltration down the storm sewer outfall ditch, final design of the waste storage area Phase II system). Once these issues are finalized, an updated groundwater remedy design will be issued. When the updated remedy design is issued, the OMMP will be revised (the use of change pages being the preferred approach) to incorporate operational changes needed to accommodate the updated design.

5.4.6.1 Groundwater Treatment Prioritization vs. Bypassing

Treatment of groundwater well discharges are prioritized in order of uranium concentration, with the highest uranium concentration wells routed to treatment until all available treatment capacity is utilized. Remaining well discharges are bypassed around treatment to the Parshall Flume. As shown schematically in Figure 3-4, treatment/bypass decisions for the Southfield extraction wells are made on a well-by-well basis. The existing four South Plume off-property, leading-edge wells combined with the two wells of the South Plume Optimization Project are routed as a group either for treatment, full bypass, or partial bypass since piping does not exist for well-by-well treatment/bypass decision. The off-property South Plume wells are typically routed directly to bypass at the South Field Valve House since their combined uranium concentration is very near or less than 30 ppb uranium.

5.4.7 Ion Exchange Vessel Rotation

All of the ion exchange systems (except IAWWT) have trains of two ion exchange vessels operating in series, lead and lag. When the ion exchange resin in both vessels is new, the majority of uranium is removed in the lead vessel. As the lead vessel becomes loaded with uranium more passes through into the lag vessel. As the lag vessel becomes loaded, more uranium passes into the discharge stream. When the uranium concentration in the discharge from a particular ion exchange train causes the uranium concentration at the Parshall Flume to exceed 30 ppb, the resin will be removed from the lead vessel and replaced with new resin. The lag vessel is moved into lead and the vessel containing new resin is place in lag. The ability to regenerate ion exchange resin no longer exists for any of the treatment systems after CAWWT construction begins in the fall of 2004.

IAWWT is operated with three vessels in series. The lead and lag vessels contain ion exchange resin and operate as indicated above. The third vessel does not contain resin. It has a screen on the outlet pipe that acts as a "resin trap." Any resin that leaks through the lag vessel will be retained in the "resin trap" and not reach the effluent line.

5.5 WELL FIELD OPERATIONAL OBJECTIVES

Several objectives must be considered when well field operational decisions are made. These objectives are listed in Table 5-2 along with the anticipated actions required to achieve each objective. At times the objectives conflict; therefore, operational decisions are generally made by group consensus of WTO and Aquifer Restoration/Wastewater Project management. These discussions are held on an as-needed basis. Decisions from these meetings that affect wellfield operations are normally communicated to the EPA and OEPA on the weekly conference calls. Operational changes are also reported in the IEMP reports. Changes in groundwater restoration well pumping set points are transmitted to shift supervisors by the WTO manager.

5.6 OPERATIONAL MAINTENANCE PRIORITIES

Maintaining the treatment facilities on line includes ensuring that all equipment is operating properly, that adequate personnel are assigned to operate the treatment systems safely, and that the combined treatment and bypassing systems are removing uranium to below 30 ppb as measured at the Parshall Flume. Following is a list of operational maintenance priorities in their order of importance for each stage of operation covered by this document:

Operational Period 2

- Keeping the AWWT SDF available to process clarifier slurries.
- Keep the AWWT Phase II treatment system on line at maximum capability. This will allow the water from the SWRB to be treated through the carbon filters.
- Keep AWWT Phase I on line to prevent the SWRB from overflowing.
- Keep the sewage treatment plant on line and operating correctly. This will prevent NPDES permit violations by STP discharge.
- Keep the Parshall Flume discharge point and sampling system on line. If the discharge monitoring system were to become nonoperational, discharge monitoring of effluent to the river from the Fernald site would have to be collected manually. The sampling system must be operational so that accurate reports of uranium and NPDES contaminant levels can be made.
- In periods of heavy precipitation or high level in the SWRB, the priority is to keep IAWWT on line. IAWWT, which normally provides additional treatment capacity for groundwater, also provides supplemental and backup capacity for storm water.
- Keep SPIT on line. SPIT provides additional groundwater treatment.
- Keep South Plume Wells 1–4 operating at desired setpoints
- Keep all extraction wells operating at the desired setpoints.

Operational Period 3

- Keep the CAWWT (SW) treatment system on line at maximum capability. This will allow the water from the SWRB to be treated through the carbon filters.
- Keep IAWWT on line to prevent the SWRB from overflowing.
- Keep the sewage treatment plant on line and operating correctly. This will prevent NPDES permit violations by STP discharge.
- Keep the Parshall Flume discharge point and sampling system on line. If the discharge monitoring system were to become nonoperational, discharge monitoring of effluent to the river from the Fernald site would have to be collected manually. The sampling system must be operational so that accurate reports of uranium and NPDES contaminant levels can be made.
- Keep the SDF available to treat sludge generated during cleanout of AWWT Phases I and II.
- Keep the CAWWT (GW) treatment trains operating at full capacity.
- Keep SPIT on line. SPIT provides additional groundwater treatment.
- Keep South Plume Wells 1–4 operating at desired setpoints.
- Keep all extraction wells operating at the desired setpoints.

Operational Period 4

- Keep the CAWWT (SW) treatment system on line at maximum capability. This will allow the water from the SWRB to be treated through the carbon filters.
- Keep the Parshall Flume discharge point and sampling system on line. If the discharge monitoring system were to become nonoperational, discharge monitoring of effluent to the river from the Fernald site would have to be collected manually. The sampling system must be operational so that accurate reports of uranium and NPDES contaminant levels can be made.
- Keep the CAWWT (GW) treatment trains operating at full capacity.
- Keep South Plume Wells 1–4 operating at desired setpoints.
- Keep all extraction wells operating at the desired setpoints.
- More specific details of managing equipment operation and maintenance are contained in Section 6.

5.7 OPERATIONS CONTROLLING DOCUMENTS

Operations at the wastewater treatment facilities are controlled directly by Standing Orders and Standard Operating Procedures (see Appendix C). Standing Orders translate the DOE Orders, conduct of operations principles, guidelines, and procedures into performance requirements for personnel involved in operating the wastewater treatment facilities. The Standing Orders were written to ensure that all operations are conducted in full conformance with DOE conduct of operations requirements.

A more extensive discussion of Standard Operating Procedures and Standing Orders is contained in Section 6.1.2. Standing Orders and Standard Operating Procedures implement the requirements of this plan. The OMMP is not intended to replace Standing Orders or Standard Operating Procedures.

5.8 MANAGEMENT AND FLOW OF OPERATIONS INFORMATION

Samples are taken from each of the treatment systems at locations indicated on Figures 5-1A through 5-1C. The results of the sample analysis are reviewed daily by the shift supervisors, the process engineer, the operations manager and the manager of the Aquifer Restoration/Wastewater Project of DSDP to review system performance and determine if any of the treatment system ion exchange vessels need to be removed from service for resin replacement or regeneration.

The operations manager issues daily and monthly operations reports that summarize flow rates and flow totals as well as uranium concentrations from each wastewater treatment system. The operations manager communicates process information from the operations personnel to the manager of the Aquifer Restoration/Wastewater Project. Information on required well pumping rates is communicated from the manager of the Aquifer Restoration/Wastewater Project to the WTO manager, who in turn communicates to the operations personnel via the operations manager's monthly performance goals and operating orders, as specified in the Standing Orders.

5.9 MANAGEMENT OF TREATMENT RESIDUALS

Treatment residuals consist of exhausted ion exchange resin, used multimedia filter media, used carbon from the carbon filter, and filter cake from the SDF filter press. Filter cake is produced by filtration of clarifier bottoms from AWWT Phases I and II, sludge from the sewage treatment plant, and sludge generated during shutdown of the treatment systems.

The uranium concentration in the exhausted ion exchange resin and the filter cake exceeds the Waste Acceptance Criteria (WAC) for the OSDF. These materials are currently being transferred to WPP for disposal at Envirocare. After WPP shipping is complete, an alternate disposal method must be developed.

Carbon is currently being disposed of with WPP waste. An alternate disposal method for carbon must also be developed.

Media from multimedia filtration should be acceptable for disposal in the OSDF until the last cell is capped.

TABLE 5-1
STORM WATER RETENTION BASIN LEVELS AND CAPACITIES

East Storm Water Retention Basin

Water Depth (feet)	Water Volume (gallons)	Remaining Capacity (gallons)
1	322,000	4,238,000
2	663,000	3,897,000
3	1,022,000	3,538,000
4	1,400,000	3,160,000
5	1,800,000	2,760,000
6	2,210,000	2,350,000
7	2,640,000	1,920,000
8	3,090,000	1,470,000
9	3,560,000	1,000,000
10	4,050,000	510,000
11	4,560,000	0

Total Capacity when level reaches overflow spillway is 4,560,000 gallons.

West Storm Water Retention Basin

Water Depth (feet)	Water Volume (gallons)	Remaining Capacity (gallons)
1	147,000	5,583,000
2	583,000	5,147,000
3	1,050,000	4,680,000
4	1,540,000	4,190,000
5	2,060,000	3,670,000
6	2,600,000	3,130,000
7	3,170,000	2,560,000
8	3,770,000	1,960,000
9	4,400,000	1,330,000
10	5,050,000	680,000
11	5,730,000	0

Total Capacity when level reaches overflow spillway is 5,733,000 gallons.

Emergency Spill Basin (ESB)

Water Depth (feet)	Water Volume (gallons)	Remaining Capacity (gallons)
1	0	578,000
2	26,000	552,000
3	63,000	515,000
4	106,000	472,000
5	155,000	423,000
6	210,000	368,000
7	272,000	306,000
8	339,000	239,000
9	412,000	166,000
10	492,000	86,000
11	578,000	0

Total Capacity when level reaches overflow spillway is 587,000 gallons.

Examples for determining remaining capacity in SWRB at different levels from the flow charts:

Example 1

Sum of basin levels equal to 15 feet:	remaining capacity
East Basin at 6 feet	2,350,000 gal.
West Basin at 9 feet	1,330,000 gal.
ESB at 9 feet	166,000 gal.
Total remaining capacity	3,846,000

Sum of basin levels equal to 15 feet:	remaining capacity
East Basin at 9 feet	1,000,000 gal.
West Basin at 6 feet	3,130,000 gal.
ESB at 6 feet	368,000 gal.
Total remaining capacity	4,498,000 gal.

Example 2

Sum of basin levels equal to 8 feet:	remaining capacity
East Basin at 4 feet	3,160,000 gal.
West Basin at 4 feet	4,190,000 gal.
ESB at 4 feet	472,000 gal.
Total remaining capacity	7,822,000

Sum of basin levels equal to 8 feet:	remaining capacity
East Basin at 6 feet	2,350,000 gal.
West Basin at 2 feet	5,147,000 gal.
ESB at 2 feet	552,000 gal.
Total remaining capacity	8,049,000 gal.

Example 3

Sum of basin levels equal to 18 feet:	remaining capacity
East Basin at 10 feet	510,000 gal.
West Basin at 8 feet	1,960,000 gal.
ESB at 8 feet	239,000 gal.
Total remaining capacity	2,709,000 gal.

Sum of basin levels equal to 18 feet:	remaining capacity
East Basin at 8 feet	1,470,000 gal.
West Basin at 10 feet	680,000 gal.
ESB at 10 feet	86,000 gal.
Total remaining capacity	2,236,000 gal.

TABLE 5-2

WELL FIELD OPERATIONAL OBJECTIVES

Objectives	Actions Required
Operate individual wells within constraints imposed by system design and equipment. Key constraints include: • Pumping equipment is limited to a range of flows that will dictate the flexibility of extraction rates for individual wells • Hydraulic capacity of the piping limits extraction rates • Control range of flow control valves and variable frequency drives for pump motors bound the range of extraction rates for individual wells • Capacity of existing electrical service to each well • Average entrance velocity of water moving into the screen should not exceed 0.1 ft/sec	• Operate well pumps and motors per manufacturer recommendations • Operate extraction and injection systems within design constraints
Perform necessary equipment/well maintenance in accordance with established schedules.	• Per OMMP, Appendix D
Maintain compliance with the discharge limits of 30 µg/L monthly average uranium concentration and 600 lbs/yr for the combined site water discharged to the Great Miami River.	• Monitor discharge concentrations • Modify well set points as necessary to maintain compliance with discharge limits. • Evaluate well set points and treatment routing monthly • Use flow weighted average concentration calculations to predict how changes to set points and routing will effect discharge concentrations. • Compare predictions with actual measurements to evaluate if/how predictions can be improved. • Maintain well set points to the degree possible
Minimize impact to the Paddys Run Road Site plume.	• Pumping from Recovery Well 3924 (RW 1) should not exceed 300 gpm. • Pumping from Recovery Well 3925 (RW 2) should not exceed 300 gpm (if Well 3924 is pumping) and 400 gpm (if Well 3924 is not pumping). • Pumping from Recovery Well 3926 (RW 3) should not exceed 500 gpm if either Well 3924 or Well 3925 goes down. • If the actual capture zone differs significantly from that defined via previous modeling it may be determined that the above-noted pumping rates require modification in order to maintain this objective. Required modifications will be made based on additional modeling projections and verified based on field data.

TABLE 5-2
(Continued)

Objectives	Actions Required
Maintain capture of the 30 μ/L uranium plume along the southern Administrative Boundary.	• The following pumping rates for each South Plume Well provides for the capture (within system constraints) of the uranium plume along the administrative boundary: Recovery Well 3924 at 300 gpm Recovery Well 3925 at 300 gpm Recovery Well 3926 at 300 gpm Recovery Well 3927 at 400 gpm • Adjust the pumping rates of the remaining operable wells in the South Plume module to maintain capture along the administrative boundary when: 1) any single South Plume Module well outage for one week or more occurs; or 2) when multiple well outages for three days or more occur • If the actual capture zone differs significantly from that defined via previous modeling it may be determined that the above-noted pumping rates require modification in order to maintain this objective. Required modifications will be made based on additional modeling projections and verified based on field data.
Maintain hydraulic capture of the remaining portions of the 30 μg/L uranium plume (within areas of active modules).	• Establish pumping rates based on model predictions of required pumping rates to maintain a desired area of capture. • Determine the actual area of capture created when the wells are operating at the modeled rates based on groundwater elevation contour maps derived from field measurements. • Adjust pumping rates within system design and operational constraints, if warranted, when the actual area of capture is not consistent with the modeled area of capture. This will be done in an effort to establish an area of capture consistent with the desired area of capture, as modeled.
Minimize duration of clean-up time for off-property portion of the 30 μg/L uranium plume.	• Give priority to keeping South Plume and South Plume Optimization Wells online when other wells have to be shut down • Maximize pumping rates within the following constraints/considerations: system design and equipment, hydraulic capacity of the aquifer, regulatory limits, interaction with other modules and remedy performance.
Minimize duration of cleanup time for on-property portions of the uranium plume.	• Maximize pumping rates within the following constraints/considerations: system design and equipment, hydraulic capacity of the aquifer, regulatory limits, interaction with other modules
Minimize migration of on-property portion of the plume to off-property areas.	• Balance pumping from the South Field Extraction and South Plume Modules such that the stagnation zone is at or south of Willey Road.
Minimize drawdown in off-property areas.	• Do not exceed set points defined in Table 4-1 unless modified by Aquifer Restoration/Wastewater Project management

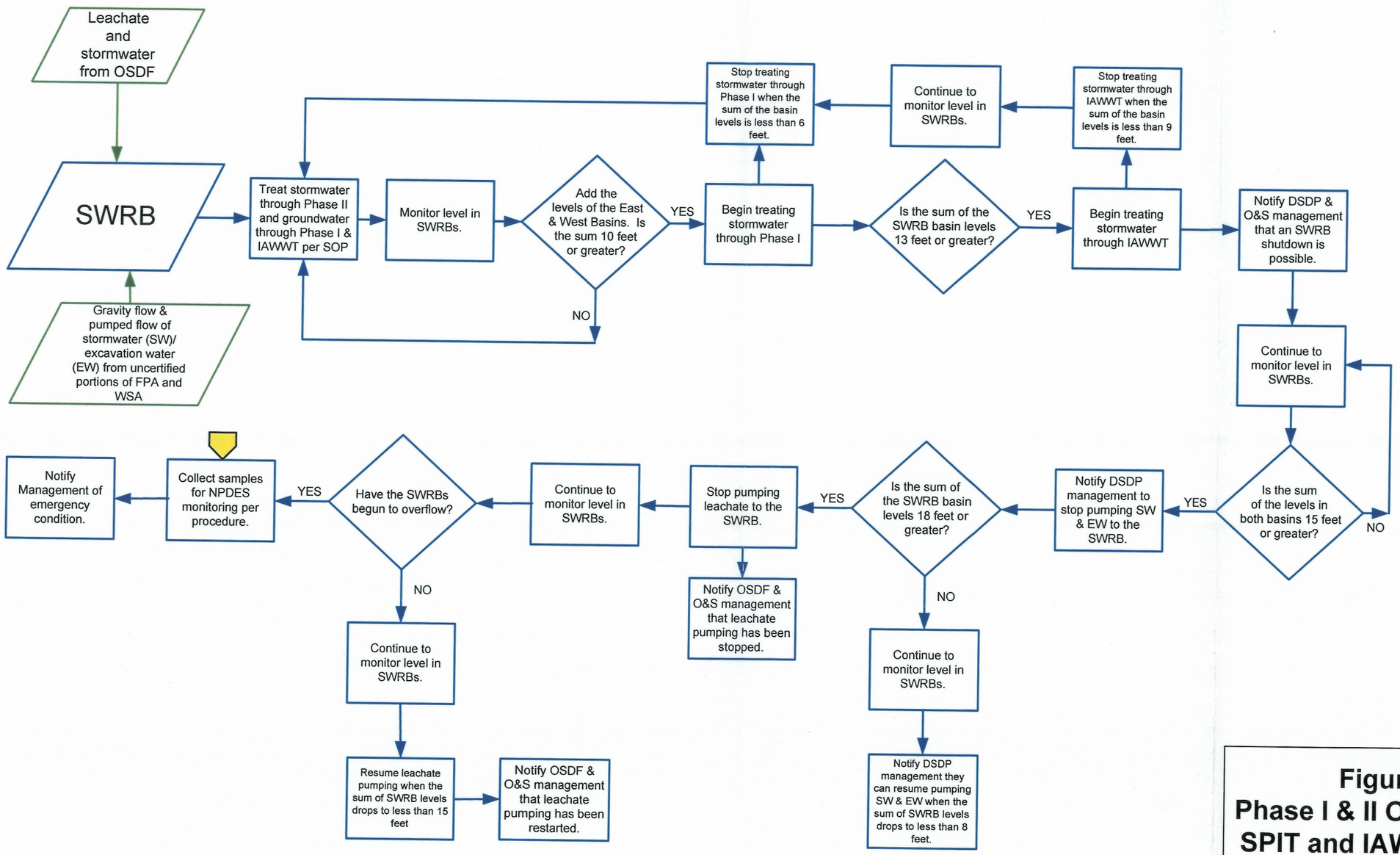


Figure 5-1A
Phase I & II Operations with SPIT and IAWWT after BSL Shutdown

Flow chart for after BSL Figur.vsd 8:59:37 AM Friday, June 25, 2004

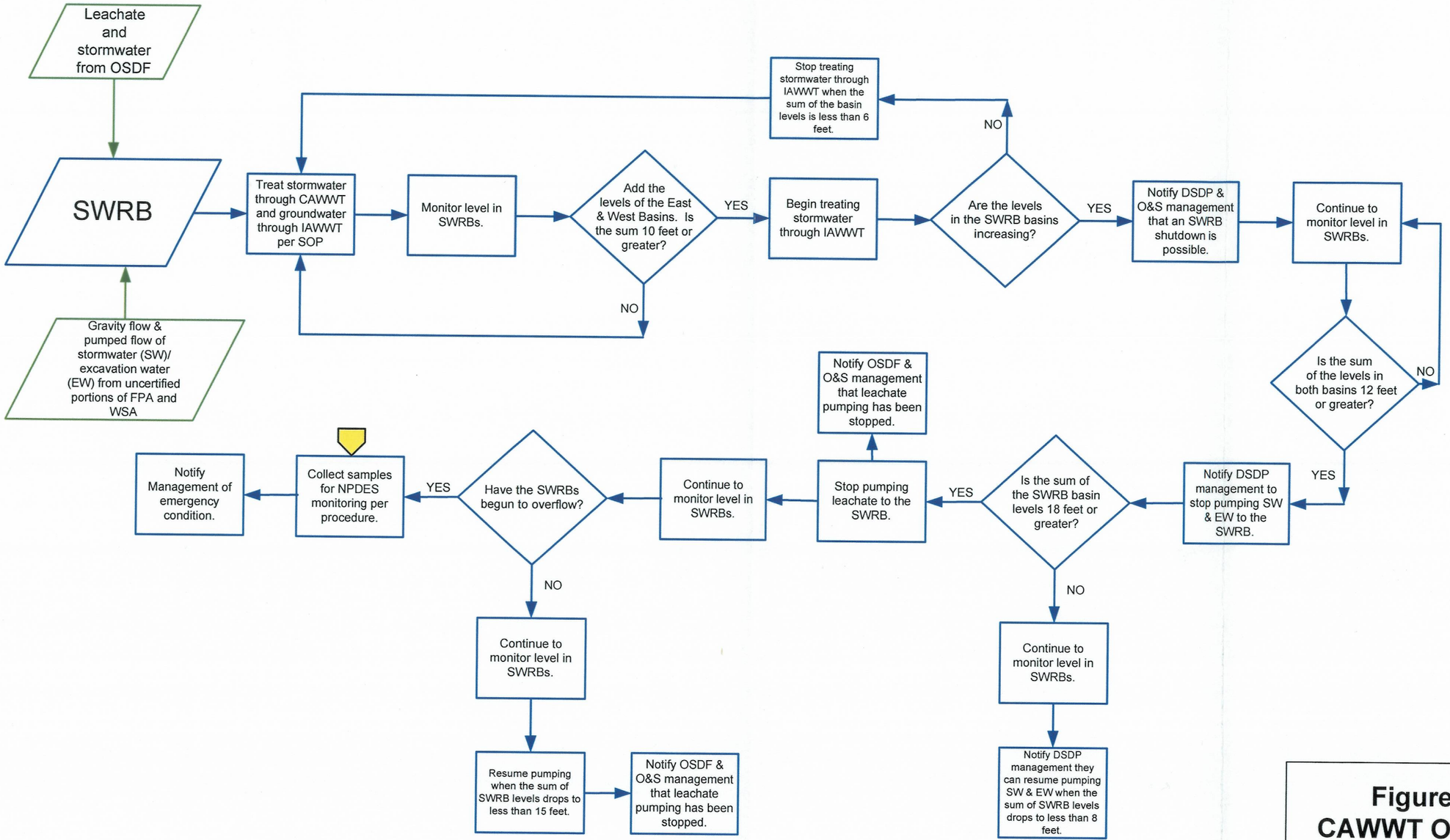


Figure 5-1B
CAWWT Operations with SPIT and IAWWT

Flow chart for after BSL Figur.vsd 8:59:37 AM Friday, June 25, 2004

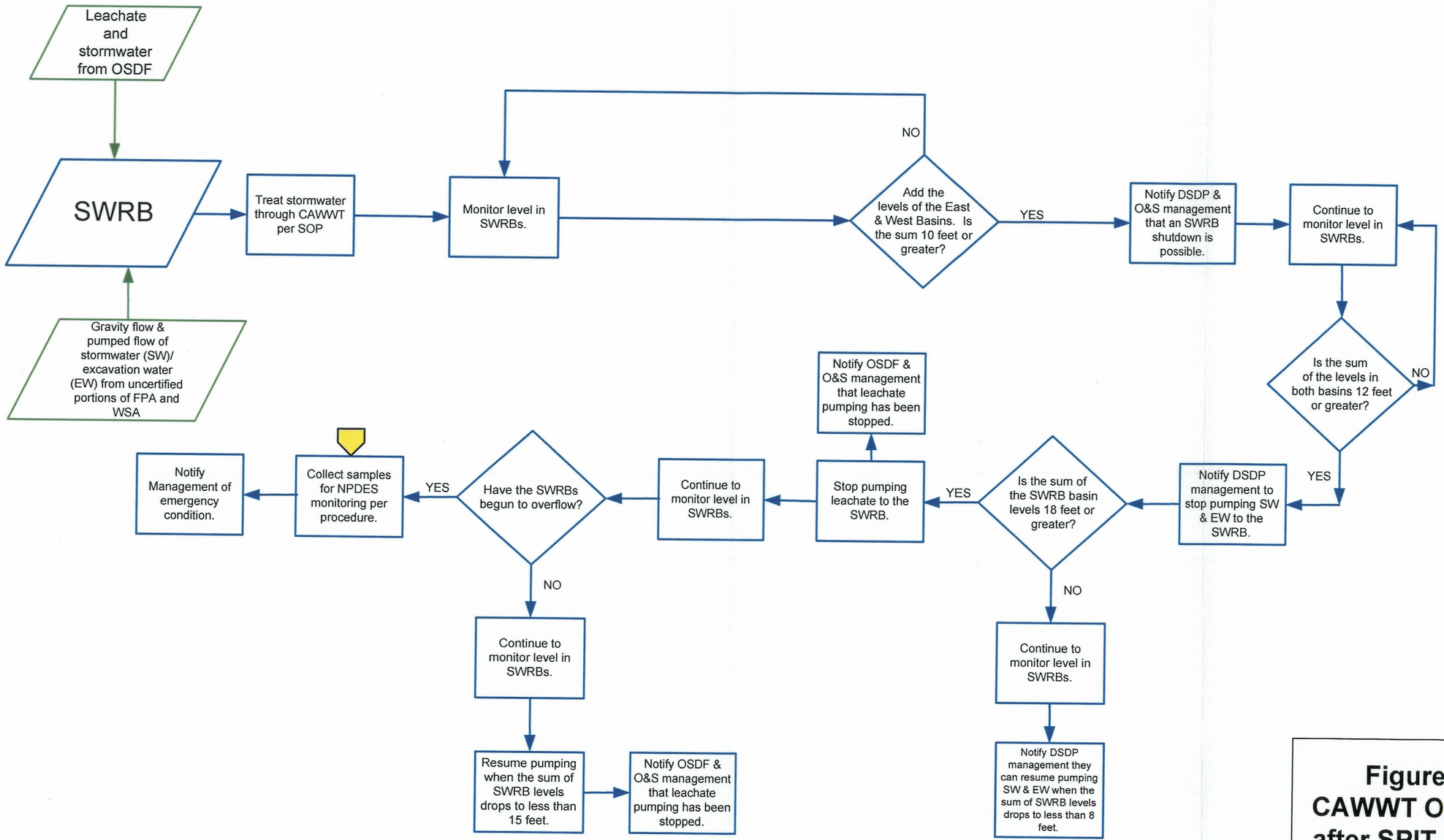


Figure 5-1C
CAWWT Operations after SPIT & IAWWT Shutdown

Flow chart for after BSL Figur.vsd 8:59:37 AM Friday, June 25, 2004

6.0 OPERATIONS AND MAINTENANCE METHODS

This section describes the general methods, guidelines, and practices used in managing equipment operation and maintenance. Managing equipment operation and maintenance in the context of this document includes not only routine control panel monitoring and repair work, but also the preventive, predictive, and proactive actions used to maximize equipment operating efficiency and capacities. This section presents some of the management systems that will help to assure that the Operable Unit 5 Record of Decision requirements are met, describes the key parameters used to monitor the performance of the groundwater and wastewater facilities, and describes the principal features and maintenance needs of the overall operation.

The treatment and restoration well system performance parameters and maintenance requirements have unique differences. The treatment systems are designed and built with many redundant features and equipment to reduce potential downtime (e.g., installed spare pumps and ion exchange units). Those features are not economically practical for the well systems. The equipment in the treatment systems has more easily discernible indicators of equipment condition and is more easily accessed for monitoring by operator walk-through than the underground well system. The methods used to measure the equipment condition and the specific measurable goals for the two systems also are different.

6.1 MANAGEMENT SYSTEMS

6.1.1 Maintenance and Support

The maintenance and operations groups are responsible for routine repairs, preventive maintenance, and minor modifications and improvements needed to maintain the operational capability of Fernald site wastewater treatment facilities. Full-time maintenance supervision and skilled, qualified craftsmen (pipe fitters, welders, millwrights, electricians, instrumentation technicians, and asset preservation specialists) are headquartered in a combination shop/storage/office facility inside of Building 51. The maintenance and operations groups work together closely on a day-to-day basis, promoting a sense of ownership and cooperation between the operators and maintainers of this system.

The technical staff directly supports facility operation and maintenance, and includes chemical and civil engineers, geologists and hydrogeologists, quality assurance, health, safety, and environmental compliance personnel. The technical staff works together to resolve issues and improve operations. They also provide troubleshooting and technical assistance to the day-to-day operations and maintenance groups.

Key responsibilities of the central maintenance group include developing preventive maintenance schedules, developing spare parts inventories, developing maintenance work instructions, and administering the sitewide computerized maintenance database. Specific engineering discipline skills may be utilized from the sitewide facilities engineering group for specific maintenance needs (for example, structural analysis, electrical power distribution design, and instrumentation system configuration). All work involving a modification is reviewed by knowledgeable, technical staff members to ensure that it is appropriate. All maintenance work is formally planned and scheduled, except for emergency repairs, which are handled in a safe, expeditious manner. Major system maintenance turnarounds are planned in detail to help minimize the duration of system outages.

The facilities consist of standard gravel-packed water wells and conventional water and wastewater treatment unit processes that are typical for the industry. It may be expected to have good reliability and has well-documented maintenance guidelines. Routine maintenance practices, as documented by the original equipment manufacturer's maintenance manuals, have been used to provide the basis for Fernald site maintenance procedures and practices. A spare parts inventory (developed from original equipment manufacturer's recommendations) is maintained to expedite the completion of equipment repairs.

6.1.2 Operations

Operating personnel play an important role in maximizing equipment operating efficiency and capacity. One significant duty of the facility operators is to identify and report existing and potential future equipment problems. Operators perform routine scheduled checks, inspections, and walk-throughs of the facilities and systems. Potential problems and maintenance needs are reported to supervision and maintenance work orders are initiated. Operators and Shift Supervisors maintain shift logbooks that document activities and specific actions taken during each shift. Information in the logbooks is used as the basis for transfer of duty from one shift to the next. The logbooks are kept as a historical record of operational activities. Management and technical staff periodically review the logbooks and roundsheets as additional assurance that the systems are being effectively operated.

6.1.2.1 Process Control

Facilities are staffed by operators and shift supervisors around the clock (24 hours per day, seven days per week, 365 days per year). The operators at AWWT and the SDF monitor the process using a computerized control system located in control rooms. The control system receives input from process meters (e.g., tank level and process flow meters) and from devices that indicate equipment status (e.g., valve position limit switches and motor run relays). The control system outputs control signals to

regulate the process (e.g., control valve positioning and motor start/stop control). The control system uses desktop-style computer equipment (monitors, keyboards, and pointing devices) to provide a graphic operator-machine interface for the process monitoring and control. The control system operator interface includes various process graphics screens depicting portions of the treatment system in piping and instrumentation diagram format and providing real time process measurements and information. The control system has graphic process trending capabilities, process alert and alarm management, and an historical database of all operator inputs and process alert/alarms. The control system also provides an interface with new and existing well systems to provide enhanced real time monitoring and remote controls. The operators at AWWT, CAWWT, and SDF also access process and equipment information by making "walking rounds" of all equipment in the process.

The other facilities have more traditional control panels or local control boards at the equipment. Operators at all the other facilities perform walking rounds to ensure correct operation of all equipment. Information collected during the walking rounds is documented on rounds sheets, which are reviewed each shift by the shift supervisor. If any unusual conditions are observed during the walking round, the operator immediately notifies the Shift Supervisor and appropriate corrective actions are taken.

6.1.2.2 Standard Operating Procedures

Each operation is performed in accordance with approved Standard Operating Procedures that are developed by the technical staff with the assistance of operations personnel. The Standard Operating Procedures are reviewed periodically and revised as necessary for the safe and consistent operation of treatment processes. A list of current these procedures is contained in Appendix A. The list is current as of the writing of this OMMP. The number of procedures will be reduced as facilities are shut down and the procedures are canceled.

Standard Operating Procedures provide step-by-step instructions for performing wastewater treatment operations activities. They also contain health and safety precautions that must be followed while performing the steps contained in the procedure. The procedures are written from the perspective of the operator who will be performing the steps.

Standard Operating Procedures also contain instructions as to when management must be notified of non-routine operating conditions or events and to whom in management these conditions must be reported. Reporting of these conditions or events to site management and to outside agencies is discussed in Section 7.0 of this OMMP.

6.1.2.3 Conduct of Operations

The DOE Conduct of Operations standards (DOE 2001c) are implemented for operations and maintenance through Standing Orders. The Standing Orders spell out the specific methods used by the project for the implementation of all 18 chapters of DOE 5480.19. The chapter titles (which are indicative of the important operational protocol) are Operations, Organization, and Administration; Shift Routines and Operating Practices; Control Area Activities; Communications; Control of On-Shift Training; Investigation of Abnormal Events; Notifications; Control of Equipment and System Status; Lockouts and Tagouts; Independent Verification; Log Keeping; Operations Turnover; Operations Aspects of Facility Chemistry and Unique Processes; Required Reading; Timely Orders to Operators; Operations Procedures; Operator Aid Postings and Equipment; and Piping Labeling. Implementation of the Standing Orders helps to assure clarity, consistency, and a common purpose in the day-to-day activities.

6.1.2.4 Training

A training and qualification program exists to ensure that all operating personnel involved in treating wastewater are qualified and competent for their positions. The goal of the training and qualification program is to prepare personnel for the operations team and to continually improve the team's knowledge and capabilities. The program consists of two major elements. An initial training program leads to operator qualification in wastewater treatment facilities. A continuing training program provides a means to update team members on changes to regulations, equipment, and procedures as well as information and exercises to improve understanding and performance. Along with the in-house training programs, the operators and supervisors of the wastewater systems affirm their competence through the requirement that they possess a Class I (or higher) wastewater operator's license.

6.1.2.5 Self-Assessments

Verification that personnel are operating according to Standard Operating Procedures is accomplished through self-assessments and audits. Self-assessments are performed regularly to ensure that the Standard Operating Procedures accurately reflect current operating conditions, and to ensure that operations personnel are following the Standard Operating Procedures. Independent audits are performed to ensure that all activities in the wastewater treatment facilities are performed in accordance with internal and external requirements. The results of the self-assessments and audits are used to revise and update procedures and to improve performance of activities involved in wastewater treatment.

6.1.2.6 Oversight

In general, a much greater level of control and oversight exists in government work than that found in the private sector. In-depth safety review and analysis, job-specific health and safety plans and procedures, execution of internally generated permits, and careful reliance on personal protective equipment are used to help reduce employee exposures to risks, to levels as low as reasonably achievable. This level of control requires formal, written documentation, analysis, and justification, lengthier authorization and approval chains, and a greater need to create and to ensure strict adherence to fixed rules and procedures.

6.2 RESTORATION WELL PERFORMANCE MONITORING AND MAINTENANCE

This section describes the key performance monitoring and maintenance guidelines for the groundwater restoration well systems. To complete the aquifer restoration within the accelerated schedule, a high level of on-stream time at the modeled pumping rates is needed for each individual well. Some well downtime is expected and can be accommodated. However, lengthy outages can adversely impact the planned goals. An upgraded well maintenance program has been developed to address this issue. More frequent component preventive maintenance checks along with periodic formal performance testing and well chlorination were identified and included as major program elements to improve well operating efficiency. The following sections provide a description of the highlights of the planned well maintenance program that is detailed in Appendix B.

6.2.1 Operational Monitoring and Performance Testing

The main system performance indicators for the wells will be gathered and summarized using formal performance tests to monitor the recovery well specific capacity and the pump/motor assembly performance. The test results will be used to determine the need for well redevelopment or pump/motor rebuilding. The information will help to minimize unscheduled, unplanned emergency maintenance and will help to shorten the duration of well outages. System operating parameters that will be routinely monitored include: 1) water level - static and pumping; 2) flow; 3) discharge pressure; and 4) motor amperage draw.

Water level, both static and pumping, will be measured periodically to detect significant changes. The drawdown from static water level to the pumping water level, compared to historical drawdown for an individual well, is an indication of the degree of fouling of the well screen and the surrounding formation. The vertical placement of the recovery well pump/motor assemblies is fixed, based upon an anticipated worst-case drawdown that is below the seasonal low-static water levels. While each pump setting has some added submergence to be conservative, pumping levels need to be routinely monitored in order to ensure that adequate pump/motor submergence is maintained and to prevent severe

component damage. Each recovery well has an installed pressure transducer that can be linked to an automated data logger. These pressure transducers are located approximately one foot above the pump bowl assembly, well above the required minimum submergence for the pump intake. As long as the pumping water level is maintained above the transducer, adequate pump intake submergence is assured. If the pumping water level above the pressure transducer approaches zero head (i.e., begins to approach the still acceptable level of one foot above the bowl assembly), well/screen maintenance actions will be taken.

Performance testing of the wells is anticipated to require an outage of approximately four-hours each. Until an adequate historical database is developed, the testing is planned to be conducted for each well on a quarterly basis. It is planned to measure static water level, then pump flow, discharge pressure, pumping water level, and motor amperage for at least five different flow rates for each performance test of a well.

The results of the performance measurements will be used to determine the condition of the pump/motor and of the well. The flow and discharge head will be plotted and compared to the manufacturer's pump curve and to previously developed head/flow curves. The amperage draw of the well's pump motor at various flows will also be compared to previous readings and pump/motor manufacturer published information. The static water level and pumping levels will be used to calculate drawdown and specific capacity (flow rate divided by drawdown) within the recovery well at various flows. As fouling and encrustation of the well progresses, drawdown within the well will increase for a given flow rate (the specific capacity will decrease). The need for well screen maintenance activities will be triggered by excessive drawdown. Maintenance work will be planned, scheduled, and performed to avoid costly damage to equipment such as the recovery well pump/motor assembly and to avoid lengthy unplanned outages.

6.2.2 Routine Well/Screen Maintenance

Well/screen routine maintenance is required to maximize system overall on-stream time and to minimize recovery well drawdown and the need for major rehabilitation. The recovery wells will be superchlorinated by the addition of sodium hypochlorite (an industrial strength bleach with 12.5 percent available chlorine). This is a common practice in the well water supply industry. The chlorination will serve to deter bacteria growth and buildup on the screen and in the local formation and will serve to increase long-term well production. The procedure will be performed on each well on a scheduled basis or when pumping drawdown exceeds 8 feet. It is anticipated to require an outage of 72 hours for each recovery well. Routine well superchlorination is currently being performed on a semi-annual basis. It is

anticipated that periodic, major rehabilitation efforts will be required every few years, when the drawdown within the well becomes excessive and the superchlorination procedure is not adequately effective.

The basic procedure includes well shutdown, removal of the well cover, feed of a calculated quantity of sodium hypochlorite, well surging by pump stop and start, and a hold time to allow the sodium hypochlorite to react and dissipate. The hypochlorite quantity will be calculated to yield about 2000 to 3000 milligrams per liter (mg/L) available chlorine in the volume of water within the well screen assembly (between the static water level and bottom of the well screen). The reaction/dissipation time will be 24 to 72 hours, during which the free chlorine residual is expected to fall to acceptable limits. It is anticipated that the water initially pumped from a superchlorinated well will contain turbidity and scale. The water quality of this discharge will be documented and controlled through the internal procedure for discharge of miscellaneous wastewater sources to treatment systems (Fluor Fernald, Inc, 2003b). Sampling and analysis of this water will be performed in order to document its chlorine content If, after superchlorination, the drawdown remains excessive, more extensive rehabilitation efforts will be required.

6.3 TREATMENT FACILITIES PERFORMANCE MONITORING AND MAINTENANCE

This section describes the key performance monitoring parameters and maintenance needs for the wastewater treatment systems and their ancillary facilities. Meeting the Fernald site effluent discharge uranium limit of 30 ppb on a monthly average basis within the accelerated schedule is an ambitious undertaking. The experience that has been gained in operating the various Fernald site systems provides an increased confidence level that the limit may routinely be met. Round-the-clock vigilance and wise decision-making will be needed to ensure compliance.

6.3.1 Treatment Facilities Performance Monitoring

All of the Fernald site's wastewater treatment systems use strong base-anion exchange as the final unit process for uranium removal. The strong base-anion exchange resins have a very strong affinity for the uranyl carbonates in the Fernald site's wastewater. The technology is reliable; however, treatment to the effluent levels required at the Fernald site (i.e., < 30 ppb) is not widely practiced in wastewater systems. An expected performance of the various Fernald site treatment systems has been used in this plan to demonstrate the ability to meet the Record of Decision effluent requirements. The performance expectations are, for the most part, based on historical Fernald site operating experience, utilizing new resin, as opposed to vendor performance guarantees or widely published data.

Measurable parameters for the Fernald site treatment systems are the total volume of water treated, the influent and effluent uranium concentrations and mass, and the total mass of uranium removed by treatment. The Fernald site total effluent flow rate is metered. Flow weighted composite samples of the

effluent are analyzed daily for total uranium. Those two parameters are used to measure compliance with the Operable Unit 5 Record of Decision requirements for uranium discharge in the Fernald site's effluent. Additionally, each individual wastewater treatment train has flow measurement and control. The individual treatment systems are also routinely sampled at strategic process locations, including the inlet and outlet of each ion exchange vessel. The sample results and treatment flow rates are reported, tracked, and used to determine the need for troubleshooting, process adjustments, and corrective actions. A daily summary sheet of all aquifer restoration and wastewater process data, including individual well and treatment system total flows and treatment train uranium inlet and outlet concentrations, is published and distributed to the project's management and technical staff. All of the routine uranium analytical work is conducted in a laboratory located within the AWWT, Building 51A.

6.3.2 Treatment Facilities Maintenance Practices

The CAWWT and AWWT expansion systems are designed with only two ion exchange units per train. Normally, both units in a train operate in series. For short-duration shutdowns of a single vessel (e.g., backwashing, resin regeneration, minor maintenance, etc.), flow will be routed through one ion exchange unit only. Long-duration outages of a single vessel may necessitate specific well shutdowns, depending on the overall system performance and on the performance of the affected train. The two-vessel-per-train configuration was selected during the project's design to provide a higher total system capacity and better equipment utilization within the remaining serviceable space in Building 51.

As described above, much of the routine preventive maintenance and repair work in the treatment systems can be accomplished without a unit shutdown, because of the installed spare equipment and bypass piping and valving. There are some planned maintenance activities that will result in treatment system outages. The Operable Unit 5 Record of Decision provides for relief allowances from the effluent discharge limit of a monthly average of 30 ppb uranium concentration during periods of treatment plant scheduled maintenance. Decisions regarding well operations during treatment plant scheduled maintenance will be made on a case-by-case basis. For planned maintenance shutdowns, advanced EPA approval will be obtained for relief allowances that may be requested.

Some breakdowns will lead to system shutdowns. Loss of utilities or a failure in the AWWT's computerized control system would result in a system shutdown. All treatment systems will fail safely on loss of a utility or a major component and are not very complicated to restart. Spare parts inventories follow the original equipment manufacturer's recommendations and a corps of experienced, skilled craftsmen is available for emergency repairs in the treatment systems.

7.0 ORGANIZATIONAL ROLES, RESPONSIBILITIES, AND COMMUNICATIONS

This section presents the organizational roles and responsibilities with respect to implementation of this OMMP. Also presented are information needs and communications protocol for coordination with other Fernald site project organizations, and interaction with the EPA and OEPA.

7.1 ORGANIZATION ROLES AND RESPONSIBILITIES

7.1.1 DOE Fernald

The DOE is responsible for providing direction and oversight of all activities at the Fernald site.

7.1.2 Operating Contractor

Fluor Fernald Inc., is the operating contractor for the Fernald site. The OMMP falls under the responsibility of two projects within Fluor Fernald Inc.: 1) the DSDP; and 2) the OSP. Specifics are provided below.

The Aquifer Restoration/Water Management (AR/WM) team within DSDP is responsible for all engineering design and construction activities for the OMMP which include:

- Engineering functional requirements, design basis, and detailed design drawings and documents
- Title III engineering support during construction (in conjunction with WTO)
- Start-up Plans, System Operability Test procedures, and test supervision (in conjunction with WTO)
- Standard Start-up Review Plans and coordinate resolution of issues (in conjunction with WTO)
- Technical support to Operations
- Coordination of project-specific activities associated with procurement and management of construction contractors.

The Aquifer Restoration/Water Management team is also responsible for all aquifer restoration planning and environmental monitoring/reporting activities within the project, which include:

- Developing and maintaining the aquifer restoration strategy
- Developing and implementing remedy performance groundwater monitoring, data evaluation, and reporting
- Technical input to WTO on recovery well operation and maintenance
- Technical input to WTO regarding compliance with discharge limits
- Technical input to design and construction of site groundwater extraction/injection systems
- Preparation of required CERCLA documentation (e.g., RA Work Plan, aquifer remedy design documents, the IEMP groundwater section, and various other required reports).

Environmental Compliance personnel are responsible for:

- Fulfilling site NPDES reporting requirements
- Analysis of state and federal regulations to identify project-specific regulatory requirements

The WTO team within OSP is responsible for all operations and maintenance activities within the project, which include:

- Operations of groundwater extraction and injection well systems
- Operation of all site wastewater treatment systems and their ancillary facilities
- Estimate, plan, and execute corrective and preventative maintenance
- Training and qualification of operators and supervisors
- Develop, review and revise Standard Operating Procedures
- Sampling and analysis of process streams for compliance with operational parameters and established regulatory limits.

The Safety and Health team within DSDP and OSP is responsible for Safety and Health activities within the project, which include:

- Development and revision of Safety and Health Project matrices for operations and construction
- Radiological monitoring of activities
- Industrial health monitoring of activities
- Oversight of construction and operations safety programs
- Safety design reviews and technical input.

The Project Controls teams within DSDP and OSP is responsible for:

- Project cost and schedule baseline development and maintenance
- Monthly performance and variance reporting to DOE
- Estimate at completion funding analysis and reporting
- Change proposal and cost savings coordination
- Project quality assurance oversight.

7.2 INTEGRATION WITH OTHER PROJECT ORGANIZATIONS

Wastewater Acceptance Guidelines have been developed to assist the Fernald site remediation projects in identifying wastewater issues and concerns. The AR/WM team along with WTO will continue to: 1) work with the projects to obtain best estimates of water quality and quantity data during the design review process; 2) apply the guidelines to these estimates to identify areas of concern; and 3) interface with the projects to develop an awareness of the functions and capabilities of existing and planned site-wide water treatment facilities and handling operations. As noted above, this integration occurs during design reviews. These reviews include as necessary, comment resolution meetings and alignment sessions. Integration with the other projects also will occur as necessary to maintain adequate storage capacity in the SWRB in order to ensure no bypassing/overflow of the basin – after the SWRB becomes the headworks for leachate from the OSDF (See Section 5).

7.3 REGULATORY AGENCY INTERACTION

Interaction with EPA and OEPA regarding the OMMP initially occurs during the review and comment resolution process for the document. Future versions of the OMMP will also be submitted for review and will go through a review and comment resolution process similar to this submittal. As noted in Sections 1.0 and 3.0, the IEMP provides for the collection and reporting of groundwater remedy performance (IEMP Section 3.0) and treated effluent (IEMP Section 4.0) information that supports operational decisions regarding groundwater restoration and water treatment.

The current plan is that well field and treatment operational summaries are included in the IEMP reporting process. These summaries allow for agency input as aquifer restoration and water treatment progress. In addition, the NPDES and Federal Facilities Compliance Agreement reporting will continue as outlined in Section 4.0 of the IEMP. The AR/WM and WTO participation in meetings and weekly conference calls will continue as necessary.

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APPENDIX A

AQUIFER RESTORATION AND WASTEWATER TREATMENT STANDARD OPERATING PROCEDURES

AQUIFER RESTORATION AND WASTEWATER TREATMENT STANDARD OPERATING PROCEDURES

PROCEDURE NO.	FILENAME
20-C-510	REMOVAL, TRANSPORT, AND STORAGE OF DECANT SUMP LIQUID FROM K-65 SILOS 1 AND 2
43-C-100	CLEANING GLASS AND PLASTIC LABORATORY WARE
43-C-101	STORING AND HANDLING CHEMICALS
43-C-102	SAMPLE PRESERVATION BY ACID ADDITION
43-C-104	HORIBA WATER QUALITY METER CALIBRATION, OPERATION, AND MAINTENANCE
43-C-105	ION EXCHANGE RESIN SLUICING AND ADDITION - SOUTH PLUME INTERIM TREATMENT (SPIT) SYSTEM
43-C-107	K-65 AREA ROUNDS AND OPERATIONS
43-C-108	IEMP SURFACE WATER SAMPLING
43-C-305	WATER PLANT LABORATORY PROCEDURES
43-C-306	STORM SEWER LIFT STATION
43-C-308	RESPONDING TO INDICATIONS OF OUT-OF-SPECIFICATION EXCURSIONS OF STORM SEWER WATER QUALITY
43-C-326	STORMWATER RETENTION BASIN CONTROL SYSTEM OPERATION
43-C-332	OPERATION OF THE HACH DR/3000 SPECTROPHOTOMETER
43-C-335	IAWWT (STORMWATER RETENTION BASIN) SYSTEM OPERATION
43-C-337	WASTE PIT AREA STORMWATER RUNOFF CONTROL SYSTEM OPERATION
43-C-340	AWWT PHASE I AND II OPERATIONS
43-C-341	ADVANCED WASTE WATER TREATMENT BASELINE VALVE LINE-UP
43-C-343	ADVANCED WASTE WATER TREATMENT (AWWT) BULK CHEMICAL SYSTEMS
43-C-344	AWWT SUMPS OPERATIONS AND RESPONSE TO CHEMICAL SPILLS
43-C-345	REGENERATION, SLUICE IN AND OUT OF ION EXCHANGE RESIN FOR AWWT PHASES I AND II
43-C-347	AWWT EMERGENCY SHOWER SYSTEM OPERATION
43-C-348	AWWT HEATING, VENTILATION AND AIR CONDITIONING SYSTEM OPERATION
43-C-349	AWWT PROCESS ARE MAKE-UP AIR SYSTEM OPERATION
43-C-350	AWWT STEAM AND CONDENSATE SYSTEM OPERATIONS
43-C-353	AWWT TREATED WATER SYSTEM OPERATION
43-C-356	RECEIVING SLURRIES AND CHEMICALS AT THE AWWT SLURRY DEWATERING FACILITY
43-C-357	PRETREATMENT OF MISCELLANEOUS SLURRIES AT THE AWWT SLURRY DEWATERING FACILITY
43-C-358	THICKENING, FILTRATION, AND DISCHARGE AT THE AWWT SLURRY DEWATERING FACILITY
43-C-359	PRETREATMENT OF AWWT SLURRY AT THE AWWT SLURRY DEWATERING FACILITY
43-C-360	BASELINE VALVE LINE-UP FOR THE AWWT SLURRY DEWATERING FACILITY
43-C-361	BUILDING UTILITIES AT THE AWWT SLURRY DEWATERING FACILITY
43-C-362	CLEANING SAMPLE TUBES AT THE AWWT
43-C-364	BACKWASHING IAWWT ION EXCHANGE VESSELS
43-C-365	LEACHATE CONVEYANCE SYSTEM OPERATION
43-C-367	AWWT EXPANSION (PHASE III 1800 GPM) SYSTEM OPERATIONS
43-C-368	NEW SEWAGE TREATMENT PLANT OPERATIONS
43-C-369	OPERATION OF EXTRACTION AND REINJECTION WELLS AT THE AWWT DCS
43-C-370	STARTUP AND SHUTDOWN OF AWWT PHASE I AND II OPERATIONS
43-C-371	SLUDGE DREDGE OPERATIONS
43-C-412	MANAGEMENT OF THE WATER COVER FOR WASTE PIT 6
43-C-413	HANDLING WASTE MATERIALS WITH THE INDUSTRIAL VACUUM LOADER TRUCK (SUPERSUCKER)
43-C-414	INDUSTRIAL VACUUM LOADER TRUCK (SUPERSUCKER) OPERATION
43-C-421	ION EXCHANGE RESIN SLUICING AND ADDITION FOR THE IAWWT (STORMWATER RETENTION BASIN) SYSTEM
43-C-502	INDUSTRIAL VACUUM LOADER TRUCK (GUZZLER) OPERATION

AQUIFER RESTORATION AND WASTEWATER TREATMENT STANDARD OPERATING PROCEDURES (Continued)

PROCEDURE NO.	FILENAME
43-C-505	ENVIRONMENTAL SAMPLING AT THE SEWAGE TREATMENT PLANT AND THE PARSHALL FLUME
43-C-601	INSPECTION/OPERATION OF SURFACE IMPOUNDMENTS
43-C-701	GENERAL SUMP OPERATION
43-C-903	SOUTH PLUME INTERIM TREATMENT (SPIT) SYSTEM OPERATION
43-C-904	RECOVERY WELL FIELD
43-M-1001	DISSOLVED OXYGEN (DO) AZIDE MODIFICATION OF WINKLER METHOD
43-M-1002	DISSOLVED OXYGEN (DO), MEMBRANE ELECTRODE METHOD
43-M-1003	DPD METHOD FOR FREE AND TOTAL CHLORINE TEST
43-M-1004	TOTAL COLIFORM TESTING BY MEMBRANE FILTER METHOD
43-M-1005	FECAL COLIFORM TESTING OF WATER BY MEMBRANE FILTER METHOD
43-M-1006	BRPADAP TEST FOR SOLUBLE URANIUM BY SPECTROPHOTOMETER
43-M-1007	ALKALINITY (TOTAL AND PHENOPHALEIN) TESTING OF WATER
43-M-1008	TOTAL HARDNESS TESTING OF WATER BY EDTA TITRIMETRIC METHOD
43-M-1009	TOTAL PHOSPHORUS TESTING OF WATER BY ASCORBIC ACID METHOD WITH PERSULFATE PREDIGESTION
43-M-1010	STABILITY TEST OF WATER BY SATURATION WITH CALCIUM CARBONATE
43-M-1011	PH (HYDROGEN ION) TESTING OF WATER BY ELECTROMETRIC METHOD
43-M-1012	CONDUCTIVITY/RESISTIVITY TESTING OF WATER BY ELECTROMETRIC METHOD
43-M-1013	SPECTROPHOTOMETRIC TEST FOR NITRATES IN WATER USING MODIFIED CADMIUM REDUCTION METHOD
43-M-1014	TOTAL SUSPENDED (NON-FILTERABLE) SOLIDS IN WATER
43-M-1015	TOTAL DISSOLVED (FILTERABLE) SOLIDS IN WATER
43-M-1016	IGNITION TEST FOR VOLATILE AND FIXED SOLIDS IN WATER
43-M-1017	TOTAL SOLIDS IN WATER
43-M-1018	VOLUMETRIC MEASUREMENT OF SETTLEABLE SOLIDS IN WATER
43-M-1020	CHEMICAL OXYGEN DEMAND OF WATER BY REACTOR DIGESTION METHOD WITH COLORIMETRIC DETERMINATOR
43-M-1021	BICINCHONINATE METHOD FOR TESTING COPPER IN WATER BY SPECTROPHOTOMETER
43-M-1022	QUALITY TESTING OF REAGENT-GRADE WATER
43-M-1023	BIOCHEMICAL OXYGEN DEMAND (BOD) AND CARBONACEOUS BIOCHEMICAL OXYGEN DEMAND (CBOD)
43-M-1024	DETERMINATION OF URANIUM IN WATER: UA-3 LASER INDUCED PHOSPHORESCENCE
43-M-1025	AMMONIA NITROGEN IN WATER BY THE NESSLER METHOD
43-M-1026	IRON IN WATER BY 1,10 PHENANTHROLINE METHOD
43-M-1027	SULFATE IN WATER BY SULFAVER4 METHOD
43-M-1028	NITRATE ION-SELECTIVE ELECTRODE METHOD
43-M-1029	HEXAVALENT CHROMIUM BY COLORIMETRIC METHOD (DR3000)
43-M-1030	FLUORIDE BY ION-SELECTIVE ELECTRODE METHOD
43-M-1031	SOLUBLE URANIUM BY KINETIC PHOSPHORESCENCE ANALYZER (KPA)
43-M-1032	PH TESTING OF WATER BY ELECTROMETRIC METHOD WITH ORION 920A
43-M-1033	PH (HYDROGEN ION) TESTING OF WATER USING ORION 420A
43-M-1034	DETERMINATION OF SPECIFIC GRAVITY USING AN ANALYTICAL BALANCE
43-M-1035	DETERMINATION OF SPECIFIC GRAVITY - DMA-35 DENSITY METER
43-M-1036	WATER TEMPERATURE OF FEMP WASTEWATER
M-123	STANDING ORDERS FOR AWWT OPERATIONS
M-137	WATER TREATMENT PLANT LABORATORY QUALITY ASSURANCE PLAN
M-140	FACILITIES CLOSURE AND DEMOLITION PROJECTS DIVISION PROCEDURE SYSTEM
PO-S-04-006	AERATION FACILITY

APPENDIX B

GROUNDWATER RESTORATION WELL PERFORMANCE MONITORING AND MAINTENANCE PLAN

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GROUNDWATER RESTORATION WELL PERFORMANCE MONITORING AND MAINTENANCE PLAN

FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
FERNALD, OHIO

JUNE 2004

U.S. DEPARTMENT OF ENERGY

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GROUNDWATER RESTORATION WELL PERFORMANCE MONITORING AND MAINTENANCE PLAN

FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
FERNALD, OHIO

JUNE 2004

U.S. DEPARTMENT OF ENERGY

FINAL

TABLE OF CONTENTS

	Page
1.0 Introduction	1
2.0 Restoration Well Descriptions	2
2.1 South Plume Extraction Wells	2
2.2 South Field and Waste Storage Area Extraction Wells	3
3.0 Factors Affecting System Operation	8
4.0 Maintenance and Operational Monitoring	10
4.1 Maintenance of the Well and Screen	10
4.2 Maintenance of Pumps, Piping, and Controls	11
4.3 Operational Monitoring	12
4.3.1 Parameters to Be Monitored	13
4.3.2 Performance Testing	14
5.0 Regulatory Issues	18
6.0 Organizational Roles and Responsibilities	19
7.0 Path Forward	21

LIST OF TABLES

Table 4-1 Planned Outages of the South Plume Module Wells
Table 4-2 Planned Outages of the South Field and Waste Storage Area Module Wells

FIGURES

Figure 1 South Plume Module, Extraction Well Installation Details
Figure 2 South Field Module, Extraction Well Installation Details

1.0 INTRODUCTION

The objective of this Performance Monitoring and Maintenance Plan (PMMP) is to document planned maintenance and monitoring requirements for the groundwater restoration wells to support successful long-term operation of the groundwater restoration system. The activities described within this document will become the basis for providing routine maintenance of the extraction wells comprising the various modules of the system and for monitoring system performance to determine if more extensive maintenance activities are required. Regularly scheduled maintenance of components of the restoration well system is required so that the difficulties associated with continuous operation will be minimized and thus manageable with the resulting system's online time maximized. Continuous operation of the well system, within practical limitations, is required to maintain groundwater restoration objectives at the FCP.

Periodic revision of this document will be necessary as additional operating experience is gained and the various new modules of the groundwater restoration system are activated.

2.0 RESTORATION WELL DESCRIPTIONS

This section provides a general description of the extraction wells comprising the active groundwater restoration modules that are covered by this monitoring and maintenance plan. The active modules are the South Plume, South Field, and the Waste Storage Area.

2.1 SOUTH PLUME EXTRACTION WELLS

The South Plume Module includes six wells that are used to pump groundwater from the off-property portion of the Great Miami Aquifer plume to the FCP Site's South Field valve house. In the valve house, the flow from the south plume is routed to treatment or to the Great Miami River as necessary, to maintain compliance with discharge limitations. These wells are as follows:

Extraction Well ID	Common Well ID	Formal Site Well ID
Extraction Well 1	RW-1	3924
Extraction Well 2	RW-2	3925
Extraction Well 3	RW-3	3926
Extraction Well 4	RW-4	3927
Extraction Well 6	RW-6	32308
Extraction Well 7	RW-7	32309

Each of the South Plume extraction wells contains a submersible pump/motor assembly and has a pitless type adapter near the ground surface that transitions the vertical pump discharge piping to the underground force main. The underground force main from wells RW-1, RW-2, RW-3, and RW-4 passes through individual underground valve pits. These valve pits contain several components of the individual wells control system. RW-6 and RW-7 do not utilize underground valve pits to contain any control system components. All control components for these two wells are located in the South Plume Valve House building.

The design of the flow control systems for each of these six wells is identical; flow is controlled by a flow control loop consisting of a magnetic flow meter, a process control station (PCS), and a motor operated flow control valve. Each well can be controlled locally by the PCS or remotely by the computerized control system located at CAWWT. The normal operational mode is to have the wells operated remotely from the CAWWT computer control system, via the local PCS. Additionally, a local set point is input to the PCS so that the well can automatically revert to local control if communication with the CAWWT computer control system is interrupted.

The desired flow rate set point for each is entered into the computer control system and PCS at the CAWWT and the South Plume Valve House respectively. This value is compared continuously to the actual flow measured by the magnetic flow meter. When required, the CAWWT computer control system or PCS adjusts the position of the flow control valve to maintain the desired flow. Pump AStart@ and AStop@ can be controlled by the DCS or the PCS and can also be controlled from the pump starter panel. The starter panels for RW-1 through RW-4 are located at the individual well heads while the starter panels for RW-6 and RW-7 are located in the South Plume Valve House.

In addition, each of the South Plume extraction wells is equipped with isolation valves, check valves, air releases and pressure indicating transmitters. The pressure indicating transmitters are tied to process interlocks that will shut the pumps down if high or low pressures are maintained for extended periods indicating a closed valve or catastrophic system leak respectively. This interlock is intended to protect the pump/motor assemblies from damage due to closed discharge valves or to shut down the pumps if no system back pressure is sensed. Critical control components are protected by lightning/surge arresters to prevent damage to the control system during electrical storms.

Routine water level monitoring within the well is performed during regularly scheduled performance monitoring and more frequently if required.

Installation details of the South Plume extraction wells are shown in Figure 1.

2.2 SOUTH FIELD AND WASTE STORAGE AREA EXTRACTION WELLS

The South Field and Waste Storage Area (WSA) Modules currently include thirteen and two wells, respectively, that are used to pump groundwater from the Great Miami Aquifer to the FCP Site water treatment facilities or to the Great Miami River if treatment is not required to achieve discharge limitations.

These wells are as follows:

Extraction Well ID	Common Well ID	Formal Site Well ID
Extraction Well 15A		
Extraction Well 17		
Extraction Well 18	EW-15A	33262
Extraction Well 19	EW-17	31567
Extraction Well 20	EW-18	31550
Extraction Well 21	EW-19	31560
Extraction Well 22	EW-20	31561
Extraction Well 23	EW-21	31562
Extraction Well 24	EW-22	3227632447
Extraction Well 25	EW-23	32446
Extraction Well 30	EW-24	33061
Extraction Well 31	EW-25	33264
Extraction Well 32	EW-30	33265
WSA Well 26	EW-31	33266
WSA Well 27	EW-32	32761
	EW-26	33062
	EW-27	

Each of the thirteen South Field and two Waste Storage Area extraction wells is of similar design with the exception of the well depth, screen length, and screen slot size. Each contains a submersible pump/motor assembly. Groundwater is pumped from the below grade pump to the well head at the ground surface via the vertical discharge piping. At the well head, this piping is routed horizontally through a magnetic flow meter and into the individual well houses. All of the individual well control components are located at these well houses.

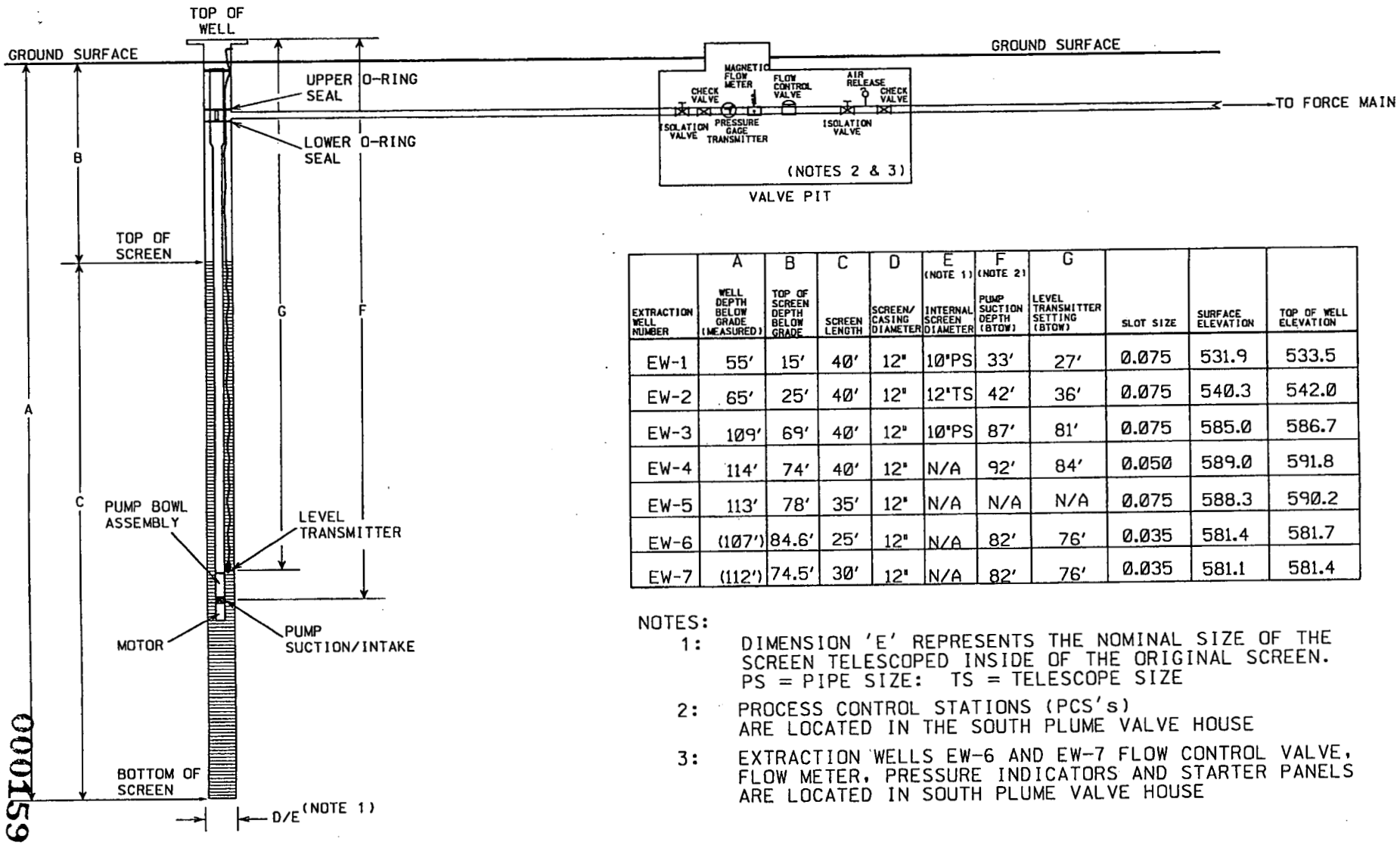
The flow control system for each of the fifteen extraction wells is identical; flow is controlled by a flow control loop consisting of an magnetic flow meter, a process control station (PCS) and a variable frequency drive (VFD). Each extraction well can be controlled locally by the PCS or remotely by the computerized control system located at CAWWT. The normal operational mode is to have the wells operated remotely from the CAWWT computer control system, via the local PCS. Additionally, a local set point is input to the PCS so that the well can automatically revert to local control if communication with the CAWWT computer control is interrupted.

The desired flow rate set point for each extraction well is entered into the DCS and PCS at the AWWT and the individual well houses, respectively. This value is compared continuously to the actual flow rate

measured by the magnetic flow meter. When required, the DCS or PCS adjusts the pump motor speed via the VFD to maintain the desired flow. Pump AStart@ and AStop@ can be controlled by the DCS or the PCS and can also be controlled at the VFD.

In addition, each extraction well is equipped with isolation valves, a check valve, air releases, and a pressure indicating transmitter. Routine water level monitoring within the well is performed during regularly scheduled performance monitoring and more frequently if required.

Installation details of the South Field Extraction Wells are shown in Figure 2.



EXTRACTION WELL NUMBER	A WELL DEPTH BELOW GRADE (MEASURED)	B TOP OF SCREEN DEPTH BELOW GRADE	C SCREEN LENGTH	D SCREEN/ CASING DIAMETER	E (NOTE 1) INTERNAL SCREEN DIAMETER	F (NOTE 2) PUMP SUCTION DEPTH (BTOW)	G LEVEL TRANSMITTER SETTING (BTOW)	SLOT SIZE	SURFACE ELEVATION	TOP OF WELL ELEVATION
EW-1	55′	15′	40′	12"	10"PS	33′	27′	0.075	531.9	533.5
EW-2	65′	25′	40′	12"	12"TS	42′	36′	0.075	540.3	542.0
EW-3	109′	69′	40′	12"	10"PS	87′	81′	0.075	585.0	586.7
EW-4	114′	74′	40′	12"	N/A	92′	84′	0.050	589.0	591.8
EW-5	113′	78′	35′	12"	N/A	N/A	N/A	0.075	588.3	590.2
EW-6	(107′)	84.6′	25′	12"	N/A	82′	76′	0.035	581.4	581.7
EW-7	(112′)	74.5′	30′	12"	N/A	82′	76′	0.035	581.1	581.4

NOTES:

1: DIMENSION 'E' REPRESENTS THE NOMINAL SIZE OF THE SCREEN TELESCOPED INSIDE OF THE ORIGINAL SCREEN. PS = PIPE SIZE: TS = TELESCOPE SIZE

2: PROCESS CONTROL STATIONS (PCS's) ARE LOCATED IN THE SOUTH PLUME VALVE HOUSE

3: EXTRACTION WELLS EW-6 AND EW-7 FLOW CONTROL VALVE, FLOW METER, PRESSURE INDICATORS AND STARTER PANELS ARE LOCATED IN SOUTH PLUME VALVE HOUSE

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FIGURE 1. SOUTH PLUME MODULE, EXTRACTION WELL INSTALLATION DETAILS

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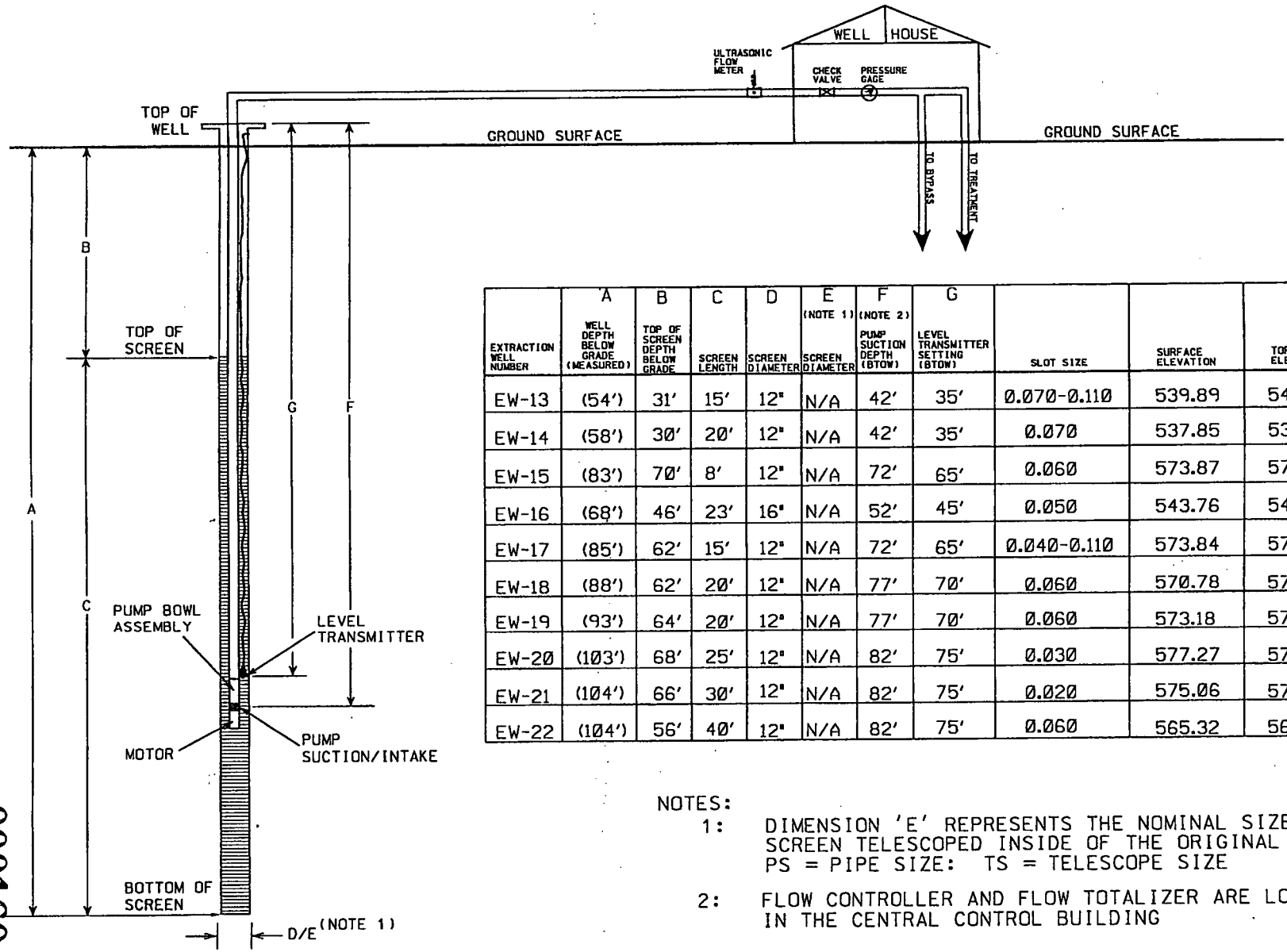

EXTRACTION WELL NUMBER	A WELL DEPTH BELOW GRADE (MEASURED)	B TOP OF SCREEN DEPTH BELOW GRADE	C SCREEN LENGTH	D SCREEN DIAMETER	E (NOTE 1) SCREEN DIAMETER	F (NOTE 2) PUMP SUCTION DEPTH (BTOW)	G LEVEL TRANSMITTER SETTING (BTOW)	SLOT SIZE	SURFACE ELEVATION	TOP OF WELL ELEVATION
EW-13	(54')	31'	15'	12"	N/A	42'	35'	0.070-0.110	539.89	540.72
EW-14	(58')	30'	20'	12"	N/A	42'	35'	0.070	537.85	537.85
EW-15	(83')	70'	8'	12"	N/A	72'	65'	0.060	573.87	573.87
EW-16	(68')	46'	23'	16"	N/A	52'	45'	0.050	543.76	543.76
EW-17	(85')	62'	15'	12"	N/A	72'	65'	0.040-0.110	573.84	573.84
EW-18	(88')	62'	20'	12"	N/A	77'	70'	0.060	570.78	570.78
EW-19	(93')	64'	20'	12"	N/A	77'	70'	0.060	573.18	573.18
EW-20	(103')	68'	25'	12"	N/A	82'	75'	0.030	577.27	577.27
EW-21	(104')	66'	30'	12"	N/A	82'	75'	0.020	575.06	575.06
EW-22	(104')	56'	40'	12"	N/A	82'	75'	0.060	565.32	565.32

NOTES:

1: DIMENSION 'E' REPRESENTS THE NOMINAL SIZE OF THE SCREEN TELESCOPED INSIDE OF THE ORIGINAL SCREEN. PS = PIPE SIZE: TS = TELESCOPE SIZE

2: FLOW CONTROLLER AND FLOW TOTALIZER ARE LOCATED IN THE CENTRAL CONTROL BUILDING

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FIGURE 2. SOUTH FIELD MODULE, EXTRACTION WELL INSTALLATION DETAILS

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3.0 FACTORS AFFECTING SYSTEM OPERATION

The original 5 extraction wells comprising the South Plume groundwater restoration module began pumping operations in August 1993, as part of the implementation of the Operable Unit 5 Removal Action No. 3, South Plume Removal Action. In the intervening time period, Fluor Fernald (FF) has obtained valuable operational experience and knowledge that is being used to optimize long-term operation of extraction wells site wide. This experience base has resulted in identification of factors affecting operation life and efficiency, some of which were unknown at the start of pumping operations. These factors have either already been addressed or are incorporated into this plan.

In order to better understand the factors affecting large-scale groundwater pumping operations, FFCP consulted with Moody's of Dayton, a water well maintenance and installation contractor. Moody's has served the water well industry throughout the Great Miami Aquifer for more than 30 years and has extensive experience maintaining large-capacity wells for a number of major water supply systems. Frequencies for routine maintenance and monitoring activities were selected using input received from their evaluation of the South Plume Extraction well system and based on their experience working with systems of similar magnitude in the regional aquifer.

Several factors affect the performance of the extraction wells. In addition, a number of other specific requirements of the FCP's system complicate these factors. All of these factors and requirements were considered in developing this maintenance and monitoring plan. First, all the FCP's extraction wells are placed in and are extracting water from the upper most portions of the Great Miami Aquifer. This fact complicates both pump/motor cooling and iron fouling of the extraction well screen. Normal water well practice would place the screened section of the well deeply in the aquifer and the pump/motor assembly would be placed above the screen in a submerged section of blank casing. Since the extraction wells are intended to intercept a plume of contamination located near the top of the aquifer, the screened sections begin near the normal water level. In order to provide the required submergence of the pump/motor assembly, this assembly must be placed within the screened section. The high flow rates required for plume capture combined with the "surgical" removal of the contamination plume have led to difficulties in ensuring that the flow of water passing the motor is adequate for cooling.

Placement of the pump/motor assembly within a screen that is located on the surface of the aquifer also complicates the impacts of iron-fouling. Moody's has confirmed that iron fouling is prevalent throughout the regional aquifer and that the details of the FCP installation further enhance the problem. Combined with the fact that this region of the Great Miami Aquifer contains some of the highest concentrations of iron and iron-fouling bacteria, fouling of the well screens and other downstream equipment has been experienced.

Continuous operation of the extraction wells also exacerbates the factors noted above. Normal water well industry practice does not require pumping wells to operate continuously. Typical water supply well systems pump between 6 and 10 hours per day and have spare wells that can be rotated in and out as demand requires (especially when maintenance is required). The FCP's extraction well system however, runs continuously and has no spare wells to compensate for wells taken out of service for maintenance. In fact, when a well is shut down for an extended period to perform maintenance, the remaining wells may need to increase their flow to continue the planned capture of the plume.

4.0 MAINTENANCE AND OPERATIONAL MONITORING

Several routine activities are performed to optimize performance of the extraction wells comprising the South Plume, South Field, and Waste Storage Area groundwater restoration modules. The following maintenance and operational monitoring activities are described in this section:

- Routine well/screen maintenance, which includes super-chlorination of the well (semi-annually at a minimum)
- Routine system maintenance, which includes maintenance actions related to valves, instrumentation, and controls associated with each extraction well. This maintenance is performed by FCP Maintenance and Operations personnel, and;
- Operational monitoring, which includes quarterly monitoring of extraction well capacity and pump/motor assembly performance.

4.1 MAINTENANCE OF THE WELL AND SCREEN

Well and screen maintenance is required to maximize system on-stream factors, and to minimize well drawdown and major rehabilitation. The extraction well will be super-chlorinated by the addition of sodium hypochlorite (12.5 percent chlorine). Super-chlorination will be performed on each well every six months, or more frequently if water-level monitoring indicates excessive drawdown, (see Section 4.3). This maintenance action is anticipated to require an outage of 72-hours per extraction well. It is acknowledged in this plan that periodic, major rehabilitation efforts may be required every few years or when the drawdown within the well remains consistently excessive, even after super-chlorination maintenance. These rehabilitation efforts are not considered to be routine maintenance within the context of this plan.

The routine maintenance of the extraction well and screen involves super-chlorination of the well without removal of the pump/motor assembly. This serves to deter iron-bacteria growth and buildup on the screen and in the local formation and therefore serves to enhance long-term well production. The basic steps are detailed below:

Step 1:
Shutdown the extraction well pump and allow the static water level to stabilize.

Step 2:
Inject sodium hypochlorite to obtain a 2,000 to 3,000 milligrams per liter (mg/L) concentration of chlorine. This is determined for each well individually, based on the standing water volume in the well. The volume in each well is a function of the depth of water in each well and the diameter of the screen/casing.

Step 3:
Back surge the chlorinated water into the gravel pack and aquifer by starting the installed extraction well submersible pump and pumping until the water reaches the wellhead. Shut down the pump and open the sampling port at the well head to allow the water to backflow through the 6-inch drop pipe, pump, screen, and to dissipate into the gravel pack. Repeat this procedure for twenty-four hours with approximately five minutes between surges. Allow chlorine to remain in well for 24 hours.

Step 4:
Discharge water by pumping into force main. (Note: The FCP facility owner must be notified prior to discharge of these waters.) This water is sampled and analyzed to document its chlorine content. This sampling and analysis must be completed prior to discharging the bulk of the water within the well and will require that the main discharge valve be closed, the pump started, and samples taken from the sampling port at the well head.

4.2 MAINTENANCE OF PUMPS, PIPING, AND CONTROLS

These maintenance activities are directed primarily at the valves, instrumentation, and controls associated with each extraction well. These actions will be incorporated into the FCP computerized maintenance system. This system provides automatic generation of preventative maintenance work orders to ensure that routine maintenance is performed when required. In addition to formal preventative maintenance activities, several routine system checks are performed by operations personnel, between scheduled preventative maintenance activities, to ensure that equipment is functioning properly.

The following is a list of preventative maintenance and operational checks that are routinely performed:

Process Control Station: Annual

The process control stations for each of the recovery and extractions wells are taken out of service annually. At this time, the operational setup parameters for the specific wells are verified and/or updated to reflect current operating conditions. This is anticipated to require an outage of four hours per well.

Flow Meters: Clean and Calibrate Semi-Annually Cleaning and calibration of the flow meter is anticipated to require an outage of 4 hours per extraction well in the South Plume and 8 hours per extraction well in the South Field.

Check Valves: Inspect and Clean Seat Semi-Annually

Inspection and cleaning of the check valve is anticipated to require an outage of 4 hours per extraction well.

The piping configuration for extraction wells RW-1 through RW-4 includes two check valves. The original check valve cannot be inspected or maintained without removal from the piping system and, because of its location at the extreme end of the piping run in the valve pit, requires that the entire South Plume extraction well system be shut down and drained. The redundant check valve was installed between isolation valves and is a "swing-check" valve that is equipped with a removable inspection plate. Inspection and cleaning of this check valve requires that the individual extraction well be shut down for approximately four hours. Extraction wells RW-6 and RW-7 and all of the South Field Extraction wells have a single in line check valve that is removed, inspected and cleaned. This maintenance activity is anticipated to require each well to be shutdown for approximately 4 hours.

Flow Control Valves and Actuators: Disassemble and inspect annually

Extraction wells RW-1 through RW-4, rW-6 and RW-7 each utilize motor operated flow control valves. These are required to be inspected and cleaned annually to prevent the buildup of iron fouling bacteria encrustation. This maintenance activity will require each well to be shut down for approximately 8 hours.

Pressure Indicating Transmitters: Annual Calibration

Each extraction well has pressure indicating transmitters that are used in performance testing to determine the pump's discharge head (pressure). Accurate pressure sensing in the full range of pumping pressures is required for accurate testing. Annual testing and calibration of these transmitters is anticipated to require an outage of 2 hours per well.

Lightning Arresters: Monthly Test

Extraction wells RW-1 through RW-4, RW-6 and RW-7 each have lightning arresters installed to prevent damage from electrical storms. Routine testing of these devices is required to ensure that they are in working order. An outage of 2 hours per well is anticipated for this maintenance activity.

4.3 OPERATIONAL MONITORING

The main system performance indicators for the South Plume and South Field extraction well modules are gathered and summarized in performance tests conducted quarterly. These tests monitor the specific

capacity of each well and the pump/motor assembly performance. Several of the parameters measured may be monitored more frequently to develop additional system data for trending purposes.

4.3.1 Parameters to Be Monitored

Extraction well operating parameters that are required to be routinely monitored include the following:

- Water level - static and pumping
- Flow
- Discharge pressure
- Motor amperage draw.

Water Level Monitoring:

Water level, both static and pumping, is perhaps the most critical parameter measured and therefore needs to be measured routinely. The drawdown from static water level to the pumping water level is used to calculate a specific capacity for the well and is a direct indication of the degree of fouling of the well screen and/or the adjacent formation. The installation depth of the extraction well pump/motor assemblies has been established, based upon an anticipated worst-case drawdown of 10 feet below the seasonal low-static water levels. Historical data were reviewed to determine seasonal lows. While each setting has some added submergence to be conservative, pumping levels are monitored routinely to ensure that adequate pump/motor submergence is maintained.

If the pumping water level measured during the quarterly performance testing approaches the top of the pump's bowl assembly, super-chlorination maintenance will be performed. If, after super-chlorination, pump submergence remains minimal, more extensive rehabilitation efforts may be necessary. Rehabilitation efforts include cleaning of the well utilizing dual swab and airlift pumping to remove debris. After cleaning, the well will be acid treated to break down encrustation on the well screen and within the local formation. This will then be followed by chlorination to inhibit future iron-fouling bacterial growth. These processes may if necessary, be repeated several times to ensure that the well has been rehabilitated to its optimal condition.

Flow Monitoring:

The ability of an extraction well pump/motor to sustain the desired flow is a key indicator of the health of the flow meter, controls, variable frequency drive, well and the pump/motor assembly. Specific testing to determine the ability of a pump/motor assembly to perform as expected will be completed quarterly. This testing is detailed in the performance testing description in Section 4.3.2.

Additionally, individual extraction well flow is monitored continuously by the flow controller for each well. The actual flow verses the controller set point is checked by operations personnel locally, in the field once per shift on first and second shift each day. Any significant deviation from the flow set point is investigated and required maintenance actions are determined then carried out.

Discharge Pressure Monitoring:

Pump discharge pressure, coupled with flow, is monitored quarterly to assess the pump/motor assemblies performance against the manufacturers published performance curves and is detailed in the performance testing description in Section 4.3.2.

Amperage:

As with flow and pressure, amperage is a good indicator of how the pump/motor assembly is performing. During performance testing, motor amperage draw is measured on each of the three phases of the electrical supply. Amperage draw is compared to the motor manufacturer' published specifications. Amperage should be below the manufacturer's full-load amperage and should be approximately equal across the phases of the motor. An imbalance of greater than 20 percent across the phases indicates a motor or electrical supply situation that triggers more extensive diagnosis. Additional diagnostics and repairs are not within the scope of this plan.

4.3.2 Performance Testing

Performance testing of the extraction wells is conducted quarterly to assess their condition; this testing requires an outage of approximately 4 hours per well. Performance testing is currently performed by Moody's of Dayton, the site's drilling and well maintenance subcontractor, and is summarized in written reports. Static water-level measurements are made prior to each performance test. This measurement serves as the basis for computing drawdown within the extraction well. System flow, discharge pressure, pumping level, and motor amperage per phase are measured at each of at least five different flows for the extraction well. These five flows include maximum flow (discharge valve fully open) and zero flow conditions (discharge valve closed).

The results of these measurements are summarized in two ways. First, the flow and discharge head is plotted and compared to extraction well pump manufacturer and previously developed head/flow curves. Second, the static water level and pumping levels are used to calculate drawdown and specific capacity within the extraction well at various flows. As plugging of the well screen due to iron fouling and encrustation progresses, it is expected that drawdown within the well will increase for a given flow rate. Super-chlorination maintenance as described in Section 4.1 will be completed to determine its effect on drawdown levels. If, after super-chlorination, the drawdown remains excessive, more extensive rehabilitation efforts will likely be required.

Additionally, the amperage draw of the well at various flows is compared to previous readings and pump/motor manufacturers published information.

TABLE 4-1

PLANNED OUTAGES OF THE SOUTH PLUME MODULE WELLS (including EW-1 through 4, and EW-6, and EW-7)

Item	Description	PMMP Reference	Frequency	Duration per Event
1	Performance Testing	4.3.2	Quarterly	~ 4 hours/well
2	Maint. of the well and screen [a]	4.1	Semi-Annually [a]	~ 72 hours/well
3	Process Control Station	4.2	Annually	~ 4 hours/well
4	Pressure Transmitter Calibration	4.2	Annually	~ 2 hours/well
5	Magnetic Flow Meter Clean and Calibrate [b]	4.2	Semi-Annually [b]	~ 4 hours/well
6	Check Valve Inspect/Clean	4.2	Semi-Annually	~ 4 hours/well
7	Flow Control Valve and Actuator Cleaning	4.2	Annually	~ 8 hours/well
8	Rehabilitation	4.1	Variable	~ 3 weeks
9	Lightning Arrester Testing	4.2	Monthly	~ 2 hours/well

[a]Well screen maintenance will be completed at a minimum frequency of twice per calendar year. This frequency is dependent upon individual well performance. The need for this maintenance activity will be based upon the monitoring of the specific capacity of the individual wells.
[b]Flow meter calibration may occur as a post maintenance test utilizing a portable flow meter.

TABLE 4-2

PLANNED OUTAGES OF THE SOUTH FIELD AND WASTE STORAGE AREA MODULE WELLS (including EW-13 through EW-22)

Item	Description	PMMP Reference	Frequency	Duration per Event
1	Performance Testing	4.3.2	Quarterly	~ 4 hours/well
2	Maint. of the well and screen [a]	4.1	Semi-Annually [a]	~ 72 hours/well
3	Process Control Station	4.2	Annually	~ 4 hours/well
4	Pressure Transmitter Calibration	4.2	Annually	~ 2 hours/well
5	Magnetic Flow Meter Clean and Calibrate [b]	4.2	Semi-Annually [b]	~ 8 hours/well
6	Check Valve Inspect/Clean	4.2	Semi-Annually	~ 4 hours/well
7	Rehabilitation	4.1	Variable	~ 3 weeks

[a]Well screen maintenance will be completed at a minimum frequency of twice per calendar year. This frequency is dependent upon individual well performance. The need for this maintenance activity will be based upon the monitoring of the specific capacity of the individual wells.
[b]Flow meter calibration may occur as a post maintenance test utilizing a portable flow meter.

5.0 REGULATORY ISSUES

The current extraction well rehabilitation efforts and the proposed routine well/screen maintenance require the addition of chemicals to the well. The only proposed chemicals to be added are sodium hypochlorite and hydrochloric acid. The sodium hypochlorite is used for routine well screen maintenance to disinfect the well and inhibit the growth of iron-fouling bacteria. Non-routine, major well rehabilitation efforts require the use of both sodium hypochlorite and hydrochloric acid. The hydrochloric acid is used to break down flow-limiting encrustation on the well screen. The well is purged of the sodium hypochlorite from routine well screen maintenance by pumping to the common force main and combining with other extraction well discharges. The combined flow is directed to discharge and/or treatment, and ultimately discharges to the Great Miami River via the Parshall Flume. Following major well rehabilitation efforts, the sodium hypochorite and hydrochloric acid are purged from the well by pumping to a tanker truck and discharging the dilute chemicals to the sites storm water retention basin (SWRB) for subsequent treatment at AWWT and discharge to the Great Miami River via the Parshall Flume.

The use of these chemicals in well rehabilitation efforts to date has been monitored closely by FDF Environmental Compliance. Ohio EPA has been notified and has approved of the intended chemical additions and subsequent discharges. After the addition of these chemicals, the water pumped initially from the extraction well is turbid, contain iron residual, dissolved scale, and has a low pH. The discharge of this water will be documented through procedure EP-0005, Controlling Aqueous Wastewater Discharges into Wastewater Treatment System. This procedure requires advance review by FCP Environmental Compliance and the treatment system facility owner. Adequate dilution of this stream by other water sources is anticipated so that chlorine, turbidity, and low pH will not exceed National Pollutant Discharge Elimination System (NPDES) outfall limits. The chlorine residual is expected to fall to acceptable limits prior to pumping.

In order to discharge chlorinated water, the amount of chlorine residual and rate of discharge must not produce a detectable level (currently defined by OEPA as 0.038 mg/L) of residual chlorine at the Parshall Flume (NPDES Outfall 4001). This requirement is tightly controlled through FCP Environmental Compliance review using procedure EP-0005.

6.0 ORGANIZATIONAL ROLES AND RESPONSIBILITIES

This section defines the organizational roles and responsibilities associated with the completion of the work defined in this plan. Descriptions of the key responsibilities of the various project organizations involved are provided below:

The DOE Operable Unit 5 Team Leader is responsible for:

- Providing direction and oversight to the completion of the activities defined in this plan
- Acting as the point of contact within DOE and for the regulators and stakeholders for all communications concerning work carried out under this plan.

The Fluor Fernald Wastewater Treatment Operations Manager is responsible for:

- Providing overall project management and technical guidance to the Fluor Fernald team
- Ensuring the necessary resources are allocated to the project for the efficient and safe completion of plan activities
- Oversight and auditing of plan activities to ensure that the work is being performed efficiently and in accordance with all regulatory requirements and commitments, DOE Orders, site policies and procedures, and safe working practices.
- Providing a technical lead for the collection and interpretation of data

The Fluor Fernald Process Engineer is responsible for:

- The safe and prompt completion of work outlined in the plan
- Oversight and programmatic direction of activities
- Reporting to the DOE Operable Unit 5 Team Leader and the Fluor Fernald Wastewater Treatment Operations Manager on the status of plan activities and on the identification of any problems encountered in the accomplishment of this plan
- Reporting to the Fluor Fernald Project Manager on the progress of plan activities
- Establishing and maintaining extraction well status files
- Interpreting and reporting data collected
- Coordinating maintenance activities with external service contractors as required.

The Groundwater Monitoring Team will be responsible for:

- Collection of water level data

- Compilation of water level data and reporting of data to FDF Technical Lead.

- Providing oversight of external service contractors during their performance of well maintenance.

The Wastewater Treatment Operations Team will be responsible for:

- Operation of the extraction well system
- Conducting preventive maintenance as scheduled in this plan
- Training and qualification of operations personnel.

7.0 PATH FORWARD

This plan contains monitoring and maintenance activities, and frequencies thereof, based on current projections. The need for and frequency of these activities may change based on future experience gained through the operation, maintenance, and monitoring of the extraction wells currently operational in the South Plume and the South Field Groundwater Restoration Modules. Parameter monitoring frequency may change, as well.

Data gathered from quarterly performance testing will be summarized in written reports submitted by the sub-contractor upon completion of each test. Each report will be added to existing reports on file in the extraction well files and compared to past performance. Additionally, water level readings and feedback from maintenance personnel regarding the condition of system components will be evaluated to determine if modifications to the frequencies of preventive maintenance activities are required. The data gathered over the next several months from the South Field extraction wells and the Optimized South Plume Module wells will be logged and trended. This will be completed in order to provide for the identification of any required changes to monitoring and maintenance activities in this plan needed to ensure that the system continues to operates at an optimum on-stream factor.

This plan will be revised as necessary during the life of the groundwater restoration process at the FCP. In addition to the above noted driver for plan revisions, a revised plan will be necessary when FCP new extraction/re-injection well modules are added to the groundwater restoration system. Development of the revised plan(s) will correlate to the individual project schedule driving the revision.

Maintenance feedback and component manufacturer suggestions have been used to develop a spare parts list and stock inventories of the most frequently used parts. The availability of spare parts will assist in minimizing downtimes associated with all maintenance activities.

These wells are as follows:

Extraction Well ID	Common Well ID	Formal Site Well ID
Extraction Well 15A		
Extraction Well 17		
Extraction Well 18	EW-15A	33262
Extraction Well 19	EW-17	31567
Extraction Well 20	EW-18	31550
Extraction Well 21	EW-19	31560
Extraction Well 22	EW-20	31561
Extraction Well 23	EW-21	31562
Extraction Well 24	EW-22	3227632447
Extraction Well 25	EW-23	32446
Extraction Well 30	EW-24	33061
Extraction Well 31	EW-25	33264
Extraction Well 32	EW-30	33265
WSA Well 26	EW-31	33266
WSA Well 27	EW-32	32761
	EW-26	33062
	EW-27	

Each of the thirteen South Field and two Waste Storage Area extraction wells is of similar design with the exception of the well depth, screen length, and screen slot size. Each contains a submersible pump/motor assembly. Groundwater is pumped from the below grade pump to the well head at the ground surface via the vertical discharge piping. At the well head, this piping is routed horizontally through a magnetic flow meter and into the individual well houses. All of the individual well control components are located at these well houses.

The flow control system for each of the fifteen extraction wells is identical; flow is controlled by a flow control loop consisting of an magnetic flow meter, a process control station (PCS) and a variable frequency drive (VFD). Each extraction well can be controlled locally by the PCS or remotely by the computerized control system located at CAWWT. The normal operational mode is to have the wells operated remotely from the CAWWT computer control system, via the local PCS. Additionally, a local set point is input to the PCS so that the well can automatically revert to local control if communication with the CAWWT computer control is interrupted.

The desired flow rate set point for each extraction well is entered into the DCS and PCS at the AWWT and the individual well houses, respectively. This value is compared continuously to the actual flow rate

Attachment B

ATTACHMENT B

POST CLOSURE CARE AND INSPECTION PLAN

POST-CLOSURE CARE AND INSPECTION PLAN

ON-SITE DISPOSAL FACILITY

Fernald Closure Project

June 2004

United States Department of Energy

20100-PL-010, Revision 2

Prepared by
Fluor Fernald, Inc.

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TABLE OF CONTENTS

Table of Contents i

List of Acronyms iv

Prologue vi

1.0 Introduction 1-1
- 1.1 Plan Scope and Duration 1-1
- 1.2 Plan Organization 1-2
- 1.3 Responsible Parties 1-2
- 1.4 Related Plans 1-3

2.0 Pertinent Requirements 2-1
- 2.1 Overview 2-1
- 2.2 Pertinent Requirements 2-1
- 2.3 Functional Requirements 2-11
- 2.4 General Design Criteria 2-11
- 2.5 Other Requirements 2-11

3.0 Final Site Conditions 3-1
- 3.1 Site History 3-1
- 3.2 Location and Description of On-Site Disposal Facility Area 3-3
- 3.3 OSDF as Built 3-6
- 3.4 FCP OSDF Baseline Photographs 3-8
- 3.5 Site Inspection Photographs 3-8

4.0 Institutional Controls and Points of Contact 4-1
- 4.1 Introduction 4-1
- 4.2 Points of Contact 4-1
- 4.3 Ownership 4-2
- 4.4 Access Controls/Restrictions and Security Measures 4-3
- 4.5 Deed Restrictions/Use Restrictions 4-3

5.0 Environmental Monitoring 5-1
- 5.1 Introduction 5-1
- 5.2 Air Monitoring 5-1
- 5.3 Groundwater Monitoring 5-1
- 5.4 Monitoring of Other Media 5-2

TABLE OF CONTENTS
(Continued)

6.0 Routine Scheduled Inspections 6-1
6.1 Introduction 6-1
6.2 Routine Facility Inspections 6-1
6.2.1 Preliminary Considerations 6-1
6.2.2 Site Inspection 6-3

7.0 Unscheduled Inspections 7-1
7.1 Introduction 7-1
7.2 Follow-Up Inspections 7-1
7.2.1 Objectives and Procedures 7-2
7.2.2 Schedule and Reporting 7-3
7.3 Contingency Inspections 7-3

8.0 Custodial Maintenance and Contingency Repair 8-1
8.1 Introduction 8-1
8.2 Conditions Requiring Maintenance or Repair Actions 8-2
8.3 Maintenance and Repair 8-2
8.3.1 Security System 8-2
8.3.2 Cap and Final Cover System 8-2
8.3.3 Run-On and Run-Off Drainage Features 8-6

9.0 Post-Closure Corrective Actions 9-1
9.1 Introduction 9-1
9.2 Future Corrective Actions/Response Actions 9-1

10.0 Emergency Notification and Reporting 10-1
10.1 Introduction 10-1
10.2 Agency Agreements 10-1
10.3 Unusual Occurrences and Earthquakes 10-1
10.4 Meteorological Events 10-2

11.0 Modifications of Post-Closure Plan 11-1
11.1 Introduction 11-1
11.2 Conditions Triggering Potential Need for Modification 11-1
11.3 Mechanism 11-2

12.0 Community Relations 12-1

13.0 References 13-1

TABLE OF CONTENTS
(Continued)

LIST OF TABLES

Table 3-1 On-Site Disposal Facility Waste Acceptance Criteria 3-2
Table 3-2 OU3 Material Categories/Descriptions of Demolition Debris for On-Site Disposal 3-4
Table 3-3 Predesign Investigation Objectives and Field Components 3-5
Table 3-4 Aerial Photography Specifications 3-10
Table 4-1 Institutional Controls as Key Components in the FEMP RODs 4-1
Table 4-2 Points of Contact 4-2
Table 4-3 Notice in Deed or Other Transfer Instrument 4-5
Table 7-1 Possible Problem Situations and Responses 7-2
Table 8-1 Examples of Conditions That May Require Custodial Maintenance or Contingency Repair 8-3
Table 8-2 Site Security System Inspection and Maintenance Activities 8-4
Table 8-3 Custodial Maintenance Schedule 8-5
Table 8-4 Drainage Channel System Inspection and Maintenance Activities 8-8
Table 12-1 Public Involvement Activities During Remedial Activities 12-2

LIST OF ACRONYMS

ACA	Amended Consent Agreement
ACM	asbestos containing materials
a.k.a.	also known as
ARARs	applicable or relevant and appropriate requirements
AWWT	Advanced Wastewater Treatment
BSL	Biodenitrification Surge Lagoon
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act of 1980, as amended
CFR	Code of Federal Regulations
CQA	Construction Quality Assurance
CAWWT	Converted Advanced Waste Water Treatment
DCP	Design Criteria Package
DOE	United States Department of Energy
EPA	United States Environmental Protection Agency
FCP	Fernald Closure Project
FFCA	Federal Facility Compliance Agreement
HDPE	high-density polyethylene
HWMU	Hazardous Waste Management Unit
IEMP	Integrated Environmental Monitoring Plan
IMP	Impacted Materials Placement
LCS	Leachate Collection System
LDS	Leak Detection System
LMICP	Comprehensive Legacy Management and Institutional Controls Plan
LTS	Leachate Transmission System
mg/kg	milligram per kilogram
NCP	National Oil and Hazardous Substances Pollution Contingency Plan (also known as the National Contingency Plan)
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
NESHAP	National Emission Standards for Hazardous Air Pollutants
OAC	Ohio Administrative Code
OEPA	Ohio Environmental Protection Agency
ODNR	Ohio Department of Natural Resources
OSDF	On-Site Disposal Facility
OSHA	Occupational Safety and Health Administration
OU	operable unit, as numbered
PCCI	Post-Closure Care and Inspection

LIST OF ACRONYMS
(continued)

pCi	picoCurie(s)
PVC	polyvinyl chloride
PTI	permit to install
RCRA	Resource Conservation and Recovery Act, as amended
RI/FS	remedial investigation/feasibility study
RDWP	remedial design work plan
ROD	Record of Decision
SARA	Superfund Amendments and Reauthorization Act of 1986, as amended
SWMEC	Surface Water Management and Erosion Control Plan
TBCs	to be considered criteria
WAC	waste acceptance criteria

PROLOGUE

This plan has been developed with a specific focus on the Fernald Closure Project (FCP) On-Site Disposal Facility. However, many aspects of post-closure care are common regardless of the characteristics of the facility for which it is implemented. Hence, this plan could be revised as needed to expand the scope of coverage to encompass the entire FCP site. This plan has been specifically developed in such a manner to facilitate such a potential.

1.0 INTRODUCTION

This Post-Closure Care and Inspection (PCCI) Plan covers the Fernald Closure Project (FCP) On-Site Disposal Facility (OSDF) and its associated buffer area after the last cell of the OSDF has been closed and covered. This plan has been developed to address reasonably expected circumstances, which may arise during the post-closure care period. Other relevant key concepts addressed by this PCCI Plan are: ownership; access controls and restrictions; deed and/or use restrictions; environmental monitoring; inspections (of three types - scheduled, unscheduled, and contingency); custodial maintenance; contingency repair; corrective actions; emergency notification and reporting; modifications to this plan; and public involvement. These concepts are addressed in subsequent sections of this plan.

1.1 Plan Scope and Duration

This PCCI Plan establishes the inspection, monitoring, and maintenance activities necessary to ensure the continued proper performance of the OSDF. The period covered by this PCCI Plan begins after the last cell of the OSDF has been closed and covered. The facilities and structures covered under this PCCI Plan include:

- Security system (e.g., fences, gates, warning signs),
- Permanently surveyed benchmarks,
- OSDF run-on/run-off controls, and
- OSDF final cover.

As specified in the Records of Decision (RODs) and in accordance with appropriate regulations, the initially established duration of the post-closure care period is 30 years (subject to potential future modification, as discussed in Section 12.0) [Ohio solid waste rule Ohio Administrative Code (OAC) 3745-27-14(A) in lieu of federal solid waste regulation 40 Code of Federal Regulations (CFR) §258.61(a), and Ohio hazardous waste rules OAC 3745-66-17 and 3745-68-10 in lieu of federal hazardous waste regulations 40 CFR §§265.117(a)(1) and 264.117(a)(1), respectively]. Care and maintenance of the OSDF is expected to continue in perpetuity.

1.2 Plan Organization

The remainder of this plan is organized as follows:

- a description of the parties responsible for this plan and the plans related to this plan are presented in the remainder of Section 1.0;
- the requirements pertinent to this plan are addressed in Section 2.0;
- final site conditions at closure of the OSDF are addressed in Section 3.0;
- institutional controls and points of contact are addressed in Section 4.0;

- environmental monitoring is addressed in Section 5.0;
- routine scheduled inspections are addressed in Section 6.0;
- unscheduled inspections are addressed in Section 7.0;
- custodial maintenance and contingency repair are addressed in Section 8.0;
- corrective actions are addressed in Section 9.0;
- emergency notification and reporting are addressed in Section 10.0;
- modifications to this plan are addressed in Section 11.0;
- public involvement is addressed in Section 12.0; and
- references are presented in Section 13.0.

1.3 Responsible Parties

The governing document for Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) response actions at the FCP is the Amended Consent Agreement between the U.S. Department of Energy (DOE) and the U.S. Environmental Protection Agency (EPA) Region V, signed in September 1991. As such, responsibility for the implementation of the PCCI Plan lies with DOE, as the lead agency responsible for CERCLA activities at the FCP, and with EPA, as the oversight agency. The DOE Fernald Area Office has the ultimate authority for ensuring that the post-closure care of the OSDF meets all the goals, standards, specifications, and requirements of this PCCI Plan.

1.4 Related Plans

Several other support plans have been prepared for the OSDF remedial action project and should be used in conjunction with this plan, or referred to for information on how impacted materials were placed into the OSDF. The other plans containing information relevant to this plan are listed below with a brief statement of the relationship to this plan.

- *Permitting Plan and Substantive Requirements for the On-Site Disposal Facility [FDF, 1997]: identifies the administrative and substantive requirements for the National Pollutant Discharge Elimination System (NPDES) Permit, and the substantive requirements for all of the FEMP's operable units' on-site disposal needs for the Wetlands Nationwide Permit, the Ohio Solid Waste Permit to Install (PTI), and the Resource Conservation and Recovery Act (RCRA) Permit; additionally, discusses how the requirements relate to the OSDF, presents the plan for compliance with the requirements, and discusses additional applicable or relevant and appropriate requirements (ARARs) that are not related to the issuance of a specific permit.*

- *OSDF Construction Quality Assurance (CQA) Plan* [GeoSyntec, 1997a]: contains procedures used to evaluate soils and other features of the OSDF liner and final cover system.

- *OSDF Impacted Materials Placement (IMP) Plan [GeoSyntec, 1996]: outlines waste acceptance criteria (WAC) for the OSDF, and contains procedures used to place the impacted materials into the OSDF.*

- *OSDF Surface-Water Management and Erosion Control (SWMEC) Plan [GeoSyntec, 1997b]: provides details of permanent erosion and sediment controls and surface-water controls for the OSDF, including maintenance requirements for channels and sediment controls.*

- *OSDF Groundwater/Leak Detection and Leachate Monitoring Plan [DOE, 2004]: provides details on the leak detection monitoring program for the OSDF, addressing monitoring both within the OSDF in the leachate collection system and leak detection and the underlying groundwater in the till immediately underneath the OSDF and the groundwater in the Great Miami Aquifer.*

- *Systems Plan, Collection and Management of Leachate for the On-Site Disposal Facility (DOE 2001): describes the inspection, monitoring, and maintenance activities that will be undertaken at the FCP to collect and manage leachate collected from the OSDF.*

- *Integrated Environmental Monitoring Plan (IEMP) [DOE, 2003]: defines the environmental monitoring and reporting requirements.*

In addition, this PCCI Plan is used as a support document for the Comprehensive Legacy Management and Institutional Controls Plan (LMICP). The LMICP describes the long-term operations and maintenance of the FCP during legacy management and discussed the institutional controls that will be in place to help ensure the protectiveness of human health and the environment.

2.0 PERTINENT REQUIREMENTS

2.1 Overview

Regulatory and other requirements pertinent to this plan primarily take the form of ARARs and to be considered criteria (TBCs) as determined by the record of decision for each of the various FCP operable units, functional requirements, and general design criteria. These are addressed in the following subsections.

2.2 Pertinent Requirements

ARARs and TBCs that should be addressed by this plan are provided here, as obtained from the *Final Record of Decision for Remedial Actions at Operable Unit 2 (OU2 ROD)* [DOE, 1995a], the *Final Record of Decision for Remedial Actions at Operable Unit 5 (OU5 ROD)* [DOE, 1996a], and the *Operable Unit 3 Record of Decision for Final Remedial Action (OU3 ROD)* [DOE, 1996b], as identified by the "X" in the appropriate column. Additional regulatory requirements that are appropriate guidance for development or maintenance of this plan have been identified and are indicated by an "X" in the *Permitting Plan and Substantive Requirements for the On-Site Disposal Facility (OSDF Permitting Plan)* [FDF, 1997a] column but no "X" in the previous columns.

#	Title	Requirements	OU2 ROD	OU3 ROD	OU5 ROD	OSDF Permitting Plan
		PLANS				
1	Ohio Municipal Solid Waste Rules – Sanitary Landfill Facility Permit to Install Application OAC 3745-27-06(C)(7)	• Prepare a post-closure plan as detailed in OAC 374-27-11(B).	X	X	X	X
		• Prepare a leachate monitoring plan to ensure compliance with OAC 3745-27-19(M)(4).	X	X	X	X
		• Prepare a leachate contingency plan as required by OAC 3745-27-19(K)(6).	X	X	X	X
		• Prepare a groundwater detection monitoring plan as required by OAC 3745-27-10, and if applicable a groundwater quality assessment pland and/or corrective measures plan required by OAC 3745-27-10.	X	X	X	X
2	Ohio Municipal Solid Waste Rules – Final Closure of Sanitary Landfill Facility OAC 374-27-11(B)	The owner shall prepare a post-closure plan which shall contain: • The name and location of the facility and unit(s) included in the plan. • A description of the post-closure activities. • The name, address and telephone number of the person or office to contact regarding the unit(s) of the facility during the post-closure care period. The Ohio EPA shall be notified of any changes.			X	X
3	Ohio Hazardous Waste Interim Standards Rules – Post-closure Plan: Amendment of Plan OAC 3745-66-18(A) & (C)	The owner of a hazardous waste disposal unit shall have a written post-closure plan, which shall identify the activities that will be carried on after closure of each unit and the frequency of those activities, and include at least: • A description of the planned monitoring activities and frequencies at which they will be performed; • A description of the planned maintenance activities and frequencies at which they will be performed, to ensure (a) the integrity of the cap and final cover or other containment systems, and (b) the function of the monitoring equipment; and • The name, address and telephone number of the person or office to contact about the hazardous waste disposal unit or facility during the post-closure period.				

		CLOSURE AND POST-CLOSURE OBJECTIVES				
4	Ohio Municipal Solid Waste Rules – Final Closure of a Sanitary Landfill Facility OAC 3745-27-11(H)	At final closure of a landfill facility: • All land surfaces shall be graded to prevent ponding of water where solid waste has been placed. Drainage facilities shall be provided to direct surface water from the landfill facility. • A groundwater monitoring system shall be designed and installed in accordance with OAC 3745-27-10, if a system is not already in place.	X	X		X
5	Ohio Municipal Solid Waste Rules – Final Closure of a Sanitary Landfill Facility OAC 3745-66-11(O)	Closure of the sanitary landfill facility must be completed in a manner that minimizes post-closure formation and release of leachate…to surface water to the extent necessary to protect human health and the environment.	X	X		X
6	Ohio Hazardous Waste Interim Standards Rules – Closure Performance Standard OAC 3745-66-11	The owner shall close his facility in a manner that: • Minimizes the need for further maintenance; • Controls, minimizes, or eliminates to the extent necessary to protect public health and the environment, post-closure escape of hazardous waste, hazardous constituents, leachate, contaminated run-off, or hazardous waste decomposition products to the groundwater, or surface waters, or to the atmosphere; and • Complies with closure requirements.		X	X	X
7	Ohio Hazardous Waste Landfill Rules – Closure and Post-closure OAC 3745-68-10(A) (in lieu of 40 CFR § 265.310(a))	At final closure of the landfill…the owner or operator must cover the landfill…with a final cover designed and constructed to: • Provide long-term minimization of migration of liquids through the closed landfill; • Function with minimum maintenance; • Promote drainage and minimize erosion or abrasion of the cover; • Accommodate settling and subsidence so that the cover's integrity is maintained; and • Have a permeability less than or equal to the permeability of any bottom liner system or natural subsoil present.		X	X	X

8	Ohio Municipal Solid Waste Rules – Operational Criteria for a Sanitary Landfill Facility OAC 3745-27-19-(J)(1) & (4)	Surface water shall be diverted from areas where solid waste has been deposited. The facility shall be designed, constructed, maintained, and provided with surface water control structures, as necessary, to control run-on and run-off of surface water to ensure minimal infiltration of water through the cover material and cap system, and minimal erosion of the cover material and cap system. If ponding or erosion occurs on areas of the landfill facility where solid waste had been deposited, action will be taken to correct the conditions causing the ponding or erosion.	X	X	X	X
9	Ohio Municipal solid Waste Rules – Operational Criteria for a Sanitary Landfill Facility OAC 3745-27-19(E)(26)	The integrity of the engineered components of the landfill facility shall be maintained and any damage to, or failure of, the components shall be repaired.	X	X	X	X
		DURATION OF POST-CLOSURE CARE PERIOD				
10	Ohio Municipal Solid Waste Rules – Post-closure Care of Sanitary Landfill Facilities OAC 3745-27-14(A) (in lieu of RCRA Subtitle D)	Following completion of final closure activities in accordance with OAC 3745-27-11, post-closure care activities shall be conducted at the sanitary landfill facility for a minimum of 30 years.	X	X	X	X
11	Ohio Hazardous Waste Interim Standards Rules – Post-closure Care and Use of Property OAC 3745-66-17(A) (in lieu of 40 CFR §265.117(a)(1))	Post-closure care…must begin after completion of the unit and continue for 30 years after that date, unless shortened or extended by the Director [of the OEPA, a.k.a. the Ohio director of Environmental Protection] in accordance with OAC 3745-66-18(G) (40 CFR §265.117(a)(2)). NOTE: Identified in OU5 ROD as applicable only to existing Hazardous Waste Management Units (HWMUs).			X	
12	Ohio Municipal Solid Waste Rules – Post-closure Care of Sanitary Landfill Facilities OAC 3745-27-14(A)(1) & (2) (in lieu of RCRA Subtitle D)	Post-closure care activities for all sanitary landfill facilities shall include, but are not limited to: • Continuing operation and maintenance of the leachate management system, surface water management system…and the groundwater monitoring system; and • Maintaining the integrity and effectiveness of the cap system, including making repairs to the cap system as necessary to correct the effects of erosion and preventing run-on and run-off from eroding or otherwise damaging the cap system.	X	X	X	X

13	Ohio Hazardous Waste Interim Standards Rules – Post-closure Care and Use of Property OAC 3745-66-17(A)(1) (in lieu of 40 CFR §265.117(a)(1))	Post-closure care…must consist of at least the following: • Monitoring and reporting; and • Maintenance and monitoring of waste containment systems. **NOTE:** Identified in OU5 ROD as applicable only to existing HWMUs.			X	
14	Ohio Hazardous Waste Landfill Rules – Closure and Post-closure OAC 3745-68-10(B) (in lieu of 40 CFR §265.310(b)	After final closure, the owner or operator must comply with post-closure requirements, including maintenance and monitoring throughout the post-closure care period. The owner or operator must: • Maintain the integrity and effectiveness of the final cover, including making repairs to the cap as necessary to correct the effects of settling, subsidence, erosion, or other events; • Continue to operate the leachate collection and removal system until leachate is no longer detected; • Maintain and monitor the leak detection system; • Maintain and monitor the groundwater monitoring system; • Prevent run-on and run-off from eroding or otherwise damaging the final cover; and • Protect and maintain surveyed benchmarks.		X	X	X
15	Ohio Hazardous Waste Landfill Rules – Closure and Post-closure OAC 3745-68-10(D) (in lieu of 40 CFR §265.310(b))	During the post-closure period, the owner of a hazardous waste landfill must: • Maintain the function and integrity (integrity and effectives) of the final cover; • Maintain and monitor the leachate collection, removal and treatment system…to prevent excess accumulation of leachate in the system; and • Protect and maintain surveyed benchmarks.		X	X	X
		LEACHATE MANAGEMENT				
16	Ohio Municipal solid Waste Rules-Sanitary Landfill Facility Construction OAC 3745-27-08(C)(5)	If required by the Director [of the OEPA, a.k.a Ohio director of Environmental Protection], leachate storage structures are to be monitored.	X	X	X	X

17	Ohio Municipal Solid Waste Rules – Operational Criteria for a Sanitary Landfill Facility OAC 3745-27-19(K)(1)	If leachate is detected on the surface of the landfill facility, then the outbreak(s) shall be repaired and: • Leachate shall be contained and properly managed at the sanitary landfill facility; • If necessary, leachate shall be collected and disposed in accordance with OAC 3745-27-19(K)(5) & (6); and • Actions shall be taken to minimizes, control, or eliminate the conditions which contribute to the production of leachate.	X	X	X	X
18	Ohio Municipal Solid Waste Rules – Operational Criteria for a Sanitary Landfill Facility OAC 3745-27-19(K)(3)	The collection pipe network of the leachate management system shall be inspected…annually [after placement of the initial lift of waste]…to ensure that clogging had not occurred.	X	X	X	X
19	Ohio Municipal Solid Waste Rules – Operational Criteria for a Sanitary Landfill Facility OAC 3745-27-19(K)(4)	If authorized by the Director [of the IOPA, a.k.a. Ohio Director of Environmental Protection], leachate may be temporarily stored within the limits of solid waste placement until the leachate can be treated and disposed.	X	X	X	X
20	Ohio Municipal Solid Waste Rules – Operational Criteria for a Sanitary Landfill Facility OAC 3745-27-19(K)(5)	The owner shall treat and dispose of collected leachate in accordance with the following: (a) treat and dispose of collected leachate on site at the sanitary landfill facility; or (b) pre-treat collected leachate on-site and dispose of collected leachate off-site on the sanitary landfill facility; or (c) treat and dispose of collected leachate off-site of the sanitary landfill facility.		X	X	X
21	Ohio Municipal Solid Waste Rules – Operational Criteria for a Sanitary Landfill Facility OAC 3745-27-19(K)(6)	The owner…shall prepare a contingency plan for the storage and disposal of leachate…The plan shall describe the immediate and long-term steps, including the setting aside of land for the construction and operation of an on-site treatment facility, to be taken for leachate management in the event that collected leachate cannot be managed in accordance with the management option selected in OAC 3745-27-19(K)(5).		X	X	X
22	Ohio Municipal Solid Waste Rules – Operational Criteria for a Sanitary Landfill Facility OAC 3745-27-19(M)(4) & (5)	The owner annually shall report: • a summary of the quantity of leachate collected for treatment and disposal on a monthly basis during the year; • location of leachate treatment and/or disposal; • verification that the leachate management system is operating in accordance with this rule; and • results of analytical testing of an annual grab sample from the leachate management system.		X	X	X

23	Federal Criteria for Municipal Solid Waste Landfills – Closure and Post-closure Care 40 CFR §268.61	The Director [of OEPA, a.k.a Ohio Director of Environmental Protection] may allow the owner or operator to stop managing leachate if the owner or operator demonstrates that leachate no longer poses a threat to human health and the environment.	X	X	X	X
		MODIFICATIONS TO POST-CLOSURE CARE PLAN OR PERIOD				
24	Ohio Hazardous Waste Interim Standards Rules – Post-closure Plan; Amendment of Plan OAC 3745-66-18(D)	The owner may amend the post-closure plan any time during the active life of the facility or during the post closure period.				X
25	Ohio Hazardous Waste Interim Standards Rules – Post-closure Plan; Amendment of Plan OAC 3745-66-18(G)	The post-closure plan and length of the post-closure care period may be modified any time prior to the end of the post-closure care period. A modification of the post-closure plan may include, where appropriate, the temporary suspension rather than permanent deletion of one or more post-closure care requirements. At the end of specified period of suspension, the Director [of the OEPA, a.k.a. the Ohio Director of Environmental Protection] would then determine whether the requirements should be permanently discontinued or reinstated to prevent threats to human health and the environment.				X
		PROPERTY USE RESTRICTIONS				
26	Ohio Hazardous Waste Interim Standards Rules – Post-closure Care and Use of Property OAC 3745-66-17(C) (in lieu of 40 CFR §265.117(c))	Post-closure use of property on or in which hazardous wastes remain after partial or final closure must never be allowed to disturb the integrity of the final cover, liner(s), or any other component of the containment system, or the function of the facility's monitoring systems, unless the Director [of the OEPA, a.k.a., Ohio Director of Environmental Protection] approves otherwise. NOTE: Identified in OU5 ROD as applicable only to existing HWMUs. NOTE: If clean closure is performed then post-closure care is not required.			X	
27	Ohio Hazardous Waste Landfill Rules – Closure and Post-closure OAC 3745-68-10(D)(5)	During the post-closure period, the owner of a hazardous waste landfill must restrict access to the landfill as appropriate for its post-closure use.		X	X	X

28	Ohio Municipal Solid Waste Rules – Final Closure of a Sanitary Landfill Facility OAC 3745-27-11-(H)(5)(a)	The owner shall file – with the board of health having jurisdiction with the county recorder of the county in which the facility is located, and with the Director [of OEPA, a.k.a. the Ohio Director of Environmental Protection] – a plat of the units(s) of the sanitary landfill facility and information describing the acreage, exact location, depth, volume and nature of the solid waste deposited in the unit(s) of the sanitary landfill facility.		X		X
29	Ohio Hazardous Waste Interim Standards Rules – Survey Plat OAC 3745-66-16	The owner shall submit – to the local zoning authority, or the authority with jurisdiction over local land use, and to the Director [of the OEPA, a.k.a. the Ohio Director of Environmental Protection] – a survey plat, prepared and certified by a professional land surveyor, indicating the location and dimensions of landfill cells or other hazardous waste disposal units with respect to permanently surveyed benchmarks. The plat must contain a note, prominently displayed, which states the owner's obligation to restrict disturbance of the hazardous waste disposal unit in accordance with OAC 3745-66-17(C).		X		X
30	Ohio Hazardous Waste Interim Standards Rules – Post-closure Notices OAC 3745-66-19(A)	The owner shall submit – to the local zoning authority, or the authority with jurisdiction over local land use, and to the Director [of the OEPA, a.k.a. the Ohio Director of Environmental Protection] – a record of the type, location, and quantity of hazardous wastes disposed of within each cell or disposal unit of the facility.				X
		DEED NOTATION				
31	Ohio Municipal Solid Waste Rules – Final Closure of a Sanitary Landfill Facility OAC 3745-27-11(H)(5)(b)	The owner shall record a notation on the deed to the sanitary landfill facility property, or on some other instrument which is normally examined during title search, that will notify in perpetuity any potential purchaser of the property that: • The land has been used as a sanitary landfill facility; • Includes information describing acreage, exact location, depth, volume, and nature of solid waste deposited in the sanitary landfill facility.	X	X		X

32	Ohio Hazardous Waste Interim Standards Rules – Post-closure Notices OAC 3745-66-19(B)	The owner shall record, in accordance with state law, a notation or the deed of the facility property, or on some other instrument which is normally examined during title search, that will notify in perpetuity the potential purchasers of the property that: • The land has been used to manage hazardous wastes; • Its use is restricted under the Ohio Administrative Code closure and post-closure rules; and • The survey plat and record of the type, location, and quantity of hazardous wastes disposed of within each cell or hazardous waste unit of the facility as required by OAC 3745-66-16 and 3745-66-19(A) have been filed with the local zoning authority or the authority with jurisdiction over local land use and with the Director [of the OEPA, a.k.a. the Ohio Director of Environmental Protection].				X
33	Ohio Hazardous Waste Interim Standards Rules – Post-closure Notices OAC 3745-66-19(C)	If the owner or any subsequent owner of the land upon which a hazardous waste disposal unit was located wishes to remove hazardous wastes and hazardous waste residues in satisfaction of the criteria in OAC 3745-66-17(C), the owner may request that the Director [of the OEPA, a.k.a. the Ohio director of Environmental Protection] approve either: • The removal of the notation on the deed to the facility property or other instrument normally examined during title search; or • The addition of a notation to the deed or instrument indicating the removal of the hazardous waste.				X
		OTHER DOE CRITERIA				
34	Disposal Site Closure/Post-closure DOE Order 5820.2A, Chapter III(3)(j)	• During post-closure, residual radioactivity levels for surface soil shall comply with existing DOE decommissioning guidelines. • Inactive disposal facilities, disposal sites, and disposal units shall be managed in conformance with RCRA, CERCLA, and SARA. • Corrective measures shall be applied to new disposal sites or individual disposal units if conditions occur or are forecasted that could jeopardize attainment of the performance objectives [of the unit]. • Termination of monitoring and maintenance activity at closed facilities or sites shall be based on an analysis of site performance at the end of the institutional control period.	X	X	X	

35	Environmental Monitoring DOE Order 5820.2A, Chapter III(3)(k)	Each non-operational low-level waste disposal facility shall be monitored by an environmental monitoring program that conforms with DOE Order 5484.1 and, at a minimum, meets the requirements listed below: • The environmental monitoring program shall be designed to measure: (a) operational effluent releases; () migration of radionuclides; (c) disposal units subsidence; (d) changes in disposal facility and disposal site parameters which may effect long-term site performance. • Based on the characteristics of the facility monitored, the environmental monitoring program may include, but not necessarily be limited to, monitoring: (a) suface soil; (b) air; (c) surface water; and (d) subsurface soil and water, both in the saturated and unsaturated zones. • The monitoring program shall be capable of detecting changes in trends in performance far enough in advance to allow application of necessary corrective action before exceeding performance objectives. The monitoring program shall be able to ascertain whether or not effluents from each treatment or disposal facility or disposal site meets the requirements of applicable DOE Orders.	X	X	X	

2.3 Functional Requirements

The *Design Criteria Package (OSDF DCP)* [GeoSyntec, 1997b] contains a variety of functional requirements that have been established for the OSDF. The functional requirements pertinent to this plan are:

- protect the OSDF from damage caused by precipitation and stormwater run-on and run-off;
- route run-on and run-off to designated diversion channels locations for appropriate management; and
- discharge surface water to existing watercourses in accordance with applicable regulatory and DOE requirements.

The surface water management system should be maintained such that it will continue to perform in a manner that meets the project requirements for long-term conditions (i.e., after closure of the OSDF). The system should prevent stormwater run-on to the OSDF and uncontrolled stormwater run-off from the OSDF. Features of the long-term surface-water management system were constructed to require minimal monitoring and maintenance. The system was integrated, to the extent possible, with existing topography, features, and facilities.

2.4 General Design Criteria

The *OSDF DCP* also identifies a number of general design criteria for the OSDF. The general design criteria pertinent to this plan are:

- long-term erosion and sediment control features for the OSDF were designed for the 2,000-year, 24-hour storm event (design criterion for assumption of a DOE Performance Category 2 facility); and
- long-term run-on/run-off control structures for the OSDF were designed to limit interruption and damage (i.e., washout) of the OSDF in the 2,000-year, 24-hour storm event (design criterion for assumption of a DOE Performance Category 2 facility); run-on should be controlled and diverted away from and around the OSDF using swales, channels, or diversion berms.

2.5 Other Requirements

In addition to the requirements contained in the *OSDF DCP*, other requirements that have been incorporated into this plan are:

- disturbed areas should be stabilized (i.e., vegetated) after the area has been reconstructed to final grade; and
- general practices for inspection and maintenance of erosion and sediment control features should be as recommended by the Ohio Department of Natural Resources (ODNR) Division of Soil and Water Conservation document entitled *Rainwater and Land Development* [ODNR, 1996] or its most current revision.

Other criteria relevant to this plan consist of those industry-standard practices that have proven effective at other waste disposal facilities. Inspection and monitoring requirements from the manufacturers and suppliers of material and equipment installed at the OSDF are also criteria relevant to this plan.

3.0 FINAL SITE CONDITIONS

3.1 Site History

In July 1986, the DOE and the EPA signed a *Federal Facilities Compliance Agreement (FFCA)*, addressing impacts to the environment associated with the federally operated site known as the Fernald Environmental Management Project (now the Fernald Closure Project (FCP). The DOE agreed to conduct the FFCA investigation as a remedial investigation/feasibility study (RI/FS) in accordance with guidelines of CERCLA. In November 1989, the FEMP site was included on the National Priorities List (NPL) of the EPA. The *FFCA* was later amended by the June 1990 *Consent Agreement* between DOE and EPA which was further modified by amendment in September 1991.

In accordance with the September 1991 *Amended Consent Agreement (ACA)*, EPA approved and signed the *OU2 ROD* on June 8, 1995; the *OU5 ROD* on January 31, 1996; and similarly, the *Operable Unit 3 Record of Decision for Final Remedial Action (OU3 ROD)* on September 24, 1996. The design approach for the OSDF is presented in the *Final Remedial Design Work Plan for Remedial Actions at Operable Unit 2 (OU2 RDWP)* [DOE, 1995b], which was submitted to the EPA in August 1995 and subsequently approved in November 1995. The design of the OSDF, as currently developed, is presented in the *Final Design Package, On-Site Disposal Facility* [GeoSyntec, 1997d]. Ohio Environmental Protection Agency (OEPA), which has been actively participating throughout the CERCLA response process, also has concurred with the documentation and decisions to date.

The FCP OSDF is being constructed to permanently contain impacted materials derived from the remediation of the operable units at the FCP. All material placed in the OSDF is required to meet OSDF waste acceptance criteria (WAC). The *OU2 ROD* established a radiological WAC of 346 picoCuries/gram (pCi/g) of uranium-238 or 1,030 milligrams per kilogram (mg/kg) total uranium for all soil and soil-like impacted material destined for the OSDF. Similarly, the *OU5 ROD* established additional radiological and chemical WAC for OU5 soils destined for the OSDF. The *OU3 ROD* established radiological WAC for debris materials destined for the OSDF of 105 grams technetium-99. These radiological/chemical WAC have been compiled and presented in Table 3-1. The impacted materials sent to the OSDF from OU3 may also include small material contributions from OUs 1 and 4. Any material from these latter operable units destined for the OSDF met the OU3 waste acceptance criteria. In addition to the radiological/chemical WAC discussed above, the *OSDF IMP Plan* [GeoSyntec, 1996] presents physical WAC for the OSDF.

Table 3-1
ON-SITE DISPOSAL FACILITY
WASTE ACCEPTANCE CRITERIA

	Constituent of Concern	Soil[a]		Debris[b]
		OU2	OU5[d]	OU3
1	**Radionuclides:** Neptunium-237		3.12×10^{9} pCi/g	
2	Strontium-90		5.67×10^{10} pCi/g	
3	Technetium-99		29.1 pCi/g	105 g
4	Uranium-238 Total Uranium	346 pCi/g 1,030 mg/kg	1,030 mg/kg	
5	**Inorganics:** Boron		1.04×10^{3} mg/kg	
6	Mercury[c]		5.66×10^{4} mg/kg	
7	**Organics:** Bromodichloromethane		9.03×10^{-1} mg/kg	
8	Carbazole		7.27×10^{4} mg/kg	
9	Alpha-chlordane		2.89 mg/kg	
10	Bis(2-chlorisopropyl)ether		2.44×10^{-2} mg/kg	
11	Chloroethane		3.92×10^{5} mg/kg	
12	1,1-Dichloroethene[c]		11.4 mg/kg	
13	1,2-Dichloroethene[c]		11.4 mg/kg	
14	4-Nitroaniline		4.42×10^{-2} mg/kg	
15	Tetrachloroethene[c]		128 mg/kg	
16	Toxaphene[c]		1.06×10^{5} mg/kg	
17	Trichloroethene[c]		128 mg/kg	
18	Vinyl chloride[c]		1.51 mg/kg	

NOTES:
[a]maximum concentration
[b]maximum total mass
[c]RCRA-based constituent of concern
[d]constituents which have established maximums which serve as Waste Acceptance Criteria; other compounds which will not exceed designated Great Miami Aquifer action levels within 1000-year performance period, regardless of starting concentration in the OSDF, are not listed.

SOURCES:
OU2 ROD [DOE, 1995a]
OU5 ROD [DOE, 1996a]
OU3 ROD [DOE, 1996b]

The volume of this impacted material destined for disposal in the OSDF is estimated as 2.9 million cubic yards (2.2 million cubic meters) bank/unbulked. Approximately 80 percent of this volume is expected to consist of impacted soil, with the remainder being building demolition rubble, fly ash, lime sludge, municipal solid waste, and small quantities of miscellaneous other materials. After soil and soil-like material, debris from demolition of buildings in the FCP former Production Area is expected to constitute the largest volume of impacted material for OSDF disposal. The *OU3 ROD* indicates that impacted debris can be assigned to one of ten material categories. Only material from seven of these categories is to be disposed in the OSDF. The seven material categories of impacted debris allowed for disposal in the OSDF are presented in Table 3-2, which also gives descriptions of the materials making up the categories.

The quantities presented above are best current estimates, and are expected to change as actual remediation progresses. Therefore, this subsection is anticipated to be revised after closure of the final phase/cell of the OSDF to present updated actual volumes (see Section 12.0), as well as to correct to past tense.

3.2 Location and Description of On-Site Disposal Facility Area

A Predesign Investigation was performed to define the most suitable location for the OSDF within an identified best area at the FCP based on the OU2 and OU5 RI/FSs. The results of that investigation are presented in the *Predesign Investigation and Site Selection Report for the On-site Disposal Facility* [DOE, 1995c]. That report, its objectives, and its results are summarized below.

The identified best area is located on the east side of the FCP property and measures approximately 2000 feet east to west by 5300 feet north to south. This location is considered the best location for an on-site disposal facility because it has the greatest thickness of gray clay, which provides a protective layer over the underlying Great Miami Aquifer. Fate and transport modeling and risk assessments in the OU2 and OU5 FSs have shown that a disposal facility in this area, based on a feasible facility design and a 12-foot thick gray clay layer, would be protective of human health and the environment. The identified best area is bounded on the north, east, and south using the OEPA siting requirements (buffer from property line and water supply wells). The western boundary incorporates areas with greater than 12 feet of gray clay, with the exception of the northern portion of the west boundary line, which was determined based on identification of sand lenses within the gray clay.

Based on planning meetings between DOE, EPA and OEPA, the Predesign Investigation had the three objectives as identified in Table 3-3. Results of the Predesign Investigation served as the basis for selecting the location within the identified best area for siting the OSDF. The selected

Table 3-2
OU3 Material Categories/Descriptions

Category A Accessible Metals	Category B Inaccessible Metals	Category D Painted Light Gauge Metals	Category E Concrete	Category G Non-Regulated Asbestos-Containing Material (ACM)	Category H Regulated ACM	Category I Miscellaneous Materials
Structural and miscellaneous steel	• Doors • Conduit/wire/cable tray • Electrical wiring and fixtures • Electrical transformers • Miscellaneous electrical items • HVAC equipment • Material handling equipment • Process equipment • Miscellaneous equipment • Piping	• Ductwork • Lead flashing • Louvers • Metal wall and roof panels	• Asphalt • Slabs • Columns • Beams • Foundations • Walls • Masonry • Clay piping	• Ceiling demolition • Feeder cable • Fire brick • Floor tile • Transite wall and roof panels	• Ductwork insulation • Piping insulation • Personal protective equipment • Copper scrap metal pile	• PVC conduit • Basin liners • Fabric • Drywall • Building insulation • Miscellaneous debris • Personal protective equipment • PVC piping • Roofing build-up • Process trailers • Non-process trailers • Windows • Wood

SOURCE: Table 4-2, OU3 Material Categories/Description, *OU3 ROD* [DOE, 1996b].
NOTE: Only those seven material categories allowed for on-site disposal per the *OU3 ROD* are presented.

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Table 3-3
PREDESIGN INVESTIGATION OBJECTIVES AND FIELD COMPONENTS

#	Objective	Field Components
1	Identify the most suitable hydrogeology within the identified best area	Verification of the gray clay thickness Identification of interbedded granular material
2	Verify protection of human health and the environment	Verification of existing vertical and horizontal uranium contamination Actual uranium solubility Uranium retardation Lateral and vertical gradients Background concentrations of uranium in water in the vadose zone
3	Develop field information for the design of the OSDF	Location and extent of interbedded granular material Obtain geotechnical information in the footprint of the OSDF

location, measuring 800 feet east to west by 4300 feet north to south, provides suitable space for the anticipated 2.5 million cubic yards of impacted materials and meets applicable OEPA siting requirements. The gray clay thickness is greater than the minimum 12-foot thickness established in the *OU2 ROD* [DOE, 1995a] for protection of the Great Miami Aquifer; the gray clay is actually greater than 15 feet thick within the selected location and approximately 75 percent of the selected location has a 20-50 foot thickness of gray clay. The investigation identified minimal amounts of interbedded granular material and none that would offer a rapid migration pathway through the gray till.

3.3 OSDF As-Built

The design approach for the OSDF is presented in the document *OU2 RDWP*. The design approach of the OSDF, as currently developed, is presented in the document *Final DCP, On-Site Disposal Facility* [GeoSyntec, 1997d]. The design of the OSDF includes a liner system, impacted material placement, final cover system, leachate management system, surface-water management system, and other ancillary features.

After closure of the final cell/phase of the OSDF, as-built conditions will be documented with a set of as-built record drawings (and possibly photographs). These drawings will be developed by DOE or its contractor, and will be used to prepare the topographic map discussed in the next paragraph. This information will illustrate baseline conditions for comparison to future conditions during the post-closure period. These drawings may be used to document changes in the physical site conditions of the OSDF over time, and to develop a corrective action plan, if required.

The final FCP OSDF site map will be compiled from a final topographic map of the FCP. The final topographical survey will be conducted in accordance with the standards of the *Manual of Photogrammetry* [ASP, 1980]. It is anticipated that the following specifications will be used in developing the map, in accordance with the appropriate regulations [Ohio solid waste rules OAC 3745-27-06(B)(2) and 3745-27-11(H)(5)(a), and Ohio hazardous waste general new facility rule OAC 3745-54-18 and hazardous waste interim status facility rule OAC 3745-66-16]:

- a scale of 1 inch = 200 feet (1 mm = 2.4 m)
- a contour interval of 5 ft (1.5 m)
- a coverage area of the FCP OSDF disposal site and a distance of 1,000 ft
- north arrow displayed

In addition to existing topography, it is anticipated that the maps will define the following:

- property lines of the land owned by the DOE
- limits of impacted material placement
- outline of the toe and crest of the OSDF

- the individual phases/cells of the OSDF
- OSDF site property boundaries, fences, gates, and access roads
- location and extent of permanent stormwater run-off and -on control features
- vegetation, streams, lakes, springs, and other surface waters
- survey control stations/benchmarks
- permanent site surveillance features (e.g., monuments, markers, signs)
- wetlands (if any) within the limits of impacted material placement and within 200 ft of the limits of impacted material placement
- limits of a "regulatory floodplain" [i.e., 100-year floodplain as depicted on a federal insurance administration flood map, as per OAC 3745-27-01 and 3745-54-18(B)]
- site coordinate system
- existing residences, land uses, zoning classifications, property ownership, political subdivisions, and communities
- underground utilities (sewers, water lines, electric cables), field tiles, french drains, pipelines
- location (if any) within 200 ft of the limits of impacted material placement of any fault which has had displacement in Holocene time [OAC 3745-54-18(A)]
- all public and private water supply wells within 2000 ft of the limits of impacted material placement (using a scale insert if necessary), and the current status of each, including depth, use, and where applicable, abandonment date, based on publicly available information.

These as-built drawings will be submitted to the EPA and OEPA as part of the first pre-planned revision of this PCCI Plan (see Section 12.2.2). The map will serve as the base map for site inspections. A new, separate site map will be prepared for field use during a site inspection. The map will be revised as needed to indicate changes noted after each inspection; at a minimum, the map will be revised as part of the 5-year review. Note that DOE plans to update the information under the last bullet above regarding water supply wells only during the 5-year reviews. When the FCP OSDF map is updated, the revised map will include the year of revision, the revision number, and the type of the activity or event, which triggered the need for the revision.

All drawings, disposal site map, and photographs will be archived by the FCP document control center. The DOE will be responsible for maintaining and archiving these maps, drawings, and photographs, as part of the FCP OSDF permanent file.

3.4 FCP OSDF Baseline Photographs

A photographic record of the final conditions after closure of the final cell of the OSDF will be included and maintained in the FCP OSDF permanent site file. This record is anticipated to consist of a series of aerial and ground photographs that will provide a baseline visual record of final site construction and final site conditions to complement the as-built drawings. In particular, this set of aerial photographs is anticipated to provide a permanent record of site conditions, enabling future inspectors to monitor changes in site conditions (e.g., erosion patterns, vegetation changes, and land use) over time. The need for new aerial photographs will be evaluated at 5-year intervals, beginning with the first 5-year review. Table 3-4 summarizes the anticipated specifications for the aerial photographs.

3.5 Site Inspection Photographs

Photographs will be taken during site inspections to document conditions at the OSDF and its surrounding permanent features. These photographs will provide a continuous record for monitoring changing conditions over time. The photographs can be compared with the baseline photographs to monitor site integrity.

Each photograph will be recorded individually on a site inspection photo log. An appropriate description of the feature photographed will be entered into the log. If possible, a photograph will include a reference point such as a survey monument, boundary monument, site marker, or monitoring well.

For specific areas where a photograph is used to monitor change over time, the distance from the feature and the azimuth should be recorded, and all subsequent photographs should be taken from the same orientation to provide an accurate picture of changing conditions. This information will be provided on the inspection checklist and photo log.

Copies of the site inspection photographs and the photo log will be included in the annual site inspection report. All site inspection photographs taken, as well as all corresponding photo log forms, will be maintained in the permanent FCP OSDF file.

FEATURES TO BE PHOTOGRAPHED

The following site features should be documented with photographs every scheduled inspection of the FCP OSDF site:

- permanent site surveillance features
- fences, gates, access roads, perimeter roads, and paths
- toe drains
- the OSDF (top, sides, buffer area, surrounding area) panoramic sequences of photographs from selected vantage points may be used for this purpose

- any evidence of erosion (e.g., gullies, rivulets, rills) that the inspector considers significant and includes in the text of the inspection log book
- any off-OSDF features that may affect the OSDF in the future and that the inspector considers significant and includes in the text of the inspection log book
- vegetation (OSDF topslope and sideslope, and buffer area)

Table 3-4
AERIAL PHOTOGRAPHY SPECIFICATIONS

Area to be photographed	Final disposal site plus a minimum of 0.25 mi (0.4 km) beyond its boundaries unless site conditions require otherwise.
Products to be delivered	One (1) set of vertical color, infrared stereo contact prints; glossy, double weight, not trimmed; 9-in x 9-in (230-mm x 230 mm); Scale: 1 in = 200 ft (1 mm = 2.4 m) (1:2,400) Index map showing flight lines and frame numbers; Scale: 1 in = 1,000 ft (1:12,000) One (1) set of natural color, low oblique photographs taken from a minimum of two (2) different angles with 90 degree rotation. If 35mm or 70mm film used, glossy double-weight 8-inch x 10-inch enlargements; if 9-inch x 9-inch format used, glossy double-weight contact prints.
Flight date	To be determined; mid to late summer, at peak of photosynthetic response of vegetation, unless the flight is to be used exclusively for topographic mapping.
Camera	Vertical photos: Precision, 9-inch x 9-inch (230- x 230-mm) format. Oblique photos: A 35-millimeter (single lens reflex) or larger format camera is acceptable.
Film	Vertical photos: Eastman-Kodak Aerochrome Infrared 2443, or its equivalent Oblique photos: Eastman-Kodak Aerocolor Negative Film 2445, or its equivalent
Filter	Infrared (vertical) photos: Wratten No. 12 or No. 15 Color (oblique) photos: Skylight
Flight line coverage	60 percent end overlap; 30 percent average side overlap
Ground control	Control stations will be second order, Class 1, for horizontal control, and third order for vertical control (standard U.S. Geological Survey map accuracy specifications)

- OSDF topslope and sideslope
- erosion protection material (riprap)
- survey control points for local coordinate system.

Any new or potential problem areas identified during a site inspection will be documented with photographs. Photographs will also be taken to record developing trends and to allow inspectors to make reasonable decisions concerning additional inspections, custodial maintenance or repairs, or corrective action.

4.0 INSTITUTIONAL CONTROLS AND POINTS OF CONTACT

4.1 Introduction

This section will discuss the institutional controls that will be in place for the OSDF and its buffer area during the post-closure care period. Table 4-1 presents a compilation of the institutional controls for the OSDF and its buffer area as identified in the *OU2 ROD*, and in the *OU5 ROD*. Environmental monitoring (Item 5), inclusive of groundwater monitoring (Item 4), is discussed in Section 5 of this plan. This plan, in total, addresses the maintenance program (Item 6). The following sections discuss the remaining items.

4.2 Points of Contact

Table 4-1
INSTITUTIONAL CONTROLS AS KEY COMPONENTS IN THE FEMP RODs

#	Component	OU2 ROD	OU5 ROD
		INSTITUTIONAL CONTROLS	
		The selected remedy will include the following as institutional controls:	"Institutional controls, such as ..."[5a]
1	Ownership	"continued federal ownership of the [OSDF] site"[2a]	"property ownership will be maintained by the federal government of the area comprising the [on-site] disposal facility and associated buffer areas"[5b]
2	Access controls/ restrictions	"access restrictions (fencing)"[2a]	"access controls"[5a]
3	Deed notations/ use restrictions	"restrictions on the use of property will be noted on the property deed before the property could be sold or transferred to another party"[2c]	"deed restrictions"[5a]; "if portions of the FEMP property [outside the disposal facility area] are transferred or sold at any future time, restrictions will be provided in the deed, and proper notifications will be provided as required"[5b]
4	Groundwater monitoring program	"groundwater monitoring"[2a] .... "following closure of the on-site disposal facility"[2b]	See entry 5 below, but not identified as an institutional control
		OTHER KEY COMPONENTS OF THE SELECTED REMEDY	
5	Environmental Monitoring program	See entry 4 above.	"long-term environmental monitoring program"[5a]
6	Maintenance program	"maintenance of the on-site disposal facility"[2b]	"maintenance program to ensure the continued protectiveness of the remedy"[5a]

[2a]Declaration, Description of the Selected Remedy, p. D-2, *OU2 ROD* [DOE, 1995a]
[2b]Decision Summary, Section 9.1 Key Components, p. 9-2, *OU2 ROD* [DOE, 1995a]
[2c]Responsiveness Summary, Section 3.0 Summary of Issues and Responses, Issue 7 C Future Use/Ownership, p. RS-3-33, *OU2 ROD* [DOE, 1995a]
[5a]Declaration Statement, Description of the Selected Remedy, p. D-ii, *OU5 ROD* [DOE, 1996a]
[5b]Decision Summary, Section 9.1 Key Components, p. 9-18, *OU5 ROD* [DOE, 1996a]

Points of contact by either the name or position title, address, and telephone number of the person or office to contact about the FCP OSDF during the post-closure care period are provided in Table 4-2, in accordance with appropriate regulations [Ohio solid waste rule OAC 3745-27-11(B)(3) in lieu of federal solid waste regulation 40 CFR §258.61(c)(2), and Ohio hazardous waste rules OAC 3745-66-18(C)(3) and 3745-68-10 in lieu of federal hazardous waste regulations 40 CFR §§265.118(c)(3) and 264.118(b)(3), respectively]. Table 4-2 presents the primary point of contact (entry 1), a backup point of contact (entry 2), and an emergency contact number that is accessible 24 hours each day (entry 3). These points of contact will serve to ensure that access to the facility will be possible for appropriate authorized personnel after closure and in the case of emergency. An updated copy of this plan will be maintained at each of the locations identified in Table 4-2.

Due to the duration of the post-closure period, DOE anticipates that the points of contact are likely to change over time. DOE will notify the regulatory agencies of any changes to the points of contact via modification to this PCCI Plan, likely as change pages to this section (see Section 12.0).

4.3 Ownership

As presented in Item 1 of Table 4-1, property ownership of the area comprising the FCP OSDF and its associated buffer areas will be maintained by the federal government (*e.g.*, DOE, or a successor federal agency).

Table 4-2
POINTS OF CONTACT

	Title of contact	Telephone	Address	
			Mailing	Shipping
1	DOE FCP Site Manager	(513) 648-3101	DOE Fernald Area Office P.O. Box 538704 Cincinnati, OH 45253-8704	DOE Fernald Area Office 7400 Willey Road Fernald, OH 45030
2	DOE Ohio Field Office Contact			Not applicable
3	DOE Grand Junction 24-HOUR NUMBER	877-695-5322		
Refer to the Fernald Environmental Management Project On-Site Disposal Facility				

4.4 Access Controls/Restrictions and Security Measures

As long as the federal government maintains property ownership, access to the FCP OSDF will be restricted by means of fences, gates, and warning signs. Access to those areas within the fencing will be controlled by DOE authorization, and is anticipated to be limited to personnel for inspection, custodial maintenance, or corrective actions. The fences, gates, and warning signs are covered by the inspection and custodial maintenance components of the post-closure care program implemented under this PCCI Plan (see Sections 7.0 and 9.0, respectively).

To provide additional security, a warning sign with the following information will be placed on the access gates to the OSDF:

- the name of the site,
- the international symbol indicating the presence of radioactive material,
- a notice that trespassing is forbidden on this U. S. Government owned site, and
- a DOE 24-hour telephone number (entry 3 in Table 4-2); this same 24-hour telephone number will be recorded in agreements with local agencies to notify the DOE in the event of an emergency or breach of site security or integrity.

In addition to the entrance sign, signs mounted on fence posts at approximately equal spacing around the OSDF perimeter will display the following information:

- the international symbol indicating the presence of radioactive material, and
- a notice that trespassing is forbidden on this U. S. Government property.

The effectiveness of site security measures (e.g., fence condition, locked gate, etc.) will be monitored through routine scheduled site inspections (see Section 7.0).

4.5 Deed Notations/Use Restrictions

If ownership of a portion or portions of the FCP is transferred in the future, real estate restrictions will be included in the deed, and proper notifications will be provided as required by the appropriate rules and regulations. A preliminary draft of such notice in deed is provided below in Table 4-3, along with information extracted from the appropriate rules and regulations presented side by side to facilitate understanding of development of that notice. Note that specifics and the exact language appropriate to the specific parcel(s) of property will need to be developed and inserted at the time of such recording of deed notice.

In such an event, signed certification that the notation in the deed has been recorded will be submitted to the EPA Regional Administrator and the Ohio Director of Environmental Protection in accordance with appropriate regulations [Ohio solid waste rule OAC 3745-27-11(H)(5) in lieu of federal solid waste regulation 40 CFR §258.60(I), and Ohio hazardous waste rules OAC 3745-66-19(B) and 3745-68-10 in lieu of federal hazardous waste regulations 40 CFR §§265.119(b)(1) and 264.119(b)(1)] accompanied by a copy of the document in which the notation has been placed.

TABLE 4-3
NOTICE IN DEED OR OTHER TRANSFER INSTRUMENT

Ohio Solid Waste Rules	Ohio Hazardous Waste Rules	CERCLA	FCP
[OAC 3745-27-11(H)(5)] The owner is required to submit – to the local zoning authority, or the authority with jurisdiction over local land use, and to the board of health having jurisdiction, and to the Director – a survey plat showing the units(s) of the sanitary landfill facility and information describing the acreage, exact location, depth, volume, and nature of the solid waste deposited in the units(s) of the sanitary landfill facility.	[OAC 3745-66-16 & -19 and 3745-68-10(B)] The owner is required to submit – to the local zoning authority, or the authority with jurisdiction over local land use, and to the director – a survey plat, prepared and certified by a professional land surveyor, indicating the location and dimensions of landfill cells or other hazardous waste disposal units with respect to permanently surveyed	[CERCLA §120(h)] Whenever any agency, department, or instrumentality of the United States enters into any contract for the sale or other transfer (e.g., lease) of real property owned by the United States and on which any hazardous substance was stroed for one year or more, known to have been released, or disposed of, that agency, department or instrumentality shall include in such contract or instrument – to the extent such information is available on the basis of a complete search of agency files – (I) notice of the type and quantity of such hazardous substances, (ii) notice of the time at which such storage, release, or disposal took place, and (iii) a description of the remedial action taken, if any.	
The owner is required to record a notation on the deed to the sanitary landfill property, or on some other instrument which is normally examined during title search, that will notify in perpetuity any potential purchaser that the land has been used as a sanitary landfill facility. The notation shall include information as described above regarding the requirement for filing the survey plat.	The owner is required to record a notation on the deed to the facility property, or on some other instrument which is normally examined during title search, that will notify in perpetuity the potential purchasers that: (a) the land has been used to manage hazardous wastes; (b) its use is restricted under OAC closure and post-closure rules; and (c) the survey plat and record of the type, location, and quantity of hazardous wastes disposed of within each cell or hazardous waste disposal unit of the facility has been filed as per above.		
NOTICE IN DEED	**SAMPLE NOTICE IN DEED**	**NOTICE IN TRANSFER INSTRUMENT**	**SAMPLE NOTICE IN TRANSFER INSTRUMENT**
	To Whom It May Concern:		To Whom It May Concern:

	I, *(owner or operator)*, the undersigned, or *(street address)*, City of *city)*, County of *county)*, State of *(state)*, hereby give the following notice, as required by Ohio Administrative Code hazardous waste rules 3745-66-19(A) & (B) and 3745-68-10(B) – in lieu of 40 CFR §§265.119(b)(1) and 264.119(b)(1), respectively.		I, *(owner or operator)*, the undersigned, or *(street address)*, City of *city)*, County of *county)*, State of *(state)*, hereby give the following notice, as required by Ohio Administrative Code solid waste rule 3745-27-11(H)(5), and as required by Ohio Administrative Code hazardous waste rules 3745-66-19(B) and 3745-68-10(B) – in lieu of 40 CFR §§264.119(b)(1) and 265.119(b)(1), respectively – and as required by CERCLA §120(h).
	1. I am, and since *month, day, year)*, have been in possession of the following described lands *legal description)*.		1. I am, and since *month, day, year)*, have been in possession of the following described lands *legal description)*.
	2. Since *(month, day, year)*, I have disposed of hazardous chemical wastes on/in the above- described land under the terms of the Ohio Administrative Code rules, and regulations promulgated by the United States Environmental Protection Agnecy.		2. Between *(month, year)* and *(month, year)*, remedial actions have been conducted on the property which ha disposed of materials consisting primarily of soils and building debris containing asbestos containing materials, chemical hazardous substances and radiological hazardous substances, under the terms of regulations promulgated by the United States Environmental Protection Agency on/in the above described land.
	3. The future use of the above-described land is restricted under the terms of Ohio Administrative Code hazardous waste rules 3745-66-17(C) and 3745-68-10 – in lieu of 40 CFR §§265.117 (c) and 264.117(c); the post-closure use of the identified property must never be allowed to disturb the integrity of either the containment system or the facility's monitoring system, unless the EPA Regional Administrator or the Director of OEPA		3. The future use of the above-described land used for disposal is restricted under the terms of Ohio Administrative Code hazardous waste rules 3745-66-17(C) and 3745-68-10 – in lieu of federal hazardous waste regulations 40 CFR §§265.117(c) and 264.117(c). The post-closure use of such property must never be allowed to disturb the integrity of e the On-Site Disposal Facility's containment

	[a.k.a. the Ohio Director of Environmental Protection] determines that the proposed use: • Will not increase the potential threat to human health or the environment, or • Is necessary to reduce the threat to human health or the environment.		system or monitoring system, unless the EPA Regional Administrator and/or the Ohio Director of Environmental Protection determines that the proposed use: • Will not increase the potential threat to human health or the environment, or • Is necessary to reduce the threat to human health or the environment.
	4. Any and all future users of the land shall inform themselves of the requirements of the regulations and ascertain the amount and nature of wastes disposed of on/in the above-described property.		4. Any and all future users of the land shall inform themselves of the regulations and ascertain the amount and nature of remediation wastes/impacted materials disposed of on/in the above-described property.
File a survey plat with each of the following, showing the unit(s) of the sanitary landfill facility and information describing the acreage, exact location, depth, volume, and nature of the solid waste deposited in the unit(s) of the sanitary landfill facility: • *Name and address of local zoning authority, or authority with jurisdiction over local land use*	5. I have filed a survey plat with each of the following, showing the location and dimensions of the disposal facility and its individual units, and a record of the type, location and quantity of waste material disposed within each unit of the disposal facility: • *Name and address of local zoning authority, or authority with jurisdiction over local land use*		5. I have filed a survey plat with each of the following, showing the location and dimensions of the On-Site Disposal Facility and its individual sells/phases, and a record of the type location and quantity of remediation waste/impacted material disposed within the On-Site Disposal Facility: • Butler county Recorder's Office 130 High Street Hamilton, Ohio 45001 (513-887-3409) • Hamilton County Recorder's Office ATTN: Registered Land Recordings 138 E. Court Street, Cincinnati, Ohio 45202 (513-632-8336) • Butler County Health Department ATTN: Environmental 202 S. Monument Street Hamilton, Ohio 45001 (513-887-5228)

			• Hamilton County Environmental Health Division 11499 Chester Road, Suit 1500 Sharonville, Ohio (513-326-4500) • Ohio Department of Health Chief, Bureau of Radiological Protection 246 N. High St. Columbus, Ohio 43266-0149 (614) 644-2727
	• Regional Administrator of EPA Region 5		• EPA Region 5 Administrator 77 W. Jackson Blvd. Chicago, IL 60604-3590
• Ohio Director of Environmental Protection	• Ohio Director of Environmental Protection		• Ohio Director of Environmental Protection 1800 Watermark Drive P.O. Box 1049 Columbus, Ohio 43266-0149
		A covenant warranting that- • All remedial action necessary to protect the human health and the environment with respect to any such hazardous substances remaining on the property has been taken before the date of such transfer, and • Any additional remedial action found to be necessary after the date of such transfer shall be conducted by the United States.	A covenant warranting that- • All remedial action necessary to protect the human health and the environment with respect to any such hazardous substances remaining on the property has been taken before the date of such transfer, and • Any additional remedial action found to be necessary after the date of such transfer shall be conducted by the United States.

5.0 ENVIRONMENTAL MONITORING

5.1 Introduction

Two primary elements of environmental monitoring are associated with the FCP OSDF post-closure care period, namely air monitoring and groundwater monitoring. This section describes the focus and scope of the plans for monitoring these two primary environmental media.

5.2 Air Monitoring

The environmental air monitoring at the FCP is performed on a sitewide basis under the IEMP. The air emission monitoring program for the FCP OSDF during the post-closure care period - the air monitoring stations, analytical parameters, sampling frequency, equipment, procedures, and analytical methods - will be presented in a future revision to the IEMP in order to provide data for annual 40 CFR Part 61 National Emissions Standards for Hazardous Air Pollutants (NESHAP) Subpart H reporting and for other annual site environmental reporting.

It is anticipated that data will be collected under that ongoing program during at least a portion of the OSDF post-closure care period from air monitoring stations located on-property in the vicinity of the OSDF, near the FCP property fenceline, and at several off-property locations in nearby communities. That monitoring program has been developed in response to DOE Orders 5400.1 and 5400.5 and is currently presented in the IEMP. Some air monitoring locations may require relocation to accommodate changes in site conditions due to FCP remediation activities. Any such location-based modifications will be addressed in the IEMP.

5.3 Groundwater Monitoring

Groundwater monitoring for the OSDF is currently presented in the *OSDF Groundwater/Leak Detection and Leachate Monitoring Plan* [DOE, 2004]. The focus of that plan is the leak detection monitoring program for the OSDF, addressing monitoring both within the OSDF (in the leachate collection system and leak detection) and the underlying groundwater (in the glacial till immediately underneath the OSDF and the groundwater in the Great Miami Aquifer). Although the temporal coverage of that plan begins in part prior to the placement of impacted material/remediation waste into the OSDF, its coverage is anticipated to extend through the active phase of the OSDF, when remediation wastes are being placed in the individual cells of the OSDF, and into the post-closure phase after the last cell of the OSDF has been covered and closed. It is anticipated that the *OSDF Groundwater/Leak Detection and Leachate Monitoring Plan* will be revised over time to better define the monitoring strategy and its individual components; any such revisions are anticipated to be completed in a consultative manner among the DOE, EPA, and OEPA.

If a leak is detected from the OSDF, DOE will consult with the EPA and OEPA in accordance with the requirements established in the *OSDF Groundwater/Leak Detection and Leachate Monitoring Plan* for notifications and response actions.

5.4 Monitoring of Other Media

It is anticipated that monitoring of selected additional media (e.g., surface water, vegetation) during the OSDF post-closure care period might also be addressed in a future revision to the *IEMP* focusing on the OSDF post-closure care period. See the second bullet under DOE Order 5820.2A, Chapter III(3)(k) (entry 35) in the table presented in Section 2.0.

6.0 ROUTINE SCHEDULED INSPECTIONS

6.1 Introduction

This section will establish inspection techniques and frequency as required by the appropriate regulations [Ohio hazardous waste rules OAC 3745-66-18(A) & (C) in lieu of federal hazardous waste regulations 40 CFR §§ 264.118(b)(2) and 265.118(c)(2)]. Components covered by these inspections are:

- Security system (e.g., fences, gates, locks, warning signs)
- Final cover system
- Run-on and run-off control system(s)
- Surveyed benchmarks - at least three (3) third-order benchmarks on separate sides of the OSDF within easy access to the limits of waste/impacted materials placement [Ohio solid waste rule OAC 3745-27-08(C)(7)(a)-(c), and Ohio hazardous waste rule OAC 3745-68-10(D)(4) in lieu of federal hazardous waste regulation 40 CFR §265.310(b)(6)]

6.2 Routine Facility Inspections

Discussed in this section are those background details and preliminary considerations necessary to conduct routine scheduled site inspections including the inspection team, frequency and timing of inspections, and inspection aids. Also discussed are the procedures during routine scheduled site inspections.

6.2.1 Preliminary Considerations

FREQUENCY AND TIMING OF INSPECTIONS

Routine scheduled inspections will be conducted quarterly at the FCP OSDF until closure of the final cell of the OSDF. The objective of these inspections is to establish and record physical modifications to the site through many seasonal cycles and to provide a basis for decisions regarding future inspections. Following closure, inspections will be conducted on a semi-annual basis until the 2011 5-year review, and then on an annual basis thereafter. Based on review of the inspection and maintenance reports and records for the OSDF, DOE may at any time specify a new routine schedule inspection frequency, which will be approved by the EPA and concurred on by EPA, via modification to this Plan (see section 11.0).

Timing of these routine scheduled inspections, as determined by DOE, will take into consideration such factors as:

- Inability to reach the site due to snow cover, run-off, or impassible roads.
- Inability to inspect due to snow cover.
- Climatic cycles most likely to adversely impact the site such as periods of heavy precipitation, run-off, or wind.

- Need to acquire data to confirm aerial photography data or reports from local officials or concerned citizens.

Should the inspectors find weather conditions at the site not conducive to making a complete and thorough inspection, they will use the opportunity to observe and record changes to cover, diversion channels, and other site features. The remainder of the inspection tasks will then be rescheduled to a more favorable day.

INSPECTION TEAM

The inspection team for routine scheduled inspections will consist of a chief inspector and one or more assistants. The minimum number on a team is two; more can be assigned depending on the conditions expected at the site at the time of inspection. If only two inspectors are assigned, one will be a geotechnical or civil engineer, and the second will be an ecologist. The size of the inspection team will be determined by DOE or its contractor prior to each inspection. EPA and OEPA will be notified of the scheduled dates and times of these routine inspections so they may send representatives to accompany the inspection team.

The chief inspector will have a degree in civil engineering or soil mechanics, and at least five (5) years experience (or an equivalent amount of experience/education) in projects involving the planning and implementation of earthen structure designs. Where possible, the chief inspector will have made at least one site inspection as an assistant inspector. Assistant inspectors will have degrees and experience complementing the chief inspector's, as appropriate, for the expected site conditions. Assistants will have a minimum of three (3) years experience (or an equivalent amount of experience/education) in their field. The chief inspector and assistant(s) will be designated by the DOE or its contractor prior to each inspection.

FAMILIARIZATION WITH SITE CHARACTERISTICS

The site inspection team will become familiar with the site by reviewing this PCCI Plan, and the most recent previous inspection report.

PREPARATIONS FOR CONDUCTING SITE INSPECTIONS

After site familiarization, preparations must be made to conduct the field inspection. This requires the inspection team to:

- Obtain approval to enter adjacent property (if required).
- Assemble the equipment needed to conduct the inspection. Equipment may include such items as camera(s) and film, binoculars, tape measure, optical ranging devices, Brunton compass, photo scale stick, erasable board, additional signs, *etc.*

6.2.2 Site Inspection

The primary objective of the routine scheduled site inspection is to identify potential problems at an early stage prior to the need for significant maintenance or repairs. The inspection team will be guided by a knowledge and understanding of the processes which could adversely change the disposal facility. A fundamental part of the inspection will be the detection of change, and particularly the progressive change, over a number of years due to slow processes. The inspection checklist will include the following (Appendix B of the LMICP):

- Security of fences, gates, and locks, as well as the condition of applicable warning signs
- General health and density of the vegetative cover
- Evidence of burrowing by animals on the cover
- Presence, depth, and extent of erosion or surface cracking, indicating possible cap deterioration
- Visibly noticeable subsidence, either localized or over a large area
- Presence and extent of visible settlement, including a determination of whether observed settlement is sufficient to pond water
- Presence and extent of any leachate seeps

- Integrity of run-on and run-off control features
- Integrity of benchmarks

FIELD PROCEDURES

Adjacent Off-Site Features

A reconnaissance of the adjacent area within approximately 0.25 mi of the FCP property line (in no case shall this property line be smaller than the OSDF and its buffer zone) will usually be the first stage of a site inspection. Any evidence of a change in land use will be described. The development of inadequately engineered roads and trails may, because they concentrate run-off, lead to initiation of gully erosion; increased use in any form is likely to bring about a reduction in vegetative cover and, therefore, an acceleration of erosion. In general, any increase of human activity in the vicinity increases the probability of either inadvertent or purposeful intrusion into the site.

Evaluation will be made of whether the natural drainage courses in the immediate vicinity of the FCP OSDF pose any threat to the continued integrity of the OSDF. An "overview" observation from a prominent topographic feature will be made first, looking for indications of high water levels, areas of active erosion and sedimentation, and potential changes in channel position.

Reaches of adjacent natural drainage courses will then be walked for approximately one thousand (1000) feet and notes made of unusual or changed sediment deposits, large debris accumulations, man-made or natural constrictions, and recent or potential channel changes. Any such features will be documented with photographs which will include recognizable landmarks and known objects for scale.

Similarly, any gullies or locations which appear to be favorable to the development of gullies will be examined. The portion of the head of the gully will be the most important observation, but the shape of the cross-section will give an indication of the degree of the activity, and any interruption in the longitudinal profile may suggest rejuvenation or the presence of a local base level.

Access Roads, Fences, Gates and Signs

The FCP OSDF area is anticipated to be accessible via automobile. The condition of the on-property roads will be described, and if the need for maintenance is indicated, the location and type of work will be recommended. Roads and associated grading are frequently points of gully initiation, and near the FCP OSDF particular care will be taken in looking for evidence of recent erosion associated with the roads.

A walking traverse of the fence will be made to inspect the condition of fencing, gates, locks, and signs. Evidence of deterioration, damage, or vandalism will be noted. Any breaks in the perimeter fence or conditions which might lead to a break will be described. Signs will be evaluated for legibility and proper

location and spacing. If human intrusion is indicated, an effort will be made to determine whether it was inadvertent or purposeful, and whether it poses any threat to the integrity of the FCP OSDF. Missing, badly damaged, or defaced signs will be replaced during the inspection.

Monuments

Each survey monument, boundary marker and site marker will be examined for evidence of disturbance. If any have been disturbed, a recommendation for their re-establishment and possible protective action will be made.

Crest

The crest of the FCP OSDF is an obvious vantage point from which to examine the site and surrounding area. Observations, with the aid of binoculars, will be made in all directions from the crest of any features which are anomalous or unexpected, and which may require further inspection. These will be recorded on the checklist and on the overlay. Examples of such features that might be observed include: changes in soil color; distressed vegetation patterns; trails; and patterns of erosion.

A walk around the edge and diagonal transects of the crest will be made. Additional transects, at approximately 50-yard intervals, will be walked along the sideslopes. A search will be made for evidence of differential settling, subsidence, and cracks, if any. The patterns of cracks and evidence of subsidence will be described in an overlay and photographed. The depth and width of the cracks will be measured; notes will be made of any points at which the cracks extend below the outer erosion barrier.

Erosion of the crest is not expected to be a problem because of the low slopes. However, differential settling or sliding along the slopes may cause flow concentrations that may disturb that protection, and thus irregularities will be examined for early evidence of erosion. Evidence of wind erosion including the presence of ripple marks, partially exhumed vegetation, the presence of pedestal rocks, or obvious lag gravels will be noted. As the FCP OSDF will be vegetated as part of the closure activities, careful examination will be made to determine areas of distressed or sparse vegetation, or the presence of deep-rooted species.

Slopes

Changes to the FCP OSDF are most likely to occur in the lower portions of the slopes. Therefore, an examination at the toe of the slope will be a key part of the inspection. A traverse at the toe of the slope will be made, and one (or more, dependent on findings) additional traverse on the upper slopes will be made.

Settlement or sliding, although highly unlikely, will be apparent by the presence of bulges and depressions, cracks, and scarps. If any such features are observed, the extent of the area affected, whether the area is stable or likely to continue moving, and the nature of the movement that is occurring (settlement, planar, or rotational sliding) will be determined. Evidence of related erosion will be noted. Photographs showing detail and area perspective will be taken of any such features observed.

General health of grass cover and signs of stressed or dead grass will be noted. Grass density/coverage will be inspected. Any areas with sparse vegetation or no vegetation will be mapped and described. The presence of any woody vegetation or noxious/invasive plants will be noted.

During these inspections, the slopes will be examined for evidence of animal intrusion, burrowing, changes in vegetation, and human activity. Regularly used trails (human or animal) can concentrate run-off and encourage erosion; any such trails observed will be mapped and described. Any signs of small animal trails or burrows will be noted and photographed, and an effort will be made to tentatively identify the species. If animal burrows have been observed during previous inspection, the burrow site(s) will be examined for indications of current activity.

Erosion of vegetated slopes will first be apparent by the development of rills and rivulets, which extend only part way up the slope. If they are present, their spacing, length, depth and width will be measured and noted. Particular attention will be placed on evidence of integration of the drainage and development of a master channel. Such a development can, in a short time, evolve into a gully.

Inadvertent or casual intrusion by humans is not of great concern, but evidence of removal of the cover, extensive vandalism to signs and monuments, or the presence of well-established trails will be described in detail.

Periphery

The area adjacent to the FCP OSDF will be examined during the traverse at the toe of the slope. Features to be looked for and described, if present, include: erosion channels; accumulations of sediment; evidence of seepage; and signs of animal or human intrusion.

Diversion Channels

Each diversion channel will be walked its entire on-property length to determine whether the channels have been functioning, and can be expected to continue as designed. The channels and sideslopes will be examined for evidence of erosion or sedimentation, slides or incipient erosion channels, debris, or growing vegetation. The sideslopes of the diversion channels also will be examined for evidence of piping or burrowing by animals which could lead to sloughing of material into the channel.

The portion of the channel that has riprap (or a concrete spillway), the soil or rock material adjacent to the structure will be examined carefully for evidence of unstable conditions such as piping, or destructive currents. The riprap (or concrete) will be examined for evidence of deterioration caused by weathering or erosion.

At those portions of the channel slopes which are rock, plant colonization will be slow to develop, but will gradually occur. The inspection procedure is expected to record this gradual colonization by noting the extent of vegetation, its location, and cover density.

7.0 UNSCHEDULED INSPECTIONS

7.1 Introduction

An unscheduled inspection may be triggered by reports or information that the site integrity has been or may be compromised. The two types of unscheduled inspections anticipated - follow-up inspections, and contingency inspections - are discussed in the following subsections.

7.2 Follow-up Inspections

Follow-up inspections investigate and quantify specific problems encountered during a routine scheduled inspection, special study, or other DOE or other regulatory agency activity. They determine whether processes currently active at or near the site threaten site security or stability, and they evaluate the need for custodial maintenance and/or repair or corrective action.

Because of the standards to which the FCP OSDF has been designed, it is considered unlikely that problems will occur. However, some of the situations that may require a follow-up inspection include:

- unforeseen subsidence of the OSDF slopes or its foundation,
- gullying which has cut through or is threatening to cut through the outer cover,
- slides on the slopes of the FCP OSDF,
- seepage,
- change in the position of an adjacent stream channel,
- indications of rapid headward cutting of a nearby gully,
- cracks which extend deeply (greater than six (6) inches) into the slopes,
- presence of animal burrows on the FCP OSDF or in its diversion channels,
- invasion of trees or shrubs onto the vegetative cover of the FCP OSDF, and
- removal of some of the material from the FCP OSDF cover.

Follow-up inspections should be made by technical specialists in a discipline appropriate to the problem that has been recognized. That is, if erosion is a problem, the inspector(s) will be individuals knowledgeable in evaluating erosion, presumably a soils scientist or geomorphologist; if settlement or sliding is the problem, a geotechnical engineer; if changes in an adjacent stream, a hydrologist; if plant invasion, a botanist; and the like.

The follow-up inspection begins with an on-site visit to determine the need for definitive tests or studies. Additional visits may be scheduled if more data are needed to draw conclusions and recommend corrective action. If custodial maintenance or repair or corrective action is warranted, the DOE will notify the EPA, OEPA, appropriate local officials, and other appropriate local stakeholders.

7.2.1 Objectives and Procedures

These investigations include all additional investigations or studies necessary to evaluate the continued effectiveness of the FCP OSDF for containment of the impacted materials therein. The procedures used will be those required in the judgement of the DOE and will depend upon the nature and severity of the problem. Representative and appropriate responses for several possible problems are listed in Table 7-1.

Table 7-1
POSSIBLE PROBLEM SITUATIONS AND RESPONSES

Situation	Representative Response
Gullying on slopes	Measurement or mapping not done as part of routine scheduled inspection will be done. The primary objective is to determine the factors which led to the initiation of the gully. This might involve evaluation of the erosion barrier design parameters or site drainage, and the role of sheet erosion, rill formation, slides, or burrows. The product will be a recommendation for maintenance and preventative measures, if required.
Headward gully erosion	Procedures to determine the rate of headcutting will be established and implemented. A line of reference stakes (capped rebar) upstream from the gully head is a simple and effective method of measuring change in the position of the gully; comparison of periodic aerial photographs might also be useful. An understanding of the why dissection is occurring and any limiting conditions will be sought. The product will be a recommendation for maintenance and preventative measures, if required.
Invasive vegetation	Species identification and abundance determination will be conducted if/when large trees or shrubs invade the vegetative cover of the FEMP OSDF. If deep-rooted species are present, analysis of plant material for radionuclides and heavy metals might be done. An eradication program might be recommended; if so, cover repair would also be undertaken.
Creep	The occurrence of creep can be determined by setting rows of stakes parallel to contours on the sideslopes, which will gradually tilt downslope if creep is occurring. The rate of creep can best be determined by marking a number of rock fragments on the slopes and accurately determining their location in relation to additionally emplaced survey monuments over a number of years.
Landslides	Upon evidence of a slide or debris flow, an additional investigation will be made. The area and volume affected, the type of movement, and causal factors will be determined. Drilling, hand augering, or excavation might be necessary. The product will be a recommendation for what remedial and preventive maintenance are required.

7.2.2 Schedule and Reporting

Once a routine scheduled inspection has identified a concern, the DOE will notify the EPA and OEPA and begin a follow-up inspection by submitting a preliminary assessment of the concern and a plan for follow-up inspection. Upon review by EPA and OEPA, the DOE will implement the inspection plan. Once the follow-up inspection is completed, the DOE will recommend maintenance or other appropriate action to be performed, as needed.

7.3 Contingency Inspections

Contingency inspections are unscheduled, situation-unique inspections ordered by the DOE when it receives information indicating that site integrity has been or may be threatened. Events that could trigger contingency inspections include severe vandalism, intrusion by humans or livestock, severe rainstorms, or unusual events of nature such as tornadoes or earthquakes. Events that have caused severe damage to the OSDF or that pose an immediate threat to human health and the environment will be immediately reported to EPA and OEPA.

A preliminary inspection/assessment report of each contingency inspection triggered by such an unusual event will be submitted to the EPA and OEPA within 60 days of the initial report that damage or disruption has occurred at the FCP OSDF site. At a minimum, this report will include:

- problem/event description;
- preliminary assessment of the custodial maintenance or repair or corrective action required;
- conclusions and recommendations;
- assessment data, including field and inspection data and photograph(s); and
- names and qualifications of the field inspectors.

A copy of the report and all other data and documentation from such a contingency inspection will be maintained in the permanent site file and will be submitted to the EPA and OEPA.

After EPA and OEPA have reviewed the preliminary inspection/assessment report, the DOE will submit a corrective action plan (for those events requiring corrective action) for EPA review and approval in accordance with a schedule to be determined on a case-by case basis via consultation between DOE, EPA and OEPA. Based on the findings of these reports, the DOE will implement the corrective action.

8.0 CUSTODIAL MAINTENANCE AND CONTINGENCY REPAIR

8.1 Introduction

This section explains the procedures to be used by the DOE to determine when maintenance or contingency repairs are needed at the FCP OSDF. In general, the decision to conduct maintenance or contingency repair will be based on the results of follow-up site inspections or contingency site inspections (see Section 8.0 for both), which assess problems at the site.

This section will establish maintenance activities and their frequency, fulfilling the requirements to do so established in the appropriate regulations [Ohio hazardous waste rules OAC 3745-66-18(A) & (C) in lieu of federal hazardous waste regulations 40 CFR §§265.118(c)(2) and 264.118(b)(2)]. The following subsections address custodial maintenance of the security system (e.g., fencing, gates, signage) and the impacted materials containment system as summarized below.

SECURITY SYSTEM

- Repair/replacement of sections of fence(s) and gates due to normal wear, severe weather conditions, vandalism; and
- Replacement of warning signs for similar reasons.

IMPACTED MATERIALS CONTAINMENT SYSTEM

- Maintain the integrity and effectiveness of the final cover, including making repairs to the cap/cover as necessary to correct the effects of settling, dead vegetation, subsidence, erosion, leachate outbreaks, or other events [Ohio solid waste rule OAC 3745-27-14(A), and Ohio hazardous waste landfill rule OAC 3745-68-10 in lieu of federal hazardous waste regulation 40 CFR §265.310];
- Mowing;
- Seeding and mulching repaired areas;
- Maintaining surface water run-on and run-off drainage features to prevent erosion of, or other damage to the final cover [Ohio solid waste rule OAC 3745-27-14(A), and Ohio hazardous waste landfill rule OAC 3745-68-10 in lieu of federal hazardous waste regulation 40 CFR '265.310]; and
- Control of burrowing animals.

8.2 Conditions Requiring Maintenance or Repair Actions

Inspection reports and monitoring results will be reviewed and site conditions will be compared from inspection to inspection so that trends of changing conditions can be determined. Identifiable trends will provide a means for predicting when maintenance or repair will be needed. The DOE, in conjunction with EPA and OEPA, will decide whether or not to initiate custodial maintenance or contingency repair. After the decision to initiate maintenance or a contingency repair, a statement of work will be prepared for the work to be performed. The maintenance or repair action required to correct a site problem will be dependent upon the nature of the problem. Although the details of maintenance or repair actions that may be needed throughout the post-closure care period cannot be reliably predicted in advance, examples of conditions which may require custodial maintenance or which may trigger contingency repair are outlined in Table 8-1, along with the appropriate action(s).

When compared with contingency repair, custodial maintenance is expected to be generally less costly, smaller in scale, and more frequent in occurrence. In contrast, contingency repairs are very unlikely to be needed; however, repair costs may be more substantial due to the size of the work force and technical skills required for repairs.

8.3 Maintenance and Repair

The following subsections discuss custodial maintenance for the security system, cap and final cover, and the run-on and run-off drainage features.

8.3.1 Security System

The security system established for the FCP OSDF includes fencing, gates, locks, and warning signs. Routine custodial maintenance or repair of the security systems includes visual inspection and repair or replacement of the affected components. Possible problems include deterioration, erosion, or frost heave of fence post anchors resulting in fence damage. Normal wear, deterioration, and vandalism are also possible on fencing, gates, locks, and signs. Table 8-2 presents the inspection and maintenance activities for these features. These activities will be performed as needed as identified during the routine inspections (see Section 7.0).

8.3.2 Cap and Final Cover System

Routine custodial and preventative maintenance of the cap and final cover includes visual inspection of benchmark integrity, upkeep of the vegetative cover, general mowing, clearing of debris,

Table 8-1
EXAMPLES OF CONDITIONS THAT MAY REQUIRE CUSTODIAL MAINTENANCE OR CONTINGENCY REPAIR

Condition	Appropriate Actions
Custodial Maintenance	
1. Damage due to normal wear, severe weather conditions, or vandalism to survey control monuments.	• Re-establish survey control monument(s).
2. Growth of woody species such as deep-rooted shrubs or trees on the cover.	• Remove deep-rooted shrubs or trees from the cover. • Backfill root hole with soil, compact to re-establish grade, and re-establish the regular vegetative cover via seeding and mulching.
3. Development of animal burrows on the cover or in the diversion channels.	• Control or eradication of burrowing animals. • Backfill burrow hole with soil, compact to re-establish grade, and re-establish the regular vegetative cover via seeding and mulching. • If the problem becomes extensive, the services of a professional exterminator will be retained.
Contingency Repair	
4. Development of rills or gullies deeper than 6 inches with near vertical walls and no vegetative cover.	• Fill in gullies or rills with soil, compact to re-establish grade, and re-establish the regular vegetative cover via seeding and mulching [1,2].
5. Surface rupture where the dimensions of the cracks are lager than 1 inch wide by 10 feet long by 1 foot deep, which would indicate severe shrinkage of cover materials or differential settlement.	• Reconstruction of slope segments where slumping, mass wasting, liquefaction, or other severe events have occurred. • Root cause analysis, evaluate corrective and preventive measures/actions, implement recommended actions [1,2].
6. Instability of the slopes to the point where mass wasting or liquefaction has occurred due to earthquakes, differential settlement, or other causes.	• Reconstruction of slope segments where slumping, mass wasting, liquefaction, or other severe events have occurred. • Root cause analysis, evaluate corrective and preventive measures/actions, implement recommended actions [1,2].
7. Encroachment of stream channels or gullies into the disposal facility or its buffer area.	• Reconstruction of cover or other features [1]. • Root cause analysis, evaluate corrective and preventive measures/actions, implement recommended actions [1,2].
8. Flood damage to the site in the form of new channels, or debris deposits.	• Reconstruction of cover or other features [1]. • Root cause analysis, evaluate corrective and preventive measures/actions, implement recommended actions [1,2].
9. Intrusion by man whereby cover materials have been removed.	• Reconstruction of cover or other features [1]. • Root cause analysis evaluate corrective and preventive measures/actions, implement recommended actions [1,2].

[1] This might involve general regarding in the area to modify drainage and/or the use of temporary drainage structures and controls to reduce run-off velocities until vegetation has been re-established.
[2] Sever or repetitive occurrences might best be addressed via a corrective action (see Section 10.0).

Table 8-2
SITE SECURITY SYSTEM
INSPECTION AND MAINTENANCE ACTIVITIES

Component	Inspection Frequency	Condition	Remedy	Maintenance
Fence	Quarterly	• Damaged fence fabric or posts • Under fence erosion	• Repair or replace as necessary • Repair erosion or extend fence as necessary	• Repair or replace as necessary • Provide erosion and sedimentation control
Gates	Quarterly	• Tampering or damage to locks	• Repair or replace as necessary	• Install proper lock
Warning signs	Quarterly	• Damaged or missing warning signs	• Repair or replace as necessary	• Install or re-attach warning signs to fence or gates

NOTES:
(1) Frequencies of inspection and maintenance activities are preliminary.
(2) Site security system shall be inspected after the occurrence of major earthquakes (see Section 10.3).

removal of woody weeds and seedlings, and reseeding. These activities will be performed as needed as identified during the routine inspections (see Section 6.0). Table 8-3 presents the custodial maintenance schedule for these features. When excessive localized depression is indicated by persistent water ponding, repair will be performed.

Table 8-3
CUSTODIAL MAINTENANCE SHCEDULE

Each April/May	• Implement treatments or repairs as indicated by September inspection. • Re-seed, lime and fertilize on 3-year cycles, as needed.
Each September	• Inspect site to determine adequacy of perennial vegetative (grass) cover, and to delineate erosion problems.
Each October	• Mow area inside fence to control invasion by woody species. • Evaluate options for less frequent mowing, and/or use of herbicides, which affect only woody species.

Note that the need for, and frequency of, grass cutting will depend on the final seed mix selected for the OSDF final cover systems. Mowing shall occur at least once annually (in the late fall) at a time when the final cover system is reasonably dry. Mowing equipment shall not cause rutting or disturbance of topsoil. More frequent mowing will be specified, if needed, in a subsequent modification to this PCCI Plan (see Section 11.0).

Woody reproduction that develops on the OSDF final cover systems shall be eliminated mechanically, chemically, or by fire. Many woody species maintain the root systems when cut and rapidly resprout. The root system continues to grow through repeated cuttings and can become extensive. For this reason, chemical herbicides (spraying of individual trees and shrubs) or fire shall be preferred for woody species control, as eradication of the whole plant including the root system is a primary goal. A combination of mechanical and chemical treatment where cut stumps are treated with herbicide to prevent resprouting may also be considered. The most effective method for managing woody species vegetation will be evaluated for the OSDF by DOE based on available equipment, expertise, and cost.

Inspection/investigation, corrective maintenance, or contingency repair of the final cover may be required for one of the following reasons:

- formation of localized depressions caused by subsidence of the emplaced impacted materials;
- progressive deterioration of the cover caused by erosion; or
- destruction of a portion of the final cover by some gross physical event.

Settlement is not expected to be a significant problem as the OSDF contains little putrescible waste. In the case of localized depressions, it will likely be necessary to strip existing topsoil in the affected area and stockpile it in an adjacent area. General soil would then be used to fill the settled area to restore uniform grades in order to promote proper drainage. Topsoil would then be replaced. Where this phenomenon occurs in the upper cover, simple regrading and filling of the depression with compacted fill will likely be satisfactory. All affected areas will be reseeded and mulched immediately upon completion of repairs. The following are typical steps to repair excessive settlement:

1. When maintenance is required, the amount of soil needed should be estimated and arrangements for stockpiling or delivery should be made in advance in order to minimize the amount of time the repair area is disturbed.
2. Install temporary silt control and surface water controls.
3. Remove and stockpile topsoil and rooting soil layers. Segregate as necessary.
4. Clay can be added to the existing clay portion of the cover or the existing clay (or portions thereof) can be excavated and appropriate fill placed to bring the area to acceptable grades. Adding clay is preferred since the geosynthetic layer is not exposed and tie-in to adjacent clay is not necessary.
5. Document clay placement and compaction in accordance with the original construction quality assurance program (see *OSDF CQA Plan* [GeoSyntec, 1997c]).
6. Replace rooting and topsoil layers and revegetate. Care should be taken during final grading to assure the area is tracked perpendicular to the slope to minimize channelization of surface water.

Progressive deterioration of the cover caused by erosion will likely be addressed by reconstruction of the cover in that area and by amelioration of the erosion problem. This may involve some general regrading in the area to modify drainage and/or the use of temporary drainage structures and controls to reduce run-off velocities until vegetation has been re-established.

8.3.3 Run-on and Run-off Drainage Features

Diversion and drainage channels surrounding the OSDF function to collect run-off and divert run-on. The channels may require mowing and, from time to time, reshaping to control the run-off in a controlled manner. Vegetative growth in and around diversion channels will be maintained by periodic mowing and

clearing. Mowing of the vegetation on the same schedule as the OSDF final cover system (see Section 9.3.2) will ensure proper maintenance of the channels. Any large plants or seedlings will be removed to prevent sediment buildup and damage caused by roots. Reseeding and mulching will be performed as needed in bare areas to prevent excessive erosion.

During the routine inspections (see Section 6.0), the drainage channel(s) will be examined for erosion. Any problems identified by inspections will be repaired to conform as closely as possible to the original construction specifications and drawings. To the extent possible, appropriate measures will be taken to prevent problems from recurring.

Maintenance of the diversion channel system might be needed in areas of excessive sediment buildup, sloughing of banks, or plugging of culverts due to sediment and vegetation buildup. The grade control structures - rocks placed at an inlet, outlet, or along the length of a drainage channel - might also require maintenance for sediment and vegetation buildup. Appropriate actions will be taken to address these situations, including cleaning out and/or re-contouring channels, repair of banks, and unplugging of culverts. Table 8-4 presents the inspection and custodial maintenance schedule for these features.

Table 8-4
DRAINAGE CHANNEL SYSTEM
INSPECTION AND MAINTENANCE ACTIVITIES

Component	Inspection Frequency	Condition	Remedy	Maintenance
Drainage channels	Quarterly	• Free-flowing • Clogging by sediment or debris • Scouring, other evidence or erosion, or other damage	• None – desired condition • Remove accumulated debris or sediment • Repair damage	• None – desired condition • Remove accumulated debris or sediment • Maintain as-built or undertake corrective action
Grade control structures	Quarterly	• Free-flowing • Clogging by sediment or debris • Scouring, undermining, other evidence of erosion, or other damage	• None – desired condition • Remove accumulated debris or sediment • Repair damage	• None – desired condition • Remove accumulated debris or sediment • Remove emergent vegetation • Maintain as-built or undertake corrective action
Culverts	Quarterly	• Free-flowing • Clogging by sediment or debris • Other damage	• None – desired condition • Remove accumulated debris or sediment • Repair damage	• None – desired condition • Remove accumulated debris or sediment • Maintain as-built or undertake corrective action

NOTES:
(1) Frequencies of inspection and maintenance activities are preliminary.
(2) Drainage system shall be inspected after the occurrence of major earthquakes (see Section 11.3).

9.0 POST-CLOSURE CORRECTIVE ACTIONS

9.1 Introduction

Previous sections of this plan address maintenance or repair activities for the OSDF, which are directed at routine or custodial problems. This section will discuss at the conceptual level the steps necessary to evaluate and correct situations of more significant concern. Those steps include:

- Preliminary assessment of situation,
- Development of technical approach and work plan,
- Identification of alternatives,
- Evaluations of alternatives,
- Identification of the preferred alternative,
- Public involvement,
- Selection of corrective action/response action alternative, and
- Implementation of selected alternative.

9.2 Future Corrective Actions/Response Actions

The following points are important to keep in mind, based upon legislation and regulations in effect at the time of formulation of this plan:

- The FCP has been listed on the NPL

- "Response actions" under CERCLA are being/have been conducted at the FCP to remediate the threats (or potential threats) to public health and the environment from past releases and potential releases at the FCP

- Regardless of whether the FCP is deleted from the NPL in the future, any future corrective actions/response actions needed for the FCP also would be conducted as a "response action" under CERCLA, either as a removal action or a remedial action as appropriate to the situation.

The inspection and maintenance activities identified elsewhere throughout this plan will be the mechanism to identify, and address as appropriate, situations needing maintenance or repair activities of a custodial or routine nature. DOE will consult with EPA and OEPA whenever it identifies a situation believed worthy of more significant attention.

In that situation, the first focus will be identification of the perceived problem ("problem statement"). This should include, as possible based upon existing information, a preliminary assessment of the nature of the problem and its threats to public health and the environment. This step is intended to be a remedial or removal site evaluation, as those terms are currently used in the National Oil and Hazardous Substances Pollution Contingency Plan [NCP, 40 CFR Part 300]. The intended outcome of this first step is an assessment of the seriousness of the situation and a determination of the time-criticalness of

response action. From this, the appropriate course of CERCLA response action - removal action *vs.* remedial action - will be decided.

Regardless of removal *vs.* remedial course of action, the next step would be development of a technical approach, including identification of objectives, activities to fulfill those objectives, and associated timeframes. The embodying document would vary depending on the course of CERCLA response action identified as appropriate:

(1) if a time-critical removal action, this would be a removal action work plan;
(2) if a non-time-critical removal action, an engineering evaluation/cost analysis; and
(3) if a remedial action, a work plan for a focused feasibility study.

For the last two of the above, the process would address the remainder of the bullets stated above, which are repeated below for clarity:

- Identification of alternatives
- Evaluations of alternatives
- Identification of the preferred alternative
- Public involvement
- Selection of corrective action/response action alternative
- Implementation of selected alternative.

10.0 EMERGENCY NOTIFICATION AND REPORTING

10.1 Introduction

The FCP OSDF was designed to comply with EPA and OEPA standards with minimum maintenance and oversight during the post-closure care period. However, unforeseen events could create problems that could affect the disposal facility's ability to remain in compliance with these standards. Therefore, the DOE has requested notification from local, state and federal agencies of discoveries or reports of any purposeful intrusion or damage at the site, as well as the occurrence of earthquakes, tornadoes, or floods in the area of the disposal facility. Such notification would trigger a contingency inspection, as discussed in Section 8.3.

10.2 Agency Agreements

The DOE will negotiate/has negotiated notification agreements with the Butler and Hamilton County Sheriff's Departments, and the National Weather Service. Copies of the agreements, once completed, will be presented in an appendix to this PCCI Plan. The designated point of contact for emergency notification is 877-695-5322, which is the 24-hour phone line at DOE-GJO. The number will be recorded in these agreements and will be posted on the site signage so that the public can notify the DOE if problems are discovered.

In accordance with the agreements, the DOE (Entry #3 in Table 4-2) will be the designated facility emergency contact.

Contact lists and telephone numbers for all agencies with whom DOE has entered into agreements will be updated in conjunction with the site inspection, for inclusion in the site inspection report, and for inclusion as change pages into an appendix of this PCCI Plan as necessary.

10.3 Unusual Occurrences and Earthquakes

As the majority of the FCP OSDF is within Hamilton County, the DOE has requested the Hamilton County Sheriff's Department notify the DOE of any unusual occurrences in the area of the FCP OSDF that may affect surface or subsurface stability, as well as any reports of vandalism or unauthorized entry. DOE has also requested the same from the Butler County Sheriff's Department.

Because the FCP and its OSDF are (1) not in an active seismic zone, and (2) not constructed of or in lithified earth materials, the probability of occurrence of seismic events that could damage the OSDF, are slim. If they did occur, seismic events that could potentially damage the OSDF would manifest themselves in numerous ways in the area, the most apparent of which are:

- rupture of potable water supply lines,
- rupture of natural gas supply lines,
- rupture of natural gas transmission lines, etc.

DOE will send letters to and request acknowledgement form the Hamilton County Sheriff's Department, Butler County Sheriff's Department, and both Ross and Crosby Township police and fire officials to notify DOE-LM in the event of unauthorized human intrusion or unusual natural events. The U.S> Geological Survey National Earthquakes Information Center in Denver will be issued a letter by DOE-LM requesting notification in the event of an earthquake in the vicinity of the site. These agencies will contact DOE-LM should an event occur that might affect the control of known contaminants or the condition of the site. DOE-LM will also monitor emergency weather notification system announcements.

10.4 Meteorological Events

The National Weather Service, located |location to be determined|, has agreed to notify the DOE within |to be determined| hours of issuing a flash flood or tornado warning in Hamilton or Butler Counties, Ohio. |NOTE: these are to be determined prior to closure of the last cell of the OSDF.|

11.0 MODIFICATIONS OF POST-CLOSURE PLAN

11.1 Introduction

This section will identify conditions under which this plan may need to be modified/amended, and the mechanism/process by which to modify this plan. In accordance with appropriate regulations, modifications to the post-closure plan are allowed in recognition of the need to preserve flexibility during the post-closure care period in order to incorporate changes in conditions [Ohio hazardous waste rule OAC 3745-66-18(G), in lieu of federal hazardous waste regulations at 40 CFR §265.118(d) and (g), and §264.118(d)]. These subjects are discussed in the following subsections.

11.2 Conditions Triggering Potential Need for Modification

Currently, anticipated conditions that might trigger a need to modify this plan include, but are not necessarily limited to, the following:

- At closure of the final cell of the OSDF - In order to incorporate as-built drawings of the OSDF and its permanent features, as well as to incorporate lessons learned to that point from the inspections and performance of the OSDF cells/phases that have been covered/closed.

- Change in any of the points of contact.

- Cessation of management of leachate [federal solid waste regulation 40 CFR §258.61(a)(2)], or change in the on-site vs. off-site management of leachate treatment/disposal [OAC municipal solid waste rules 3745-27-19(K)(5) & (6)].

- Changes in post-closure inspection or maintenance activities (e.g., a more extensive erosion control program is needed).

- Reduction in inspection frequency - After the first 5-year review after completion of OSDF closure activities, and no less frequently than subsequent 5-year increments, DOE will evaluate the need to continue the pre-established inspection frequency, basing its recommendation on an evaluation of annual reports and any other reports filed for maintenance or unscheduled events.

- Changes in surrounding land use (e.g., an increase in population density surrounding the facility may warrant increased security provisions during the post-closure care period).

- Temporary suspension or permanent deletion of one or more post-closure care requirements [Ohio hazardous waste interim standards rule OAC 3745-66-18(G)].

- Extension or reduction in length of post-closure care period - The post-closure care period may be extended or reduced at the discretion of the regulatory agency(ies), based on whether an extended period is necessary, or a reduced period is sufficient, to protect public health and the environment. Changes to the duration of the post-closure care period are allowable in accordance with appropriate regulations [federal solid waste regulation 40 CFR §258.61(b), and Ohio hazardous waste rule OAC 3745-66-18(G) in lieu of federal hazardous waste regulations 40 CFR §§265.117(a)(2) and (g), and §§264.117(a)(2) and (g)]. The justification for adjustment of period must make the demonstrations required by appropriate regulations [federal solid waste regulation 40 CFR §258.61(b), and Ohio hazardous waste rule OAC 3745-66-18(G) in lieu of federal hazardous waste regulations 40 CFR §§265.118(g)(1)(I) and 264.118(g)(1)(I)].

- Implementation of a corrective action or other response action.

11.3 Mechanism

If it is determined that a modification to the plan is necessary or warranted, DOE will modify this PCCI Plan (or sections or pages as appropriate) and submit the revision to the regulatory agency(ies) (EPA and OEPA, as appropriate per the regulations and enforceable agreements in effect at that time) for review and approval/concurrence. At present, the regulations and enforceable agreements in effect require that EPA review and approve any such modification, while OEPA receives the opportunity for review but not approval. It is currently anticipated that the regulatory agency(ies) may first review and comment on such proposed modification, in which case DOE would revise the proposed modification to address the review comments and then resubmit the proposed modification for further consideration.

DOE anticipates that substantive modifications (e.g., those beyond change sheets to update points of contact, changes to specifications for photographs, changes to inspection checklists, etc.) will be accompanied by appropriate public involvement opportunities, as discussed in Section 13.0.

12.0 COMMUNITY RELATIONS

The public has played a very important role in the remediation process at the FCP and the stakeholders remain very involved in the remediation and planning for legacy management. DOE holds regularly scheduled meetings with various groups and the general public to share information on the current site status and progress. The public and other key stakeholders will remain fully involved in planning for closure and legacy management of the site, and the public meetings conducted by DOE will continue, as long as the public continues to show an active interest. Additional detail on the history of the public's involvement is included in section 5.0 of the Legacy Management Plan.

Another process involving the public is the CERCLA Five-Year review. The CECLA Five-Year reviews will focus on the protectiveness of the remedies associated with each of the five OUs. Following the review, a report will be submitted to the EPA. The public will also be able to review these reports and provided feedback. In addition, the data and documentation used for the report will be available on or near the site for public access.

Reporting to the public and stakeholders will occur on a regular basis. These requirements are further defined section 4.4 of the Legacy Management Plan and in section 5.3 of the Institutional Controls Plan.

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Attachment C

ATTACHMENT C

GROUNDWATER/LEAK DETECTION AND LEACHATE MONITORING PLAN

GROUNDWATER/LEAK DETECTION AND LEACHATE MONITORING PLAN

ON-SITE DISPOSAL FACILITY

JULY 2004

United States Department of Energy

20100-PL-009
Revision 1, Draft

SUMMARY OF PROPOSED TECHNICAL CHANGES TO THE OSDF GWLMP, REVISION 1, JULY 2004

Section/Figure	Description of Proposed Change	Driver/Technical Information
Global	The Fernald Environmental Management Project (FEMP) has been renamed to the Fernald Closure Project (FCP). The FEMP has been referred to as the Fernald site.	The name of the site has been changed to "Closure Project" to better reflect the cleanup mission. For consistency, the references to FEMP have been updated to the Fernald site.
Global	Specifications regarding the OSDF have been updated to reflect current information (e.g., cell dimensions, number of cells, references to "sump" have been updated liner penetration box, which is consider to be the most likely location for a potential leak to originate).	The previous revision of the plan was written in 1997 and cell specifications have been updated in various approved design documents.
Global (e.g., Section 1.4, References)	Referenced plans have been updated to reflect current information.	The previous revision of the plan was written in 1997. Since that time, many documents related to this plan have been written or updated.
Global (e.g., Sections 2.3 and 2.4) – eliminated Figure 4-5 from Revision 0	The previous revision reflected the Plant 6 groundwater remediation effort. As this is no longer planned, text has been updated to reflect this information. Eliminated Figure 4-5 from Revision 0: Plant 6 Pumping Scenario	The previous concentration levels of uranium in the Plant 6 have decreased; therefore, groundwater remediation in this area in no longer planned, as approved by OEPA and EPA.
Global (e.g., Section 3.0, Appendix A, and Section 5.2)	ARARs and other regulatory requirements were reviewed to determine if there were any necessary updates. Minimal changes were necessary. Examples of updates include: • Section 3.1 and Appendix A of Revision 0 referenced DOE Order 5820.2A which has been replaced by DOE Order 435.1. • Section 3.2.2 add PCBs to and remove chemical oxygen demand from the annual sampling of leachate (per OAC 3745-27-10 & 19) • Section 5.2 of Revision 0 referred to proposed OEPA Policy DDAGW-04-03-221 which has been revised to OAC 3745-27-10(D)(2)	Text has been updated where necessary to reflect current/accurate regulatory references. Primarily, the update has occurred for the following reason: It has been necessary to update the annual list for leachate sampling based on revisions to the OACs, which occurred during 2003. Specifically from review of the OACs (rule 3745-27-19), it has been identified that aroclors-1242, 1254, 1221, 1232, 1248, 1260, and 1016 need to be added to annual LCS sampling, and from OAC Appendix I of rule 3745-27-10 that chemical oxygen demand can be removed. These changes have been implemented with the 2004 annual sampling effort (Documented through the June 7, 2004 conference call between DOE, EPA, and OEPA).

SUMMARY OF PROPOSED TECHNICAL CHANGES TO THE OSDF GWLMP, REVISION 1, JULY 2004 (Continued)

Section/Figure	Description of Proposed Change	Driver/Technical Information
Section 3.2.1	The recommendation has been included in the plan that after each cell is capped, monitoring for each of the four components (i.e., LCS, LDS, horizontal till well, and Great Miami Aquifer wells) for the site-specific leak detection indicator parameters should be performed on a semiannual basis to continue to meet regulatory requirements.	The Ohio Solid Waste regulations require a semiannual sampling frequency for detection monitoring but also allow for the proposal of an alternate sampling program (OAC 3745-27-10(D)(5)(a)(ii)*(b)* and (b)(ii)*(b)*, and 3745-27-10(D)(6)). During active cell operations (more specifically post-baseline monitoring prior to cell capping), the sampling frequency for the OSDF groundwater/leak detection monitoring program will be quarterly for the indicator parameters, which exceeds the semiannual frequency requirement. After each cell is capped, it is planned that monitoring for each of the four components (i.e., LCS, LDS, horizontal till well, and Great Miami Aquifer wells) for the site-specific leak detection indicator parameters will be done on a semiannual basis to continue to meet regulatory requirements. Upon approval from EPA and OEPA, the semiannual frequency will be implemented, through a variance to the project-specific plan (PSP) provided in Appendix B. This frequency would be implemented for Cells 1, 2, and 3 which have been capped.
Section 4.0 Reorganization	Section 4.0 was slightly reorganized (Section 4.4 has become Section 4.5 and Section 4.5 has become Section 4.4) to allow for a more logical discussion of monitoring. Section 4.4 now identifies the parameter selection process and Section 4.5 identifies the sample collection process for baseline and post-baseline monitoring.	Reorganization allows for a more logical discussion of monitoring. It is important to note that the overall parameter selection process that was established and approved in Revision 0 has not been altered. Minor updates to monitoring parameters have been made based on OAC updates and on technical knowledge obtained from the 7+ years of monitoring the OSDF.

SUMMARY OF PROPOSED TECHNICAL CHANGES TO THE OSDF GWLMP, REVISION 1, JULY 2004
(Continued)

Section/Figure	Description of Proposed Change	Driver/Technical Information
Deletion of sections from Revision 0: Section 4.3.4.1 Section 4.4.3 Section 5.1.2	Delete the following sections: Section 4.3.4.1 Influence of Aquifer Restoration Activities Section 4.4.3 Future Considerations Section 5.1.2 Monitoring Needs	Section 4.3.4.1 was eliminated because the previous concentration levels of uranium in Plant 6 have decreased; therefore, groundwater remediation in this area is no longer planned, as approved by OEPA and EPA. Section 4.4.3 was removed to eliminate redundancy. Monitoring frequencies to be used during baseline and post-baseline monitoring are identified in Appendix B. Section 5.1.2 was eliminated because in the previous revision, it was identified that in order to ensure the Fernald site's NPDES permit conditions associated with the effluent from the treatment facility are met, and to ensure that introduction of the leachate as a wastestream does not interrupt or affect the proper operation of the facility, that select analytical parameters for the leachate would be monitored after leachate collection and prior to treatment. Specifically, four parameters were identified as requiring analysis to ensure that the leachate does not detrimentally affect the treatment system -- pH, TOC, nitrate/nitrite, and total dissolved solids (TDS). With the 7+ years of data collected, there has been no impact and no impact is expected in the future. The constituents will continue to be monitored: pH and TOC are site-specific leak detection indicator parameters; however, it is recommended that nitrate/nitrite and TDS, which are monitored quarterly in each cell's LCS, be monitored annually as they are per OAC 3745-27-10 & 19 Appendix I constituents. Upon approval from EPA and OEPA, nitrate/nitrite and TDS monitoring will be performed annually. A variance to the PSP provided in Appendix B will be written to implement this proposed change.
Eliminated Figure 4-3 from Revision 0	Eliminated Figure 4-3 from Revision 0: Horizontal Till Well Cross Section Instead of including a figure a reference was added in Section 1.0 of Revision 1: (Refer to Plates G-32: Liner System Details and G-44: Horizontal Till Wells and Miscellaneous Details from the January 2004 OSDF Phase V Construction Drawing Package.)	Construction drawing plates are provided to EPA and OEPA and contain a great deal of detail. Figures are not easily reproducible for inclusion in reports/plans.

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SUMMARY OF PROPOSED TECHNICAL CHANGES TO THE OSDF GWLMP, REVISION 1, JULY 2004
(Continued)

Section/Figure	Description of Proposed Change	Driver/Technical Information
Section 4.3.4.1	Revision 1, Section 4.3.4.1 Siting of the Great Miami Aquifer Monitoring Wells: In Revision 0, 20 wells were proposed for monitoring based on nine cells. For Revision 1, 18 wells have been proposed for monitoring based on eight cells.	The wells have been reduced from 20 to 18 based on the reduction in cells (i.e., 9 to 8).
Section 4.3.4.2 (Figure 4-3)	In the previous revision, modeling was performed using the SWIFT modeling code. The current groundwater model code VAM3D . The VAM3D flow model results are similar to the flow modeling results previously obtained with the SWIFT groundwater model. Monitoring wells for Cells 1 through 3 were placed based on the results from the SWIFT groundwater flow model (provided in Revision 0 of this plan) and monitoring wells from Cells 4 through 8 were placed based on the results from the VAM3D flow model. Since the modeling results were so similar Figures 4-4 and 4-5 were not updated. Note: Figure 4-3 Post Remediation Scenario has changes based on VAM3D modeling and therefore has been updated.	It is necessary to use the most current groundwater model. Note that the VAM3D flow model results are similar to the flow modeling results previously obtained with the SWIFT groundwater model from the previous revision.
Appendix B through D	Replaced Revision 0 Appendix B: Sampling and Analysis Requirements Appendix C: Quality Assurance/Quality Control Appendix D: Data Management Plan With Appendix B and Appendix C: the PSP and Data Quality Objectives (DQO)	The PSP and DQO contain the same information that was in the previous appendices. The PSP and DQO are used by the field technicians. By replacing the other appendices from Revision 0 with the PSP and DQO, redundancy is eliminated.
Appendix B	Revision 1: Appendix B includes all the monitoring updates that have been approved by the EPA and OEPA per the technical memorandum for Cells 1 through 3, per annual site environmental reports, through weekly conference calls and per variances.	Updates to monitoring need to be reflected in the PSP.

GROUNDWATER/LEAK DETECTION AND LEACHATE MONITORING PLAN

ON-SITE DISPOSAL FACILITY

JULY 2004

United States Department of Energy

Draft, Revision 1

TABLE OF CONTENTS

Section — Page

List of Tables iii

List of Figures iii

List of Acronyms iv

1.0 Introduction 1-1
- 1.1 Overview of the On-Site Disposal Facility 1-2
- 1.2 Program Overview 1-2
- 1.3 Plan Organization 1-5
- 1.4 Related Plans 1-5

2.0 OSDF Area Geology and Hydrogeology 2-1
- 2.1 Introduction 2-1
- 2.2 OSDF Area Geology 2-1
- 2.3 Hydrogeologic Conditions 2-3
- 2.4 Existing Contamination 2-6

3.0 Regulatory Analysis and Strategy 3-1
- 3.1 Regulatory Analysis Process and Results 3-1
- 3.2 OSDF Monitoring Regulatory Compliance Strategy 3-2
  - 3.2.1 Leak Detection Monitoring Compliance Strategy 3-3
    - 3.2.1.1 Alternate Well Placement 3-3
    - 3.2.1.2 Alternate Statistical Analysis 3-4
    - 3.2.1.3 Alternate Parameter Lists 3-4
    - 3.2.1.4 Alternate Sampling Frequency 3-5
  - 3.2.2 Leachate Monitoring Compliance Strategy 3-6

4.0 Leak Detection Monitoring Program 4-1
- 4.1 Introduction 4-1
- 4.2 Monitoring Objectives 4-2
- 4.3 Leak Detection Monitoring Program Elements 4-3
  - 4.3.1 Overview 4-3
  - 4.3.2 Monitoring the Engineered Layers within the OSDF 4-5
    - 4.3.2.1 Leachate Collection System (LCS) 4-6
    - 4.3.2.2 Leak Detection System (LDS) 4-6
  - 4.3.3 Monitoring the Perched Groundwater 4-7
  - 4.3.4 Monitoring the Great Miami Aquifer 4-9
    - 4.3.4.1 Siting of the Great Miami Aquifer Monitoring Wells 4-9
    - 4.3.4.2 VAM3D Flow Model and SWIFT Transport Model Evaluation of Well Locations 4-9
- 4.4 Selection Process for Site-Specific Leak Detection Indicator Parameters 4-12
  - 4.4.1 Guidelines for Site-Specific Monitoring Parameter Selection 4-15
  - 4.4.2 Initial Leak Detection Monitoring Parameters List 4-17
    - 4.4.2.1 Primary Parameters 4-17
      - 4.4.2.1.1 Groundwater Pathway COCs 4-20
      - 4.4.2.1.2 RCRA Constituents 4-22
      - 4.4.2.1.3 Selected Primary Parameters 4-23
    - 4.4.2.2 Supplemental Indicator Parameters 4-25

TABLE OF CONTENTS
(Continued)

Section — Page

4.4.3 Parameter List Modifications 4-26
4.4.3.1 Eliminating Monitoring Parameters 4-27
4.4.3.2 Adding Monitoring Parameters 4-28
4.5 Leak Detection Sample Collection 4-29
4.5.1 Establishment of Baseline Conditions 4-29
4.5.2 Post-Baseline Monitoring (During Active Cell Operations and After Cells are Capped) 4-30
4.5.2.1 Flow Monitoring in the LCS and LDS 4-31
4.5.2.2 Water Quality Monitoring in the LCS and LDS 4-34
4.5.2.3 Water Quality Monitoring of the Perched Groundwater and Great Miami Aquifer 4-34
4.6 Leak Detection Data Evaluation Process 4-35
4.6.1 Trend Analysis 4-35
4.6.2 Correlation of Monitoring Data 4-36

5.0 Leachate Management Monitoring Program 5-1
5.1 Leachate Treatment and Discharge 5-1
5.2 Confirmation of Leak Detection Indicator Parameters 5-2
5.3 Future Considerations 5-3

6.0 Reporting 6-1
6.1 Routine Reporting Responsibilities 6-1
6.2 Notifications and Response Actions 6-2

7.0 References 7-1

APPENDICES

Appendix A OSDF ARARs and Other Regulatory Requirements

Appendix B Project-Specific Plan for the On-Site Disposal Facility Monitoring Program

Appendix C Fernald Closure Project Data Quality Objectives, Monitoring Program for the On-Site Disposal Facility

LIST OF TABLES

Table 4-1 Regulatory Criteria for Alternate Parameter List 4-16
Table 4-2 WAC for Groundwater Pathway COCs 4-21
Table 4-3 Expected Maximum COC Concentrations in the OSDF 4-22
Table 4-4 WAC for Additional RCRA Constituents 4-24
Table 4-5 Proposed Primary Parameters List 4-25
Table 6-1 Notification and Response Actions 6-3

LIST OF FIGURES

Figure 4-1 On-site Disposal Facility Liner System with HTW at the Drainage Corridor 4-4
Figure 4-2 OSDF Well Locations 4-8
Figure 4-3 Post-Remediation Scenario 4-11
Figure 4-4 SWIFT Modeling with Uranium Loading - 55 Years 4-13
Figure 4-5 SWIFT Modeling with Technetium-99 Loading - 30 Years 4-14
Figure 4-6 Groundwater/Leak Detection Parameter Selection Process 4-19

LIST OF ACRONYMS

ARARs	applicable or relevant and appropriate requirements
AWWT	advanced wastewater treatment facility
CAWWT	converted advanced wastewater treatment facility
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
cm/sec	centimeters per second
COC	constituent of concern
CPTs	cone penetrometer tests
D&D	decontamination and demolition
DOE	U.S. Department of Energy
EPLTS	Enhanced Permanent Leachate Transmission System
EPA	U.S. Environmental Protection Agency
FCP	Fernald Closure Project
FRL	final remediation level
FS	feasibility study
gpm	gallons per minute
HDPE	high-density polyethylene
HTQ	horizontal till well
IEMP	Integrated Environmental Monitoring Plan
LCS	leachate collection system
LDS	leak detection system
µg/L	micrograms per liter
mg/kg	milligrams per kilograms
mg/L	milligrams per liter
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
OAC	Ohio Administrative Code
OEPA	Ohio Environmental Protection Agency
OSDF	on-site disposal facility
PCBs	polychorinated biphenyls
pCi/g	picoCuries per gram
pCi/L	picoCuries per liter
PCS	permanent lift station
RA	remedial action
RCRA	Resource Conservation and Recovery Act
RI	remedial investigation
RI/FS	remedial investigation/feasibility study
SCQ	Sitewide CERCLA Quality Assurance Project Plan
SDWA	Safe Drinking Water Act
SWIFT	Sandia Waste Isolation Flow and Transport
TOC	total organic carbon
TOX	total organic halogens
UMTRCA	Uranium Mill Tailings Radiation Control Act
VAM3D	Variably Saturated Analysis Model in 3 Dimensions
WAC	Waste Acceptance Criteria

1.0 INTRODUCTION

This document presents the groundwater/leak detection and leachate management monitoring program for the on-site disposal facility (OSDF) at the U. S. Department of Energy's (DOE's) Fernald Closure Project (FCP). This plan is a support plan for the OSDF that is required by the Remedial Action (RA) Work Plan for the OSDF (DOE 1996). Revision 0 of this plan was issued in August 1997 (DOE 1997). Revision 1 is being issued at this time due to the:

- Completion and approval by the U.S. Environmental Protection Agency (EPA) and Ohio Environmental Protection Agency (OEPA) of the Technical Memorandum for the On-Site Disposal Facility Cells 1, 2, and 3 Baseline Groundwater Conditions (DOE 2002)
- Experience/technical knowledge gained over the last 7+ years of monitoring and operating under Revision 0
- Inclusion of this plan in the Legacy Management and Institutional Control Plan (DOE 2004a).

As is discussed in detail in this document, the monitoring program is comprised of two primary elements: (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 leak-detection monitoring layers (comprised of a leak detection layer inside the facility, and two groundwater zones occurring in the subsurface below the facility) will be used collectively to assess the existence of leakage from the facility and to satisfy OSDF groundwater monitoring requirements. The two groundwater zones in the monitoring plan are the Great Miami Aquifer (a water table found at depths ranging from 40 to 90 feet in the vicinity of the OSDF), and the perched groundwater residing in the glacial till overlying the Great Miami Aquifer.

This OSDF monitoring plan has been developed to meet the regulatory requirements for groundwater detection monitoring in both the Great Miami Aquifer and the perched groundwater system. These detection monitoring requirements constitute the first tier of a three-tiered detection, assessment, and corrective action monitoring strategy required for engineered disposal facilities. Consistent with this three-tiered requirement, if it is determined from detection monitoring that a leachate leak from the OSDF into the underlying natural hydrogeologic environment has occurred, follow-up groundwater quality assessment and corrective action monitoring plans will be developed and implemented as necessary. Conversely, if the detection monitoring continues to successfully demonstrate that leachate leaks are not of concern (i.e., the facility is performing as designed), then the monitoring program will remain in the first-tier "detection mode" and the need for the follow-up groundwater quality assessment and/or corrective action monitoring plans will not be triggered.

1.1 OVERVIEW OF THE ON-SITE DISPOSAL FACILITY

The OSDF will ultimately provide on-site disposal capacity for an estimated 2.9 million cubic yards of contaminated soil and debris generated through the Fernald site's environmental restoration and building decontamination and demolition (D&D) activities. The OSDF footprint (including the capped area extending beyond the disposal area) is anticipated to occupy approximately 80 acres of the 1050-acre Fernald site. This area will be dedicated to disposal and will remain under federal administrative control following the completion of the Fernald site's cleanup mission. The OSDF is located along the northeast portion of the Fernald site and, as required by the Operable Unit 2, 3, and 5 Records of Decision, is situated over the "best available geology" at the Fernald site to take maximum advantage of the protective hydrogeologic features of the glacial till above the Great Miami Aquifer.

The OSDF is being constructed in phases, with eight individual cells planned, plus a ninth contingency cell, if needed. Each individual cell is planned to be 700 feet by 400 feet, or 280,000 square feet (6.4 acres). Each individual cell is being constructed with a leachate collection system (LCS) to collect infiltrating rainwater (and storm water runoff during waste placement) and prevent it from entering the underlying environment. Other engineered features include a multi-layer composite liner system; a leak detection system (LDS) positioned beneath the primary liner; and a multi-layer composite cover placed over each cell following the completion of waste placement activities. The LCS and LDS layers drain to the west to a point where the collected fluids will be removed from each layer for treatment (henceforth, these LCS and LDS collection points will be referred to as the liner penetration box). The liner penetration box is the point where the LCS and LDS pipes penetrate the liner system and therefore represents the lowest elevation area of each cell. Since the liner penetration boxes exist the cells at the lowest area of the liner system, they are the most likely location for a potential leak to originate. (Refer to Plates G-32: Liner System Details and G-44: Horizontal Till Wells and Miscellaneous Details from the January 2004 OSDF Phase V Construction Drawing Package.)

1.2 PROGRAM OVERVIEW

The OSDF monitoring plan was developed by reviewing the pertinent regulatory requirements for detection monitoring and translating those requirements into site-specific monitoring elements (e.g., designation of monitoring zones, monitoring station locations, sampling frequency, and establishment of analytical parameters). As the remaining sections of this plan will discuss, the OSDF monitoring strategy is responsive to monitoring needs both during the active remediation of the site and during the post-remediation period when restoration activities at the Fernald site are complete. Similarly, the strategy recognizes the various operating phases of the OSDF including the periods before, during,

and after waste placement when the final cap is in place, at which point the facility will enter a long-term post-closure care mode.

The plan also considers current hydrogeologic and contaminant conditions in the glacial till and Great Miami Aquifer beneath the facility. Pre-existing contamination in the perched groundwater system and the Great Miami Aquifer, the variable nature of the geology and hydrogeology of the clay-rich glacial deposits, and the influence of aquifer restoration activities in the Great Miami Aquifer add complexity to the development of a groundwater monitoring program. The Great Miami Aquifer will be undergoing restoration during the same overall time period that the OSDF will be actively accepting waste for disposal. The aquifer restoration is a pump-and-treat operation. The closest pumping wells are approximately 2,000 feet upgradient of the OSDF footprint.

Available site-specific information that has been generated from more than 15 years of detailed site characterization efforts including geology and hydrogeology, results of detailed contaminant fate and transport modeling, OSDF construction activities, and monitoring results from the OSDF program and Integrated Environmental Monitoring Plan (IEMP) all were used to develop the monitoring strategy and to determine monitoring locations. The overall strategy employs a four-layer vertical slice/trend analysis approach to independently monitor the potential for leachate generation and leakage from each of the individual disposal cells comprising the facility. As part of this strategy, "baseline" conditions for each cell is being established to facilitate trend analysis from data generated for each of the monitoring stations over time. This baseline will help define existing conditions in both the perched groundwater and the Great Miami Aquifer in the immediate vicinity of the facility.

This plan focuses primarily on the monitoring needs associated with active cell operations and detection monitoring or post-closure monitoring. Future amendments to the plan will be prepared to address program modifications, if changes to the monitoring program are necessary. An in-depth review of program needs is also envisioned at the completion of Great Miami Aquifer restoration activities. Prior to the closure of the cells and the completion of the aquifer restoration activities, the data comparisons will focus on shorter term "interim" leakage effects that might potentially occur during active cell operations. The initial baseline will enhance the ability to conduct the interim comparisons until the facility enters its final long-term, post-closure mode and aquifer restoration activities are complete.

Throughout this process, the analytical results and trend analyses for all three leak detection monitoring layers (the LDS, perched groundwater, and the Great Miami Aquifer) and the LCS will be compared with one another to evaluate the overall performance of each cell and to determine whether a release from the

facility has occurred. In concert with the groundwater monitoring component of the program, the leachate characterization and tracking component will provide for the monitoring of leachate concentrations and flows in the LCS and LDS to support leachate management and treatment decisions.

As part of this effort, contaminant concentrations in the leachate (if present) collected from the LCS and the water from the LDS (if present) will be compared to one another and to the groundwater concentrations in the perched groundwater and Great Miami Aquifer monitoring systems. Additionally, trend analysis of the LCS and LDS flow monitoring measurements will be conducted in order to provide an indication of changes in trends in containment system performance far enough in advance to allow application of appropriate follow-up inspection and corrective action measures as necessary.

During the development of this plan, EPA and OEPA identified the need to monitor the potential for leachate leakage from the OSDF at its first point of entry into the natural hydrogeologic environment (rather than relying on Great Miami Aquifer groundwater monitoring alone). This led to the decision to install horizontal monitoring wells in the glacial till directly beneath the liner penetration box of the LCS and LDS layers in each cell. The subsurface area beneath the liner penetration box provides the best opportunity to monitor for an initial leak into the subsurface environment, should such a leak occur. As a result of the low transmissive properties of the glacial till and the discontinuous nature of the perched groundwater system in the till, it may not be possible to collect fluids routinely from the horizontal wells. In view of this limitation, DOE, EPA, and OEPA concurred that the placement of the horizontal wells beneath the liner penetration boxes represents the most feasible site-specific approach to monitor for first-entry leakage from the facility to the environment, and this approach provides adequate and appropriate early warning detection capabilities for this site-specific setting.

The OSDF groundwater monitoring plan has been implemented as a project-specific plan (refer to Appendix B), with the results presented for EPA and OEPA review as part of the comprehensive IEMP. The IEMP provides a consolidated reporting mechanism for all of the individual environmental regulatory compliance monitoring activities including the data and findings from the OSDF groundwater monitoring plan. Incorporating the OSDF data into the IEMP will maintain the continued commitment to an effective remediation-focused environmental surveillance monitoring program. Once the environmental remediation requirements have been completed and the site is successfully removed from the Superfund National Priorities List (NPL), the monitoring activity for the OSDF (which will be the last remaining facility in place at the site) will continue in accordance with applicable regulatory monitoring and reporting requirements.

1.3 PLAN ORGANIZATION

The remainder of this plan is organized as follows:

- A summary of the geology and hydrogeology in the immediate area of the OSDF is provided in Section 2.0.
- A regulatory analysis and strategy for OSDF monitoring is provided in Section 3.0.
- The OSDF leak detection monitoring program is provided in Section 4.0, including a description of program elements, monitoring frequencies, selection of analytical parameters, and data evaluation.
- The OSDF leachate management monitoring program, which will be used to support leachate management decisions, is provided in Section 5.0.
- Reporting requirements and notifications are provided in Section 6.0.
- References are provided in Section 7.0.

The appendices that support the plan are:

- Appendix A – OSDF Applicable or Relevant and Appropriate Requirements (ARARs) and Other Regulatory Requirements
- Appendix B – Project-Specific Plan for the On-Site Disposal Facility Monitoring Program
- Appendix C – Fernald Closure Project Data Quality Objectives, Monitoring Program for the On-Site Disposal Facility Program

1.4 RELATED PLANS

Several other remedial action plans have been prepared for the OSDF, or for the Fernald site as a whole, containing information relevant to this plan. These other plans are listed below along with a brief statement of their relationship to this plan:

- OSDF Systems Plan (DOE 2001b): describes the inspection and maintenance for the LCS and LDS prior to closure of the OSDF.
- OSDF Design Package (GeoSyntec 1996a/b) and subsequent design and construction drawing packages: provide the overall approved design for each cell of the OSDF.
- OSDF Post-Closure Care and Inspection Plan (DOE 2004b): describes the post closure care and inspection for the LCS and LDS, and summarizes at the conceptual level corrective actions/response actions.
- OSDF Borrow Area Management and Restoration Plan (GeoSyntec 2001a): describes management of borrow soils for use to construct the OSDF and planning for end state after soils have been excavated.

- OSDF Surface Water Management and Erosion Control Plan (GeoSyntec 2001c): describes soil erosion control to minimize sediment loss.

- OSDF Construction Quality Assurance Plan (GeoSyntec 2001b): describes quality assurance methods and testing to certify the construction of the OSDF.

- OSDF Impacted Materials Placement Plan (GeoSyntec 2004): describes the categories of material, prohibited items, and placement methods for impacted material placement in the cells.

- Project- Specific Plan for Installation of the OSDF Great Miami Aquifer Wells (DOE 2001a): describes the installation placement of Great Miami Aquifer wells.

- Technical Memorandum for the OSDF Cells 1, 2, and 3 Baseline Groundwater Conditions (DOE 2002): describes baseline conditions for Cells 1, 2, and 3.

- IEMP, Revision 3 (DOE 2003a): describes Fernald site environmental monitoring efforts and the requirements for reporting on environmental monitoring, including the data collected from this OSDF monitoring program.

2.0 OSDF AREA GEOLOGY AND HYDROGEOLOGY

2.1 INTRODUCTION

The Operable Units 2, 3, and 5 Records of Decision contain requirements that the OSDF be located in an area at the Fernald site that takes maximum advantage of available geologic and hydrogeologic conditions to further reduce the potential for contaminant migration from the facility. To identify the preferred OSDF location, a detailed predesign geotechnical and hydrogeologic investigation was conducted as a supplement to the sitewide characterization efforts contained in the Operable Unit 5 Remedial Investigation (RI) Report (DOE 1995c). The detailed findings of the predesign investigation are documented in the Pre-Design Investigation and Site Selection Report for the OSDF (DOE 1995b). As documented in the site selection report, a final site location along the eastern margin of the Fernald site was selected to satisfy the Records of Decision and other regulatory-based siting requirements.

The following sections summarize the principal geologic, hydrogeologic, and subsurface contaminant conditions in the OSDF site area that have a direct bearing on the development of the leak detection and groundwater monitoring strategy for the facility. For more detailed information, the reader is referred to the Predesign Investigation and Site Selection Report and the Operable Unit 5 RI Report.

2.2 OSDF AREA GEOLOGY

The OSDF, inclusive of its final cap configuration, is expected to occupy an area of approximately 80 acres along the northeastern area of the Fernald site. The facility is oriented in a north-to-south direction with ultimate dimensions at closure expected to be 3600 feet by 1000 feet. The edge of the facility (i.e., the toe of the cap system) is set back from the eastern property line by approximately 100 feet. The subsurface conditions in the immediate area of the selected OSDF location were characterized through the following field and laboratory activities:

Test Borings	Fifty-four borings were drilled in the immediate vicinity of the OSDF to obtain geotechnical soil samples and characterize underlying geology.
Monitoring Wells	Fifty-one groundwater monitoring wells were installed in the general vicinity of the OSDF from which water level, pre-existing groundwater contaminant concentration data, and lithology data have been obtained.
Geotechnical Tests	Key geotechnical tests (i.e., Atterberg limits, water content measurements, and permeability tests) were performed on subsurface geologic samples, including 116 sieve analyses to determine grain size.

Lysimeter Installation	Eight lysimeters were installed in the OSDF site area to determine the nature and concentration of uranium in the vadose zone of the glacial till and the unsaturated Great Miami Aquifer.
Slug Tests	Twenty-four slug tests were performed to assess the hydraulic characteristics of the perched groundwater system.
Water Level Monitoring	Water levels obtained from the perched groundwater and the Great Miami Aquifer wells were used to determine hydraulic gradients and flow directions.
Soil Analyses	Soil samples collected during the RI and the Predesign Investigation were analyzed for uranium and other constituents of concern to determine pre-existing contaminant levels in the subsurface beneath the OSDF.
Groundwater Flowmeter Study	Twenty-two flowmeter readings were obtained in the perched groundwater in the OSDF site area.
K_d Study	A distribution coefficient (K_d) study was performed to determine how uranium will partition itself between groundwater and soil in the OSDF site area.
Cone Penetrometer Tests (CPTs)	Eighty-eight CPTs were conducted in the OSDF site area to aid in making subsurface lithologic interpretations.

The information obtained through these activities, coupled with the sitewide interpretations gained through the Operable Unit 5 RI, formed the basis for the interpretations of subsurface conditions in the vicinity of the OSDF site.

In general, the OSDF site is situated on glacial till underlain by sand and gravel deposits that comprise the Great Miami Aquifer, which is designated as a sole-source aquifer under the Safe Drinking Water Act (SDWA). The Great Miami Aquifer is a high-yield aquifer (i.e., wells completed in some areas of the aquifer yield greater than 500 gallons of water per minute) and supplies a significant amount of potable and industrial water to people located in Butler and Hamilton counties.

The glacial till ranges in thickness from approximately 20 to 60 feet in the immediate vicinity of the OSDF. Based on the results of 116 sieve and hydrometer analyses, the glacial till can be characterized as a dense, heterogeneous sandy lean clay, with occasional discontinuous interbedded sand and gravel lenses. The glacial till can be further divided into an upper brown clay layer and a lower gray clay layer. The brown clay layer is more weathered, contains a greater abundance of desiccation fractures compared with the underlying gray clay layer, and has a higher incidence of interbedded sand and gravel lenses. In the eastern portions of the Fernald site, the gray clay ranges in thickness from approximately 15 to 42 feet, and the brown clay ranges from approximately 8 to 15 feet. As indicated by the Operable Unit 5

RI, the gray clay is the most uniform and least permeable and, therefore, the most protective geologic layer found above the Great Miami Aquifer across the site.

As a follow-up to the Operable Unit 5 RI, one of the primary objectives of the *Pre-Design Investigation and Site Selection Report for the On-Site Disposal Facility* was to identify the location where the thickest laterally persistent gray clay layer is present that contains the least amount of interbedded coarse granular material and which allows regulatory-based siting requirements (such as property-line and other geographic setbacks) to be met. The selected location for the OSDF has a minimum thickness of gray till of approximately 15 feet and an average thickness of approximately 30 feet. The percentage of interbedded sands and gravels in the gray till in this area is approximately 4 percent.

Beneath the glacial till layer, the sand and gravel deposits comprising the Great Miami Aquifer are approximately 175 feet thick. For RI characterization and monitoring purposes, the Great Miami Aquifer deposits have been divided into three geologic zones: the uppermost zone, represented by the Fernald site's Type 2 monitoring wells; the middle zone, represented by the Type 3 monitoring wells; and the lowermost zone, represented by the Type 4 monitoring wells. The sand and gravel deposits comprising the aquifer are extensive and, at the regional scale, occupy a land area of more than 970,000 acres.

Beneath the Great Miami Aquifer deposits, shale and limestone bedrock is encountered at a total depth of approximately 200 feet beneath the planned OSDF site. Regional studies by the Geological Survey of Ohio indicate the shale and limestone bedrock is approximately 330 feet thick in the Fernald site area (Fenneman 1916).

2.3 HYDROGEOLOGIC CONDITIONS

The Fernald site has two distinctive bodies of groundwater that have been extensively characterized through the remedial investigation/feasibility study (RI/FS) process and the Predesign Investigation: the Great Miami Aquifer and the perched groundwater found within the overlying glacial till. The discontinuous sand and sand/gravel lenses found within the glacial till can provide water to a pumping well because the deposits are more permeable than the surrounding, clay-rich glacial till. The entire section of glacial till is believed to be saturated or nearly saturated with groundwater. An unsaturated sand and gravel zone approximately 20 to 30 feet thick separates the base of the glacial till from the regional water table in the Great Miami Aquifer. Depending on local weather patterns and rainfall, the

water table in the Great Miami Aquifer fluctuates approximately 6 feet yearly within the unsaturated zone separating the two groundwater systems in the area of the OSDF.

The Great Miami Aquifer is a classic example of an unconfined buried valley aquifer. The depth to water in the aquifer in the vicinity of the OSDF ranges from 40 to 90 feet below the ground surface. Based on five years of water level measurements collected prior to the beginning of the pump-and-treat remedy (1988 through 1993), the groundwater flow direction in the aquifer in this area is from west to east (Operable Unit 5 RI Report, Figure 3-50). Groundwater velocity in the area of the OSDF is approximately 451 feet per year, based on an average hydraulic gradient of approximately 0.0008 (Operable Unit 5 RI, page 3-61); an average hydraulic conductivity of approximately 463 feet per day (average of three pumping tests); and an effective porosity of 30 percent. Using the representative distribution coefficient (K_d) for uranium of 1.78 liters per kilogram determined through the RI/FS process, the retardation factor for uranium movement in the Great Miami Aquifer is approximately 12. At a retardation factor of 12, the uranium moves approximately 1/12 as fast as the water or approximately 37.6 feet per year. More recent studies conducted by Sandia National Laboratories indicate that the K_d is higher than 1.78. A higher K_d results in a higher retardation factor and indicates slower migration times.

Perched groundwater is present above the unsaturated zone of the Great Miami Aquifer within the glacial till. Overall the till exhibits between 90 to 100 percent saturation (close to field capacity) and has the general properties of an aquitard. When the till reaches field capacity, it has the capability to release groundwater downward under a unit vertical hydraulic gradient into the underlying unsaturated zone of the Great Miami Aquifer. Eventually, this downward-moving groundwater will enter the saturated portion of the Great Miami Aquifer as recharge. Depths to perched groundwater in the till are generally 6 feet or less in the eastern portion of the Fernald site in the area of the OSDF.

Although the till is generally saturated, there are no identified suitably thick or laterally continuous coarse-grained zones beneath the OSDF that can facilitate implementation of a comprehensive, interlinked (i.e., up- and downgradient monitoring points) perched groundwater monitoring system. The current amount of saturation in the till is expected to be reduced even further in the future, once the cap and underlying liners of the OSDF are in place; they will serve as local hydraulic barriers to further reduce the volume of infiltrating moisture within the OSDF footprint.

Slug test data from 24 perched groundwater wells (Type 1 monitoring wells) indicate that the average horizontal hydraulic conductivity for wells screened across the brown and gray clay layer interface

is 6.30 x 10^{-6} centimeters per second (cm/sec). The gray clay layer beneath the brown clay is the least permeable layer above the Great Miami Aquifer. Laboratory hydraulic conductivities conducted on samples collected from this layer indicate measured values ranging from 9.53 x 10^{-9} cm/sec to 5.83 x 10^{-8} cm/sec. Other laboratory and field measurements indicate the till has an effective porosity of 4 to 10 percent, and a representative bulk density of 1.85 grams per cubic centimeter. The discontinuous nature of the perched water in the glacial till does not facilitate the measurement of a continuous water table gradient in the OSDF site area.

Model calibration studies conducted during the Operable Unit 5 RI/FS indicate average vertical groundwater flow rates through the glacial till (including the gray clay layer) to be approximately 6 inches per year. The time it takes a contaminant to move through the glacial till and break through into the Great Miami Aquifer is controlled by the thickness of gray clay present in the till, the groundwater infiltration rate through the gray clay, and the retardation properties of the gray clay. In the OSDF site area, modeled breakthrough travel times for uranium, the Fernald site's predominant contaminant, range from approximately 210 years (to have a 20 micrograms per liter [µg/L] concentration in the aquifer) to 260 years (to have 1 percent of the source concentration). These breakthrough times were calculated using a retardation factor of 165 for the gray clay, not taking any credit for movement through the brown clay, and not including any retardation in the unsaturated Great Miami Aquifer sand and gravel. The modeled breakthrough travel time for 1 percent of a technetium source, the Fernald site's most mobile contaminant, is approximately 3.6 years. This breakthrough time was calculated using a retardation factor of 2.29 for the gray clay, not taking any credit for movement through the brown clay, and not including any retardation in the unsaturated Great Miami Aquifer sand and gravel. This modeling strategy was used in the Operable Unit 5 Feasibility Study (FS) to calculate Waste Acceptance Criteria (WAC) for the OSDF.

The extensive presence of low permeability lean sandy clay throughout the till matrix and the discontinuous nature of the coarser grained lenses are the dominant factors controlling the rate at which fluids can migrate through the more permeable portions of till, either vertically or laterally.

Unlike conditions in the Great Miami Aquifer, the up- and downgradient directions of perched groundwater flow are difficult to assign at the local scale. Groundwater flow meter readings from 22 wells taken during the Predesign Investigation indicate that the horizontal flow directions vary abruptly from well to well, with no discernable consistent patterns. Consequently, horizontal flow regimes are interpreted to be very localized in nature (perhaps on the order of tens to hundreds of feet in

length) and not laterally persistent due to the discontinuous nature of the interbedded coarse grained lenses. Taken collectively, the water levels obtained during the Operable Unit 5 RI indicate that if an area gradient were present, it would range from between 0.008 to 0.015.

Model calibration studies conducted during the Operable Unit 5 RI/FS indicate that vertical flow tends to dominate in the glacial till because of several factors: (1) the steep vertical hydraulic gradients across the till—which are at or near unity—compared to the small localized lateral hydraulic gradients which collectively indicate a gradient that is much less than unity (0.008 to 0.015); (2) the laterally discontinuous nature of the coarse grained lenses in the till; and (3) the shorter overall flowpath distance in the vertical dimension for the Fernald site (60 feet compared to hundreds or thousands of feet in the horizontal) before a potential discharge point for the glacial till groundwater is reached.

It can be generally interpreted from this information that if a leachate leak were able to exit through the OSDF liner system, it would be expected to migrate vertically towards the Great Miami Aquifer (although some localized "stair step" motion laterally may also be expected to take place in route). The exact pathway(s) that a hypothetical leachate leak from the facility would take is difficult to determine, but it is clear that an effective monitoring program needs to consider both the most likely point of entry of the leak into the subsurface environment beneath the facility and the ultimate arrival of the leak at the Great Miami Aquifer.

2.4 EXISTING CONTAMINATION

In the immediate vicinity of the OSDF, existing contaminant concentrations are present above background levels in surface and subsurface soil, the perched groundwater, and the Great Miami Aquifer. The nature and extent of contamination in these three media were documented in the Operable Unit 5 RI Report and preliminary remediation levels were developed for the FCP's environmental media in the Operable Unit 5 FS (DOE 1995a). Final remediation levels (FRLs) were documented in the Operable Unit 5 Record of Decision.

Based on the data presented in the Operable Unit 5 RI Report, only the surface soil (to a depth of approximately 6 inches) was considered to be contaminated above FRLs within the actual boundaries of the OSDF. The remaining media within the OSDF footprint were contaminated above background, but generally below FRLs. An area of deep soil excavation to address deep soil and perched groundwater contamination was completed outside the OSDF footprint at the Fernald site's sewage treatment plant, located immediately east of the OSDF. Additionally, in the spring of 2004 an area due west of Cell 8 was

excavated to approximately 6 feet due to contamination just above the soil FRLs. This area was the closest excavation necessary to address soil FRL exceedances that were deeper than 6 inches.

The Plant 6 area is located approximately 300 feet west of the OSDF. During the remedial investigation, a uranium plume was detected in this area. Direct-push sampling conducted in 2000 and 2001, in support of the Design for Remediation of the Great Miami Aquifer in the Waste Storage and Plant 6 areas, indicated that the uranium plume in the Plant 6 area was no longer present. It is believed that the uranium plume dissipated to concentrations below the FRL as a result of the shutdown of plant operations in the late 1980s and the pumping of highly contaminated perched water as part of the Perched Water Removal Action #1 in the early 1990s. Because a total uranium plume with concentrations above the groundwater FRL was no longer present in the Plant 6 area at the time of the design, a restoration module for the Plant 6 area became unnecessary and was no longer planned.

Continued routine groundwater monitoring for the IEMP in the Plant 6 area detected groundwater FRL exceedances for uranium in 2002 and the first part of 2003, but uranium concentrations once again dropped below the FRL in late 2003. Groundwater monitoring will continue as part of the IEMP and additional direct-push sampling is planned for the Plant 6 area. Sporadic and isolated detections of constituents above the FRLs in the Great Miami Aquifer are observed from time to time at the Fernald site's property boundary (located approximately 300 feet east of the OSDF), but these isolated detections are not considered to be part of a definitive plume requiring remediation. These detections will continue to be tracked as part of the IEMP sampling activities.

In accordance with the Operable Unit 5 Record of Decision, remedial actions for surface and subsurface soil, the perched groundwater in the glacial till, and the Great Miami Aquifer have been implemented in areas where FRLs have been exceeded. However, at the completion of the sitewide remedial actions, low levels of some contaminants (i.e., above background levels but below FRLs) are expected to remain in the various environmental media at the Fernald site, including the area adjacent to and beneath the OSDF. This residual low-level contamination that will remain after cleanup is recognized as a factor that creates a degree of uncertainty in the ability to distinguish small quantities of potential OSDF leakage from the pre-existing levels of contamination in the media. A strategy to accommodate this uncertainty factor in the development of the monitoring plan is provided in Section 4.0.

3.0 REGULATORY ANALYSIS AND STRATEGY

The OSDF groundwater/leak detection and leachate monitoring plan is designed to comply with all regulatory requirements associated with groundwater detection monitoring and leachate monitoring for disposal facilities. The source of these regulatory requirements is the ARARs listed in the Records of Decision for Operable Units 2, 3, and 5. This section summarizes the regulatory requirements by describing each ARAR, and presents the regulatory strategy for compliance with these ARARs.

3.1 REGULATORY ANALYSIS PROCESS AND RESULTS

The analysis of the regulatory drivers for groundwater monitoring for the OSDF was conducted by examining the suite of ARARs in the Fernald site's approved Operable Unit Records of Decision to identify a subset of specific groundwater monitoring requirements for on-site disposal facilities. Three Records of Decision (for Operable Units 2, 3, and 5) include requirements related to on-site disposal. The Records of Decision for these three operable units were reviewed and the ARARs relevant to the OSDF identified. The results of this review are provided in Appendix A and summarized below.

The following sets of regulations were identified as being ARARs for the OSDF groundwater monitoring program:

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

- Resource Conservation and Recovery Act (RCRA)/Ohio Hazardous Waste Groundwater Monitoring Requirements for Regulated Units, 40 Code of Federal Regulations (CFR) 264.90 through .99 (OAC 3745-54-90 through 99), which specify groundwater monitoring program requirements for surface impoundments, landfills, and land treatment units that manage hazardous wastes. Similar to the Ohio Solid Waste regulations, these regulations describe a three-tiered program of detection, compliance, and corrective action monitoring. Because the Ohio regulations mirror or are more stringent than the federal regulations, the Ohio regulations are the controlling requirements and are cited within this document.

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

- DOE M 435.1-1 Environmental Monitoring, which requires low-level radioactive waste disposal facilities to perform environmental monitoring for all media, including groundwater. Compliance with RCRA/Ohio Hazardous Waste and Ohio Solid Waste regulations for groundwater monitoring will fulfill the requirement for groundwater monitoring in this Order, along with incorporating pertinent radiological parameters.

The following drivers were determined to necessitate an overall leak detection strategy:

- Ohio Municipal Solid Waste Rules, OAC 3745-27-06(C)(9a) and OAC 3745-27-10, which require that facilities prepare a groundwater monitoring plan that incorporates leachate monitoring and management to ensure compliance with OAC 3745-27-19(M)(4) and OAC 745-27-19(M)(5)

- Ohio Municipal Solid Waste Rules — Operational Criteria for a Sanitary Landfill Facility, OAC 745-27-19(M)(4) and (5), which require submittal of an annual operational report including:

  - A summary of the quantity of leachate collected for treatment and disposal on a monthly basis during the year, location of leachate treatment and/or disposal, and verification that the leachate management system is operating in accordance with the rule, and;

  - Results of analytical testing of an annual grab sample of leachate from the leachate management system.

3.2 OSDF MONITORING REGULATORY COMPLIANCE STRATEGY

Of the ARARs presented above, the Ohio Solid Waste and the Ohio Hazardous Waste regulations are the most prescriptive, and therefore warrant further discussion on how compliance with these two regulatory requirements will be met. The leak detection monitoring requirements of these two sets of regulations are similar, and dictate the development of detection monitoring plans capable of determining the facility's impact on the quality of water in the uppermost aquifer and any significant zones of saturation above the uppermost aquifer underlying the landfill.

Typically a detection monitoring program consists of the installation of upgradient and downgradient monitoring wells, routine sampling of the wells and analysis for a prescribed list of parameters, followed by a comparison of water quality upgradient of the landfill to water quality downgradient of the landfill. The detection of a statistically significant difference in downgradient water quality suggests that a release from the landfill may have occurred.

As discussed in Section 2.0, low permeability in the glacial till and pre-existing contamination within the glacial till and the Great Miami Aquifer, add complexity to the development of a groundwater detection monitoring program consistent with the standard approach of the Solid and Hazardous Waste regulations. Both sets of regulations accommodate such complexities by allowing alternate monitoring programs, which provide flexibility with respect to well placement, statistical evaluation of water quality, facility-specific analyte lists, and sampling frequency. The OSDF groundwater/leak detection monitoring program has required the use of an alternate monitoring program, in accordance with the criteria in the Ohio Solid and Hazardous Waste regulations. Compliance with the criteria is discussed below in Section 3.2.1.

The regulatory requirements for the leachate monitoring program are provided by the Ohio Solid Waste regulations. The compliance strategy for the leachate monitoring program is discussed below in Section 3.2.2.

3.2.1 Leak Detection Monitoring Compliance Strategy

The groundwater/leak detection monitoring program for the OSDF includes routine sampling and analysis of water drawn from four zones within and beneath the disposal facility including the LCS, the LDS, perched water within the glacial till, and the Great Miami Aquifer. This four-layered "holistic" approach allows for the earliest leak detection from the OSDF given the unique hydrogeologic and pre-existing contaminant situation at the site. However, this tailored approach differs from a typical leak detection monitoring program in several ways, and requires a compliance strategy to ensure that the program meets or exceeds the substantive requirements within the Ohio Solid and Hazardous Waste regulations. Below is a detailed discussion of compliance with several elements of the program, including alternate well placement, statistical analysis, monitoring frequency, and parameter selection. The implementation of the OSDF groundwater/leak detection program is presented in Section 4.0.

Note: Additional refinements to the monitoring/reporting process will be addressed and approved through various technical memoranda, annual site environmental reports, and/or weekly conference calls with the EPA/OEPA. After approval, the OSDF Project-Specific Plan (refer to Appendix B) will be revised and/or variances will be written to address updates as necessary.

3.2.1.1 Alternate Well Placement

The Ohio Solid Waste regulations require that a groundwater monitoring system consist of a sufficient number of wells, installed at appropriate locations and depths, to yield groundwater samples from both the uppermost aquifer and any overlying significant zones of saturation (OAC 3745-27-10(B)(1)). Groundwater samples will be obtained through wells installed in the glacial till as well as the Great Miami Aquifer. The regulations also state that the wells must represent the quality of groundwater passing directly downgradient of the limits of solid waste placement (OAC 374-27-10(B)(1)(b)). In lieu of installing vertical glacial till monitoring wells along the perimeter of the OSDF, horizontal wells will be installed beneath the OSDF and screened beneath the liner penetration box of the LDS for each disposal cell where the greatest potential for leakage exists. Horizontal wells are preferred to vertical wells due to restrictions on well installation within 200 feet of waste placement so as to avoid interference with the disposal facility cap, and the absence of significant lateral flow within the overburden. The time required for contaminants to migrate laterally in the till toward wells located 200 feet from the limits of waste placement greatly exceeds the vertical travel time through the glacial till; therefore, the aquifer would be impacted by contaminants long before OSDF horizontal till wells could detect the release. Although the existence of the OSDF may result in dewatering of the glacial till such that samples cannot be regularly obtained, horizontal wells installed beneath the liner of the OSDF represent the highest potential for detecting releases to the till. Such an alternate placement for the till wells is allowed in the

Ohio Solid Waste regulations. The performance criteria in OAC 3745-27-10(B)(4) requires that the number, spacing, and depth of the wells must be based on site-specific hydrogeologic information and must be capable of detecting a release from the facility to the groundwater at the closest practicable location to the limits of solid waste placement. The placement of till wells beneath the facility, as opposed to along its perimeter, meets or exceeds the requirement to be located adjacent to waste placement.

3.2.1.2 Alternate Statistical Analysis

A statistical analysis is required in both the Ohio Solid and Hazardous Waste regulations (OAC 3745-27-10(C)(6) and OAC 3745-54-97(H)). The statistical analysis methods listed in the regulations are: parametric analysis of variance, an analysis of variance based on ranks, a tolerance or prediction interval procedure, a control chart approach, or another statistical test method. To date, the control chart approach (combined Shewart-CUSUM control charts) has been used as it has been determined the most viable approach. The preferred method of evaluation for the OSDF groundwater/leak detection monitoring data is an intra-well trend analysis following the establishment of baseline conditions in the perched water and Great Miami Aquifer beneath the OSDF. Although vertical monitoring wells are installed in the Great Miami Aquifer upgradient and downgradient of the OSDF, an intra-well comparison is more appropriate than an up- versus downgradient comparison until aquifer restoration is complete. Transient flow conditions within the aquifer, as well as the existence and anticipated fluctuation of contaminant concentrations at levels below the final remediation levels, discourage the use of a statistical comparison of upgradient and downgradient water quality as a reliable indicator of a release from the OSDF.

3.2.1.3 Alternate Parameter Lists

The process used to select the indicator parameter list, described in detail in Section 4.5, used the extensive RI database, and fate and transport modeling to evaluate potential indicator parameters. RIs have been completed for all Fernald site source terms and contaminated environmental media. The RIs included extensive sampling and analysis to characterize wastes and quantify environmental contamination so that health protective remedies, such as the construction of the OSDF, could be selected. Extensive databases were also used to develop WACs that consist of concentration- and mass-based limitations on the waste entering the OSDF. The WAC for the OSDF were developed with consideration of the types, quantities, and concentration of wastes that would be placed into the OSDF; the leachability, mobility, persistence, and stability of the waste constituents in the environment; and the toxicity of the waste constituents. Of 93 constituents that were evaluated for waste acceptance, 18 were identified as having a relatively higher potential to impact the aquifer within the 1000-year, specified performance period. Maximum allowable concentration limits were established for wastes containing these constituents.

The factors used to establish WAC are similar to the consideration criteria for development of an alternate parameter list specified in the Ohio Solid and Hazardous Waste regulations (OAC 3745-27-10(D)(2) and (3); OAC 3745-54-93(B); OAC 3745-54-98(A)) and OEPA policy and guidance (Solid Waste Policy DDAGW-04-03-221, Interim Solid Waste Guidance GD0403.222 and GD0403.205). The methodology for developing an OSDF-specific leak detection monitoring parameter list used the WAC methodology and the Ohio Solid and Hazardous Waste regulatory criteria to identify waste constituents that are expected to be derived from wastes placed in the OSDF, and will be reliable indicators of a release from the OSDF.

3.2.1.4 Alternate Sampling Frequency

The Ohio Solid Waste regulations require that, for detection monitoring, at least four independent samples from each well will be taken to determine the baseline water quality during the first 180 days after implementation of the groundwater detection monitoring program (OAC 3745-27-10(D)(5)(a)(ii)(a)). Note that baseline monitoring continues after initiation of waste placement and during active cell operations in order to collect sufficient data to perform the required statistical analyses.

The Ohio Hazardous Waste regulations do not specify a frequency for determining a baseline dataset. A typical statistical test for a hazardous waste disposal facility requires an up- versus downgradient comparison of background water quality to downgradient water quality. The Ohio Hazardous Waste regulations do require a performance standard for establishing background; OAC 3745-54-97(G) states that the number and kinds of samples taken to establish background be appropriate for the statistical test employed. Experience/technical knowledge gained from monitoring Cells 1 through 3 have indicated that it is necessary to collect baseline samples either monthly, bimonthly, or quarterly in order to have enough data (i.e., 12 samples) to perform statistics on a standardized frequency dataset. The baseline frequency is selected to develop an appropriate statistical procedure, to address OSDF construction schedules, and to compensate for the varying temporal conditions in the groundwater flow direction and chemistry due to the remedial action and seasonal fluctuations.

The Ohio Solid Waste regulations require a semiannual sampling frequency for detection monitoring but also allow for the proposal of an alternate sampling program (OAC 3745-27-10(D)(5)(a)(ii)(b) and (b)(ii)(b), and 3745-27-10(D)(6)). During active cell operations (more specifically, post-baseline monitoring prior to cell capping), the sampling frequency for the OSDF groundwater/leak detection monitoring program will be quarterly for the indicator parameters, which exceeds the semiannual frequency requirement. After each cell is capped, it is planned that monitoring for each of the four components (i.e., the LCS, LDS, horizontal till well, and Great Miami Aquifer wells) for the site-specific leak detection indicator parameters will be done on a semiannual basis to continue to meet regulatory requirements.

3.2.2 Leachate Monitoring Compliance Strategy

The Solid Waste regulations (OAC 3745-27-19(M)(5)) require collection and analysis of leachate on an annual basis for Appendix I and polychlorinated biphenyls (PCBs) parameters listed in OAC 3745-27-10. Leachate samples in the LCS will be collected and analyzed for site-specific leak detection indicator parameters to support leachate treatment and discharge, as well as the annual analysis for Appendix I parameters and PCBs. The annual grab sample analysis for Appendix I parameters and PCBs will ensure the accuracy of assumptions regarding the nature of wastes within the OSDF that were used to develop the groundwater/leak detection parameter list.

Although constituents that are not part of the limited indicator parameter list for leak detection may be detected in the annual grab, it is not anticipated that the concentrations will be high enough to warrant revision of the leak detection parameter list. However, a review of the data will be conducted (and reported through the annual site environmental reports) to determine if any new indicator constituents should be added to the site-specific leak detection indicator parameter list. A constituent will be added if: (1) concentrations observed in the annual sample are much higher than the perched water concentrations at the Fernald site; and (2) routine analysis of the constituent can significantly enhance early detection capability. The leak detection leachate analysis will ensure that the character of the leachate will not adversely impact the treatment facility or the treatment facility effluent receiving stream (the Great Miami River).

Although not specified in the Operable Unit Records of Decision as an ARAR, the federal RCRA (Hazardous Waste) regulations include specific requirements in 40 CFR 264.303 for monitoring the volume of liquid collected from a disposal facility's leak detection system. Regulation 40 CFR 264.302 includes provisions for determining an "action leakage rate" that, if exceeded, would prompt specific response and notification actions. It is anticipated that this "action leakage rate" will be established via trend analysis on closed cells prior to closure of the last cell of the OSDF (discussed in Section 4.0). The response and notification process for an exceedance of the "action leakage rate" (40 CFR 264.304) is provided in Section 6.0.

The leachate monitoring strategy, as part of the groundwater monitoring plan and required by OAC 3745-27-06(C)(7), must include provisions for obtaining the monthly volume of leachate collected for subsequent treatment, provide the method of leachate treatment and/or disposal, and include verification that the leachate management system is operating properly (OAC 3745-27-19(M)(4)). Monitoring to verify that the leachate management system is operating properly is provided within the OSDF Systems Plan.

The monthly volume of leachate collected for treatment and subsequent disposal will be obtained based on the program in 40 CFR 264.303(c) to determine the flow rates of leachate collected in the LCS and water in the LDS. Monitoring the flow rates will provide data for determining the volume of leachate collected and will also provide data pertinent to the leak detection monitoring program. The flow rates are part of the leak detection monitoring program and are discussed further in Section 4.0. A separate leachate management monitoring strategy is provided as Section 5.0 to provide information on the method of leachate treatment and/or disposal, including analysis of parameters useful for leachate treatment. Section 5.0 also includes a discussion on obtaining an annual grab sample to be analyzed for Appendix I parameters and PCBs, in order to comply with the requirement in OAC 3745-27-19(M)(5).

4.0 LEAK DETECTION MONITORING PROGRAM

This section presents the technical approach for leak detection monitoring at the OSDF, in light of the regulatory requirements for leak detection monitoring summarized previously in Section 3.0. The section includes a summary of the objectives of the program; a description of the major program elements; the selection process for analytical parameters (i.e., site-specific leak detection indicator parameters); the monitoring to be employed to establish baseline during active cell operations and after cells have been capped; and the strategy for evaluating the data to determine whether a leak has occurred. The subsections are as follows:

- Section 4.1: Introduction
- Section 4.2: Monitoring Objectives
- Section 4.3: Leak Detection Monitoring Program Elements
- Section 4.4: Selection Process for Site-Specific Leak Detection Indicator Parameters
- Section 4.5: Leak Detection Sample Collection
- Section 4.6: Leak Detection Data Evaluation Process

Additionally, Appendices B and C provide the Project-Specific Plan and Data Quality Objectives for the OSDF Monitoring Program for each cell, with details on specific monitoring lists and frequencies. Section 5.0 describes the overall leak detection strategy including the collection and analysis of an annual leachate grab sample for Appendix I and PCB parameters per OAC 3745-27-10 and 19 to confirm the adequacy and appropriateness of the selected site-specific leak detection indicator parameters. A summary of the notifications and potential follow-up response actions that accompany the monitoring program is provided in Section 6.0.

4.1 INTRODUCTION

As discussed in Section 1.0, the OSDF leak detection monitoring program constitutes the first tier of a three-tiered detection, assessment, and corrective action monitoring strategy that is required for engineered disposal facilities. Consistent with this three-tiered approach, if it is determined from this detection monitoring program that a leachate leak from the OSDF has occurred, follow-up assessment and corrective action monitoring plans will be developed and implemented as necessary. Conversely, if the detection monitoring successfully demonstrates that leachate leaks have not occurred, then the monitoring program will remain in the first-tier "detection mode" indefinitely. The follow-up assessment and/or corrective action monitoring plans, if found to be necessary, would be prepared as new, independent plans that would supersede this first-tier detection program.

The leak detection monitoring program employs a multi-component, holistic approach for leak detection, relying on the collective responses obtained from four components: an LCS inside the OSDF; an LDS inside the OSDF and below the LCS; a perched groundwater monitoring component, which is located beneath the compacted clay liner immediately below the LDS and LCS liner penetration boxes (see Figure 4-1); and a Great Miami Aquifer monitoring component, found at depths ranging from 40 to 90 feet beneath the OSDF. The data collected from the four components will be evaluated comparatively over time, so that short-term and long-term response relationships between the components can be effectively delineated.

Clearly, the Great Miami Aquifer is the prime resource of concern that could potentially be affected by the OSDF, in the unlikely event that a leachate leak occurred. It therefore makes sense to monitor the aquifer at the immediate boundary of the OSDF to ensure the absence of impact. However, as discussed in Section 2.0, contaminant travel times to the aquifer through the glacial till beneath the OSDF are of such length that reliance on Great Miami Aquifer monitoring alone would be insufficient to provide effective early warning of a leak from the facility. The overriding intention of the holistic approach, therefore, is to ensure that there is no reliance on any one element alone to determine whether leakage has occurred. As is demonstrated in this section, the groundwater/leak detection monitoring program includes the establishment of baseline conditions in the native environment underlying the OSDF (i.e., perched and Great Miami Aquifer groundwater) to be used as a point of comparison during the system-wide evaluation of trends. Following the establishment of baseline conditions, the follow-up sampling being conducted at each monitoring interval provides a "vertical slice/snapshot in time" view of conditions that are present in each of the four components, which can be compared to past results to determine the collective significance of trends or intermittent fluctuations in the data.

4.2 MONITORING OBJECTIVES

The fundamental objective of the leak detection monitoring program is to provide early detection of a leak from the facility, should one occur. Recognition of this fundamental objective allows the Fernald site to move confidently into the next regulatory-based tiers of the program—assessment and corrective action monitoring—should they be necessary based on detection monitoring trends. This fundamental objective is the primary driver for all of the key site-specific elements (i.e., monitoring locations, frequencies, analytical parameters, and follow-up response actions) of the program.

In addition to this fundamental objective, there are several other objectives that have been considered in the site-specific design of the leak detection program:

- The program must have the ability to distinguish an OSDF leak from the above-background pre-existing levels of contamination that are found in the subsurface;
- All monitoring wells must be installed at locations and with construction methods that do not interfere with or compromise the integrity of the cap and liner system of the OSDF;
- The program needs to be readily implementable and not overwhelming in terms of reporting, data management, and the ability to identify trends; and
- The program needs to satisfy the site-specific regulatory requirements for leak detection monitoring summarized in Section 3.0.

The four-component leak detection monitoring approach described below meets the intent of providing early detection of a release from the OSDF within the complex hydrogeologic regime at the Fernald site, and is tailored to accommodate the additional program design objectives summarized above.

4.3 LEAK DETECTION MONITORING PROGRAM ELEMENTS

4.3.1 Overview

The success of the leak detection monitoring strategy for the OSDF is dependent upon how well the strategy integrates with facility integrity concerns (cap and liner system performance) and how well the groundwater component of the strategy addresses hydrogeologic conditions in the till and aquifer. The trends revealed by groundwater monitoring data need to be effectively integrated with leachate production information within the OSDF in order to provide a comprehensive evaluation of the OSDF performance and integrity.

The approved design for the OSDF is presented in detail in the initial OSDF Design Package and subsequent approved follow-up design and construction drawing packages. The OSDF consists of eight individual cells (plus a ninth contingency cell) to be constructed in phases. As shown in Figure 4-1, the liner for each cell is a composite liner system, assembled from the following layers (top to bottom): a soil cushion layer; geotextile fabric; LCS drainage layer; primary composite liner; high-density polyethylene (HDPE) (geotextile fabric, HDPE geomembrane, and geosynthetic clay liner); LDS drainage layer; and the underlying secondary composite liner (HDPE geomembrane, geosynthetic clay liner, and compacted clay). Both the LCS and LDS layers each drain to the west within each cell. At the western edge of each cell liner, any liquid within the LCS and LDS passes through the liner penetration box and

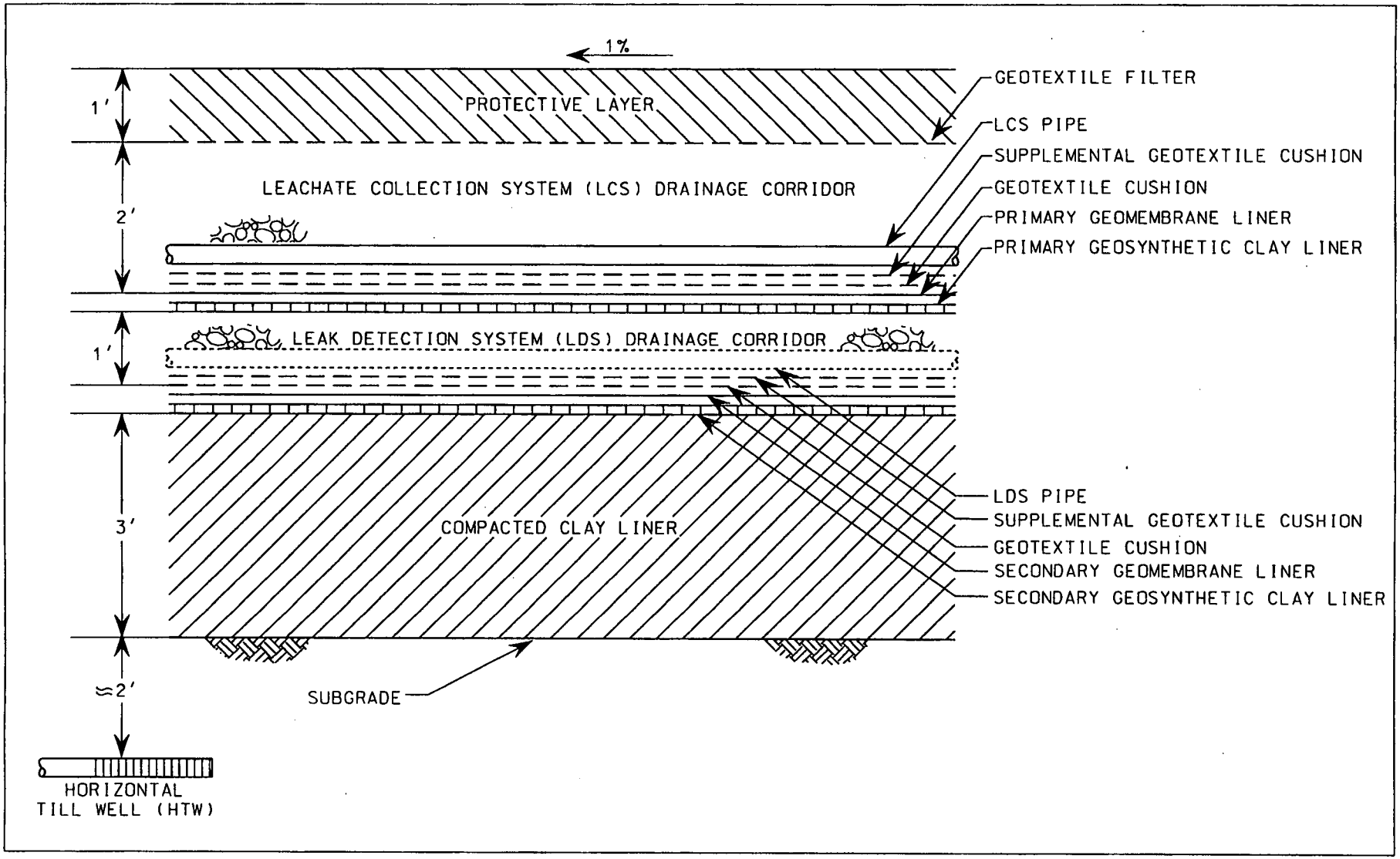

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FIGURE 4-1. ON-SITE DISPOSAL FACILITY LINER SYSTEM WITH HTW AT THE DRAINAGE CORRIDOR

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flows to the respective cell's valve house. As identified previously, the liner penetration box represents the area with the greatest leak potential for each cell and is considered the primary location where a leak would first enter the environment if a leak were to occur.

Each cell is also furnished with an engineered composite cover system following the completion of waste placement. The cover system consists of the following layers (top to bottom): a vegetative cover layer; a topsoil layer; a granular filter layer; a bio-intrusion barrier; a geotextile filter; a cover drainage layer; the primary composite cap (geotextile cushion, HDPE geomembrane, geosynthetic clay liner, and compacted clay); and an underlying contouring layer. Once the cover system is in place and the cell contents have reached equilibrium, leachate production is expected to diminish as a result of the moisture infiltration barrier properties of the cover system. During the time that the cell contents move towards equilibrium, leachate accumulation in the LCS drainage layer is expected to diminish over time.

During active cell operations and following OSDF closure, the leak detection monitoring program involves: (1) tracking the quantity of liquid produced within the LCS and LDS over time; and (2) the periodic water quality monitoring of the leachate, the perched groundwater, and the Great Miami Aquifer groundwater. Monitoring activities during active cell operations and post-closure operations consist of baseline monitoring and post-baseline monitoring (during active cell operations and after cells are capped) which use components of site-specific analytical parameters to effectively implement a holistic comparative approach. The performance of each cell is monitored individually, on its own merit; each cell has its own engineered LCS and LDS drainage layers, perched groundwater monitoring component, and upgradient and downgradient Great Miami Aquifer monitoring wells.

4.3.2 Monitoring the Engineered Layers within the OSDF

Water quality samples are collected from individual LCS and LDS drainage layers within each cell during waste placement and after cell closure as described below and per Section 5.0 (i.e., annual leachate grab samples are collected and analyzed to confirm the adequacy and appropriateness of the selected site-specific leak detection indicator parameters). In addition to water quality monitoring, the quantity of liquid within the LCS and LDS layers is recorded and reported. This information is used to support a collective qualitative trend analysis for each cell of the OSDF as discussed later in this plan.

4.3.2.1 Leachate Collection System (LCS)

The LCS drainage layer functions primarily to collect infiltrating water (expected to be greatest during construction of the cell) and to keep it from entering the environment. It is expected that infiltrating water will be greatly reduced after each cell is capped, which may subsequently limit the available sample volume and possibly affect the number of parameters that can be analyzed. The LCS drains to the west through an exit point in the liner to leachate transmission system located on the west side of the OSDF. From there, the leachate flows by gravity to a lift station and is currently pumped to the Fernald site's Bio-Surge Lagoon for subsequent treatment at the Advanced Wastewater Treatment (AWWT) facility.

Current site plans are for AWWT to be reduced in both size and capacity, referred to as the converted AWWT (CAWWT). With the scheduled permanent shut-down of the Bio-Surge Lagoon in November 2004, leachate will be redirected to the storm water retention basin (SWRB). During the conversion process of the AWWT facility, leachate collected in the SWRB will be routed for treatment in the AWWT. When the CAWWT is operational in February 2005, the leachate collected in the SWRB will be routed to the new CAWWT facility. Leachate will be managed in this manner until October 2005 when the SWRB is removed from service to support soil remediation in the SWRB footprint. At that time, leachate will be routed directly to the CAWWT facility for treatment.

Both flow (quantity/volume) and water quality information are collected from the LCS drainage layer according to Section 4.4, Section 4.5, and Appendix B (the OSDF Project-Specific Plan).

4.3.2.2 Leak Detection System (LDS)

By design, the primary composite liner located underneath the LCS drainage layer should not leak. Fluids that accumulate from time to time in the LCS drainage layer above the primary liner are removed to further reduce the potential for leakage by minimizing the level of fluid head build up on the primary liner. Notwithstanding this design, a second fluid collection layer, the LDS drainage layer, is positioned beneath the primary composite liner to provide a means to track the integrity and performance of the primary liner. In the event that fluids collect within the LDS layer, the fluids drain to the west where they are removed and routed for treatment as in the LCS.

Similar to the LCS, a greater volume of fluids may initially collect in the LDS as the moisture content of the materials comprising the liner move toward long-term equilibrium levels. This fluid volume is expected to gradually decrease over the long term. Below the LDS drainage layer is a secondary composite

liner comprised of an HDPE geomembrane, geosynthetic clay liner, and compacted clay. This secondary liner serves as the lowermost hydraulic barrier in the liner system and inhibits fluids from entering the environment before they are collected and removed through the LDS drainage layer.

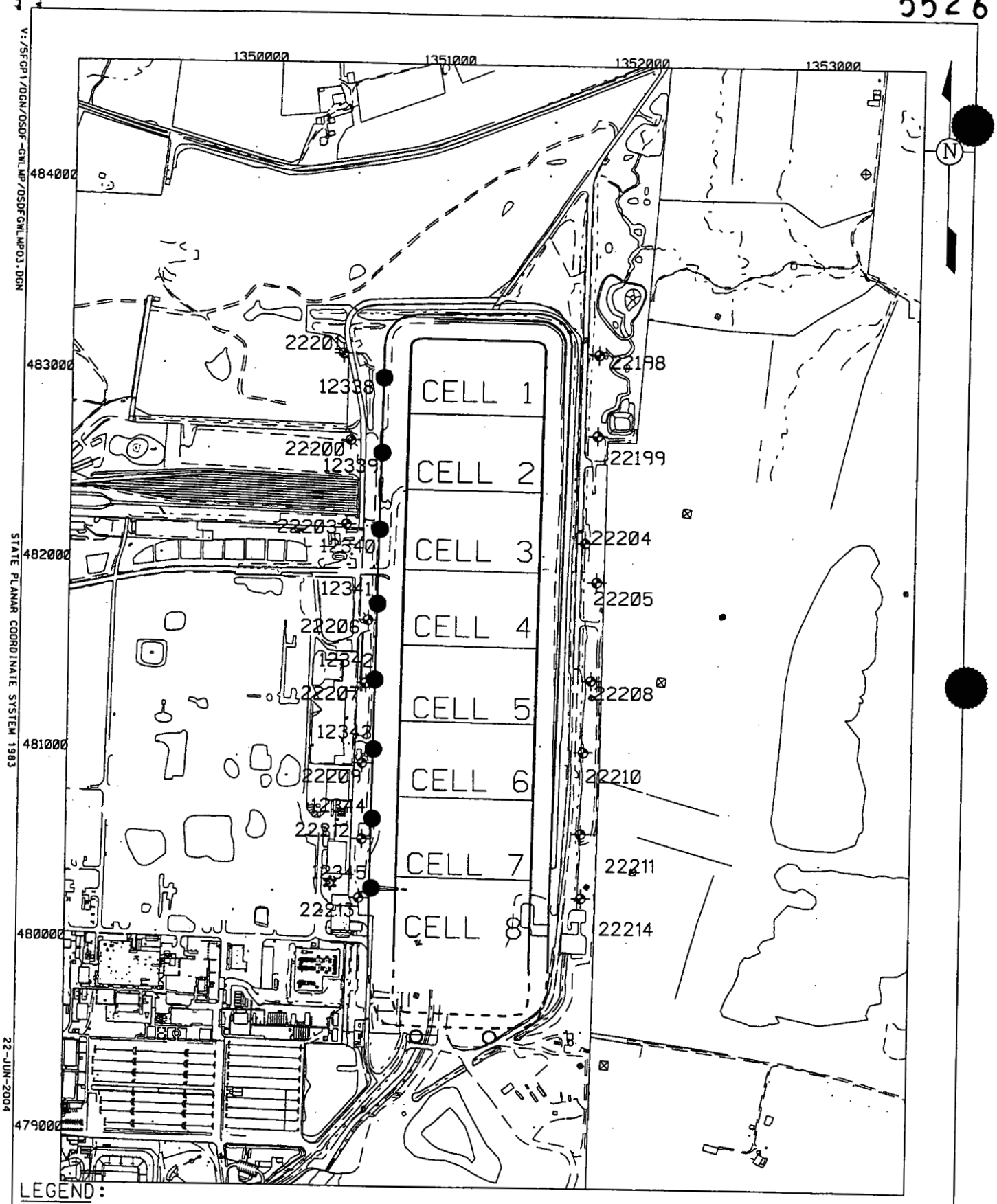
Like the LCS drainage layer, both flow (quantity/volume) and water quality information are collected from the LDS drainage layer according to Section 4.4, Section 4.5, and Appendix B (the OSDF Project-Specific Plan).

4.3.3 Monitoring the Perched Groundwater

The perched groundwater monitoring component of the program is designed to monitor for the presence of leachate leakage from the OSDF at its first point of entry into the Fernald site's natural hydrogeologic environment. As discussed in Section 1.0, EPA, OEPA, and DOE concur that a horizontally oriented glacial till monitoring well (i.e., a horizontal till well), positioned directly beneath the location of the LCS and LDS liner penetration box in each cell, represents the most feasible site-specific approach to monitor for first-entry leakage from the OSDF into the Fernald site's environment.

The horizontal till wells have been installed as part of the sub-grade construction activities for each of the cells comprising the OSDF. The individual wells were installed prior to waste placement, therefore eliminating final positioning uncertainties that would be associated with post-construction horizontal drilling techniques. The vertical portion of each of the monitoring wells is located along the western side of the OSDF (see Figure 4-2), while the sample collection interval is positioned beneath the bottom of the secondary composite liner in alignment with the location of the LCS and LDS liner penetration box.

Lithologic and hydraulic characterization of the till in the vicinity of the OSDF indicates that the clay-rich deposits may not readily yield fluid to a well. The amount of saturation in the till is likely to be further reduced in the future by the barrier properties of the composite cover and liner system of the OSDF, which will operate to significantly reduce local infiltration beneath the facility. These conditions may make it impossible to obtain sufficient sample volume from the till wells to perform detailed water quality analyses. In the event sufficient sample volume cannot be obtained to perform the full list of required analyses, a priority list will be implemented as necessary as identified in Appendix B.



LEGEND:

- FERNALD SITE BOUNDARY
- PROPOSED GMA DETECTION MONITORING WELL
- GMA DETECTION MONITORING WELL
- HORIZONTAL TILL WELL (HTW)

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SCALE

700 350 0 700 FEET

FIGURE 4-2. OSDF WELL LOCATIONS

Water quality information is collected from the horizontal till wells according to Section 4.4, Section 4.5, and Appendix B (the OSDF Project-Specific Plan). Based on experience and technical knowledge gained, purging prior to sampling the horizontal till wells was implemented to ensure sample independence.

4.3.4 Monitoring the Great Miami Aquifer

The subsections below describe the Great Miami Aquifer component of the program, including a discussion of the influence of planned aquifer restoration activities on the program, the siting of the monitoring wells, and use of the groundwater models (i.e., Variably Saturated Analysis Model in 3 Dimensions [VAM3D] and Sandia Waste Isolation Flow and Transport [SWIFT]) to evaluate the adequacy of the planned well locations.

4.3.4.1 Siting of the Great Miami Aquifer Monitoring Wells

The Great Miami Aquifer monitoring wells have been installed immediately adjacent to the OSDF, just outside the footprint of the final composite cap configuration, so as not to interfere with the integrity of the facility. Each cell has its own set of monitoring wells to assist with the evaluation of conditions associated with that cell. As each new cell has been brought online, its associated monitoring wells have been installed before (or concurrently with) the construction of the cell liners so that the wells have been available for the initiation of baseline sampling prior to waste placement. Thus the well installations have followed the north-to-south progression of OSDF cell construction. The OSDF is bordered by a network of 18 Great Miami Aquifer monitoring wells, which provide upgradient and downgradient monitoring points for each cell (see Figure 4-2). All monitoring wells were constructed in accordance with the Sitewide CERCLA Quality (SCQ) Assurance Project Plan (DOE 2003b) for Type 2 Great Miami Aquifer wells.

The overall objective of the Great Miami Aquifer component of the leak detection monitoring program is to provide long-term surveillance. The current and future (post-remediation) aquifer flow conditions were therefore used to select the 18 monitoring locations. As discussed in the next subsection, groundwater flow and particle tracking using both the VAM3D and the SWIFT aquifer simulation models were used to help select the final monitoring locations identified in this plan.

4.3.4.2 VAM3D Flow Model and SWIFT Transport Model Evaluation of Well Locations

The VAM3D and SWIFT groundwater modeling codes were used to evaluate the adequacy of the density and locations of the monitoring wells planned for the Great Miami Aquifer. The modeling effort examined

the fate of a hypothetical release from each cell to the aquifer at a point directly beneath the liner penetration box of the LCS and LDS. The groundwater model runs predicted the most likely flow path and plume configuration for particles released from the liner penetration box area over time. The modeling was conducted for post-aquifer remediation conditions (when groundwater flow directions would be from west to east). The original modeling was performed using the SWIFT groundwater model as part of the IEMP, Revision 0, and has been updated subsequently using the VAM3D groundwater model.

Particle flow path modeling was conducted using the VAM3D flow model output from two model runs representing seasonal wet and dry conditions within the aquifer. Fifteen particles were seeded in a 125-foot radius around each of nine model nodes located nearest the nine cell liner penetration box locations. These particles were tracked for a 20-year period with no retardation. The velocity flow field data from the post-aquifer remediation scenario shows the advective particle path results (Figure 4-3). The particle tracks are generally from west to east beneath the OSDF. As indicated in the figure, the tracks deviate slightly in the north-south direction with seasonal water level fluctuations in the aquifer. Downgradient monitoring wells were located in the area traced out by the modeled flowpaths for each OSDF cell in order to be in the most likely position to detect a leak based on anticipated groundwater flow. These flow model results are similar to the flow modeling results previously obtained with the SWIFT groundwater model, which was used prior to converting to the VAM3D modeling code. Monitoring wells for Cells 1 through 3 were placed based on the results from the SWIFT groundwater flow model (provided in Revision 0 of this plan) and monitoring wells from Cells 4 through 8 were placed based on the results from the VAM3D flow model (DOE 2000).

An earlier SWIFT model transport simulation was performed for Revision 0 of this plan to determine if the density of the downgradient Great Miami Aquifer monitoring well network is adequate to detect the smallest contaminant plume resulting from a leak in the OSDF that would be of concern. Those SWIFT model results are included here for completeness. The SWIFT model was used to simulate a leak from the cell liner penetration box beneath Cell 3 under natural flow gradients with no on-site pumping. Model simulations for both uranium and technetium-99 were performed. Constant loading from the cell was simulated throughout the model run such that a plume of minimum areal extent (i.e., a plume with maximum concentration equal to the FRL) was maintained in the aquifer. Hypothetical plumes of 20 parts per billion and 94 picoCuries per liter (pCi/L) were maintained for uranium and technetium-99, respectively. The plumes were loaded from two hypothetical locations. One location was approximated to be beneath the cell liner penetration box at the western edge of Cell 3, in order to represent the most likely leakage point from the cell.

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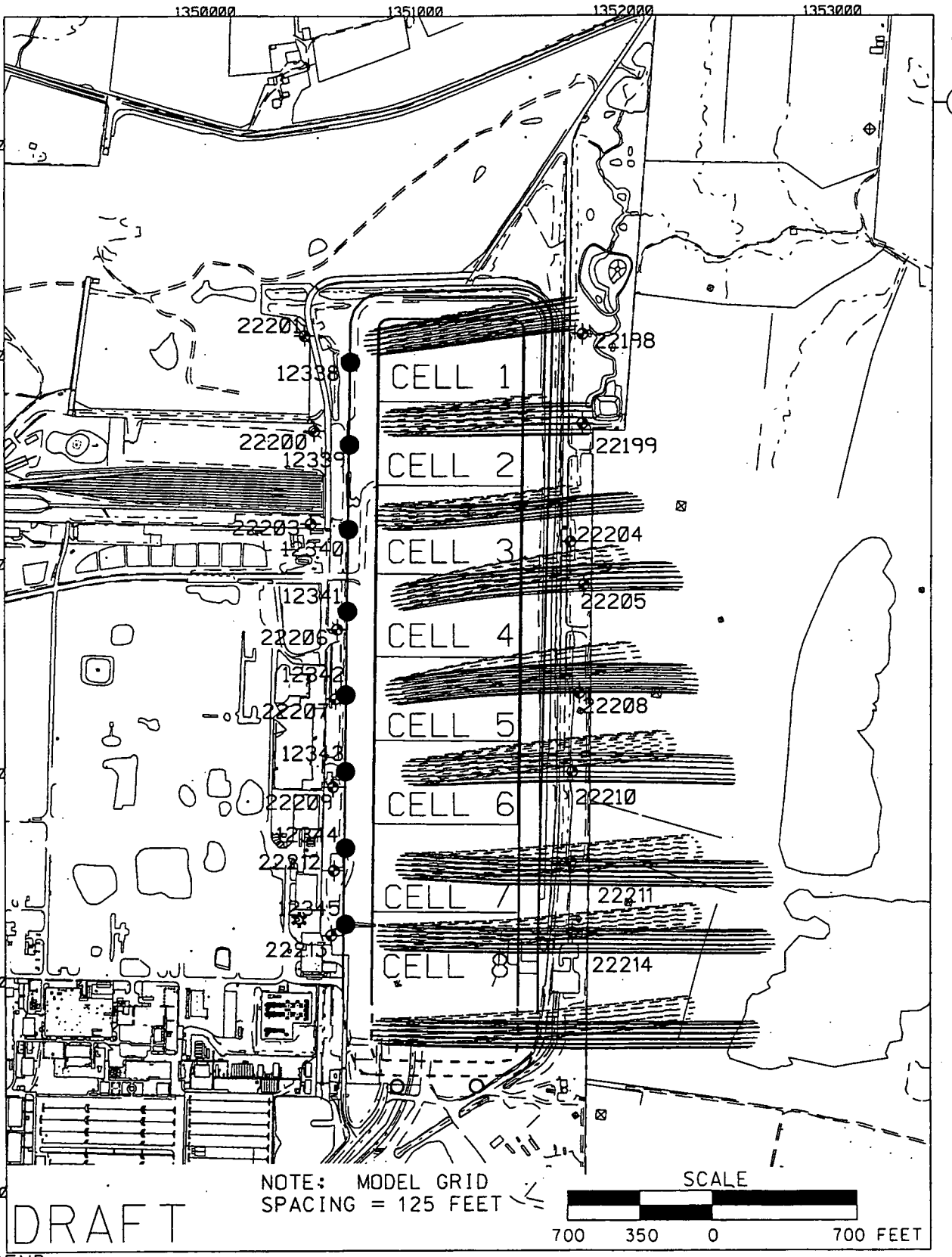


LEGEND:

- FERNALD SITE BOUNDARY
- 20 YEAR PARTICLE TRACKS (NO RETARDATION, DRY SEASON)
- 20 YEAR PARTICLE TRACKS (NO RETARDATION, WET SEASON)
- PROPOSED GMA DETECTION MONITORING WELL
- GMA DETECTION MONITORING WELL
- HORIZONTAL TILL WELL (HTW)

FIGURE 4-3. POST-REMEDIATION SCENARIO

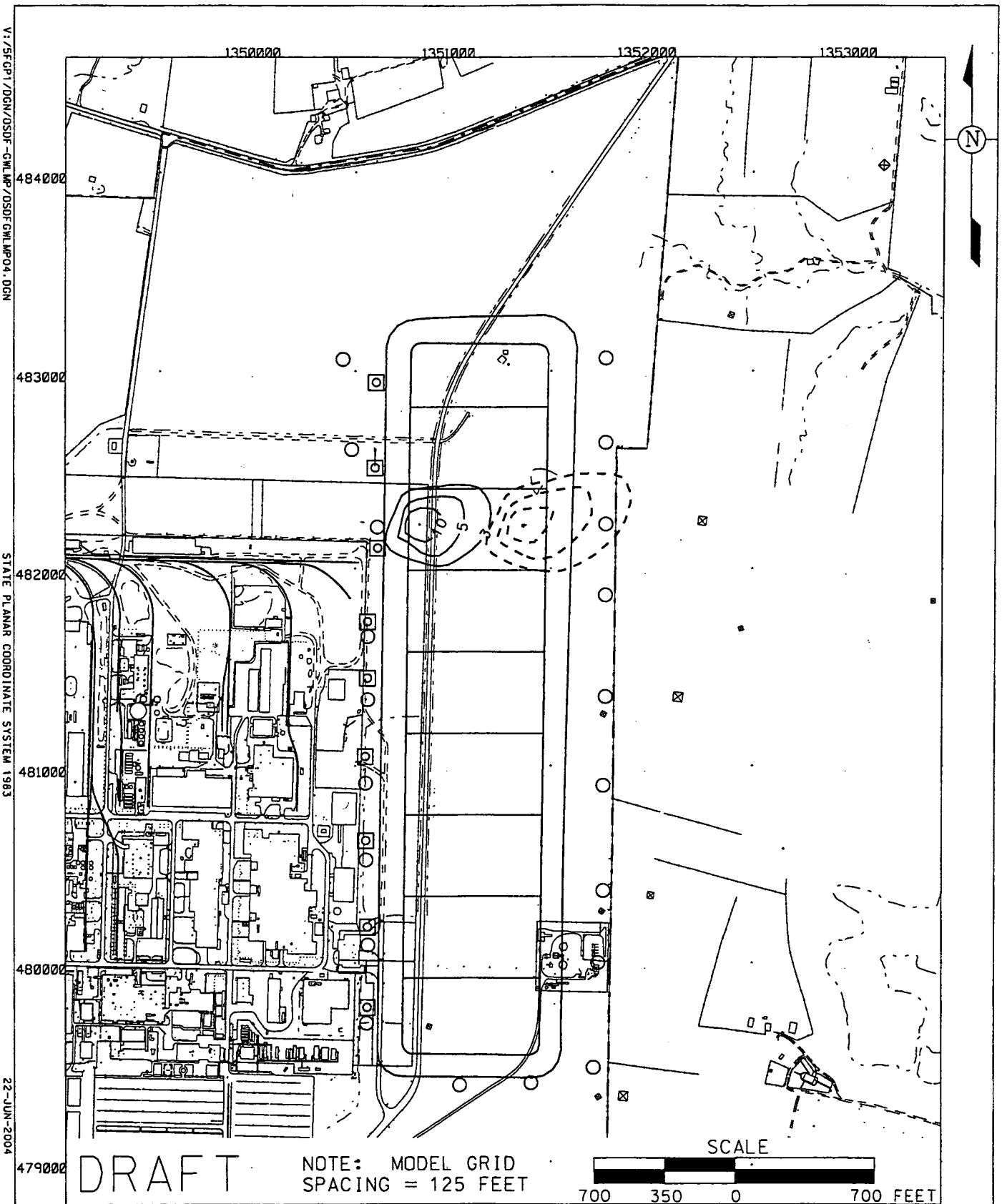
The other location was further east, in order to provide a more conservative scenario where the plume would have less time to expand before the leading edge would reach the downgradient monitoring well network.

The modeling results for uranium at model year 55 (2051) and for technetium-99 at model year 30 (2026) are shown in Figures 4-4 and 4-5, respectively. The durations were determined from the modeling, and represent the period of time under constant loading for the respective plumes to disperse to the width of the spacing distance between monitoring wells (approximately equal to the OSDF cell width). Modeling results indicate that the density of downgradient Great Miami Aquifer monitoring wells is sufficient to detect this minimal plume given the lateral expansion and the plume width under this minimal constant loading.

The width of each plume from horizontal dispersion is approximately the width of an OSDF cell, indicating that one downgradient Great Miami Aquifer monitoring well per cell is sufficient to ensure that a Great Miami Aquifer contaminant plume would be detected. Therefore, the configuration of Great Miami Aquifer wells (shown in Figure 4-2) is sufficient both in terms of well density and location for the OSDF leak detection monitoring program.

4.4 SELECTION PROCESS FOR SITE-SPECIFIC LEAK DETECTION INDICATOR PARAMETERS

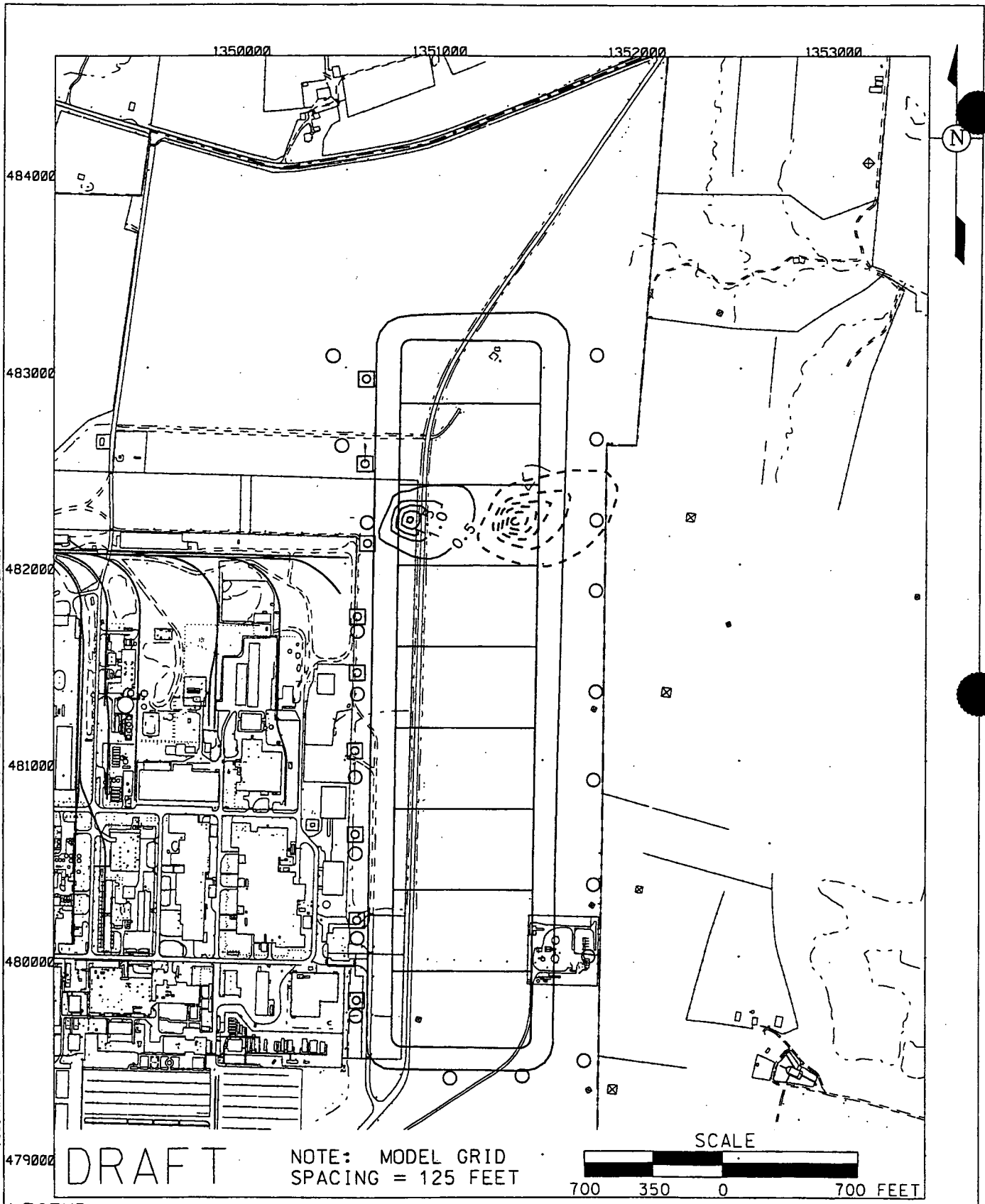
As discussed in the regulatory analysis provided in Section 3.0, a successful leak detection monitoring program must focus on the best indicators of potential releases, as opposed to analyzing for every possible constituent that may be present in a disposal facility (which would not be manageable and would add unnecessary complexity to the data analysis process). This section presents the criteria and process used to identify the site-specific indicator parameters for the OSDF groundwater leak detection monitoring program. The selected indicator parameters supplement the leachate flow monitoring conducted in the LCS and LDS layers (described in Section 4.5) to promote the early detection of potential leaks from the facility.



LEGEND:

- ○ PROPOSED OSDF GMA DETECTION MONITORING WELL
- ⊡ PROPOSED OSDF TILL DETECTION HORIZONTAL MONITORING WELL SAMPLING POINT
- —·—·— FERNALD SITE BOUNDARY
- 3 MODELED TOTAL URANIUM CONCENTRATION (ppb) FROM LEAK AT LINER PENETRATION BOX
- ------ MODELED TOTAL URANIUM CONCENTRATION (ppb) FROM DOWNGRADIENT LEAK

FIGURE 4-4. SWIFT MODELING WITH URANIUM LOADING - 55 YEARS



LEGEND:

- PROPOSED OSDF GMA DETECTION MONITORING WELL
- PROPOSED OSDF TILL DETECTION HORIZONTAL MONITORING WELL SAMPLING POINT
- FERNALD SITE BOUNDARY
- 3 MODELED TECH 99 CONCENTRATION (pCi/L) FROM LEAK AT LINER PENETRATION BOX
- MODELED TECH 99 CONCENTRATION (pCi/L) FROM DOWNGRADIENT LEAK

FIGURE 4-5. SWIFT MODELING WITH TECH 99 LOADING - 30 YEARS

4.4.1 Guidelines for Site-Specific Monitoring Parameter Selection

At the Fernald site, residual contamination in soil is expected to move through the glacial till and impact the aquifer at concentrations below the groundwater FRLs, but statistically elevated above current background conditions. It is important to recognize that all of the inorganic constituents and all but nine organic constituents included in the regulatory default monitoring parameters list (i.e., Appendix I of OAC 3745-27-10) have been detected in perched groundwater samples collected at various locations under the Fernald site. Such pre-existing contamination in the environment beneath the site along with aquifer remediation activities add complexity to the development of a successful leak detection parameter list capable of indicating the presence of a leak from the OSDF. Therefore a tailored leak detection parameter list has been developed that provides adequate leak detection and that is in compliance with the standard requirements of the Ohio Solid Waste Rules and the Ohio Hazardous Waste Rules. As discussed in Section 3.0, both sets of rules allow the use of an alternate monitoring parameter list based on site-specific conditions.

Ohio Solid Waste regulations OAC 3745-27-10(D)(2) and (3) allow six considerations in proposing an alternate monitoring parameter list in lieu of some or all of the parameters listed in Appendix I of OAC 3745-27-10. Also, the Ohio Hazardous Waste regulations for new facilities, OAC 3745-54-98(A), recognize four considerations in formulating the facility-specific monitoring parameter list. Table 4-1 summarizes the important considerations and approval criteria related to monitoring parameter selection under the Ohio Solid Waste and Ohio Hazardous Waste regulations.

It is important to point out that the chemical constituents listed in Appendix I of OAC 3745-27-10 are typical contaminants found in sanitary landfills. Appendix I does not include any radionuclides which are the primary contaminants of concern at the Fernald site. Therefore, any site-specific constituents not included in Appendix I of OAC 3745-27-10 but that are good indicators of potential leaks from the OSDF also need to be evaluated in the parameter selection process (refer to Section 5.0). However, the general considerations summarized in Table 4-1 can apply to any constituents when selecting the leak detection indicator parameters.

TABLE 4-1

REGULATORY CRITERIA FOR ALTERNATE PARAMETER LIST

Ohio Solid Waste Regulation	Ohio Hazardous Waste Regulation
REQUIREMENTS:	
• for all parameters, the removed parameters are not reasonably expected to be in or derived from the waste contained or deposited in the landfill facility; and [OAC 3745-27-10 (D)(2)]	-
• for inorganic parameters, the approved alternative monitoring parameter list will provide a reliable indication of inorganic releases from the landfill facility to the groundwater. [OAC 3745-27-10 (D)(3)]	indicator parameters (e.g., specific conductance, total organic carbon, or total organic halogen), waste constituents, or reaction products that provide a reliable indication of the presence of hazardous constituents in groundwater. [OAC 3745-54-98 (A)]
CONSIDERATIONS:	
• types, quantities, and concentrations of constituents to be managed at the facility; [OAC 3745-27-10 (D)(2)(b) and (D)(3)(a)]	types, quantities, and concentrations of constituents to be managed at the regulated unit; [OAC 3745-54-98 (A)(1)]
• mobility, stability, and persistence of the waste constituents or their reaction products in the unsaturated zone beneath the facility; [OAC 3745-27-10 (D)(3)(b)]	mobility, stability, and persistence of the waste constituents or their reaction products in the unsaturated zone beneath the waste management area; [OAC 3745-54-98 (A)(2)]
• concentrations in the leachate from the relevant unit(s) of the facility; [OAC 3745-27-10 (D)(2)(c)]	-
• detectability of the parameters, waste constituents, and their reaction products in the groundwater; [OAC 3745-27-10 (D)(3)(c)]	detectability of the indicator parameters, waste constituents, and their reaction products in the groundwater; and [OAC 3745-54-98 (A)(3)]
• concentrations or values and coefficients of variation of monitoring parameters or constituents in the background [baseline] groundwater quality; and [OAC 3745-27-10 (D)(3)(d)]	concentrations or values and coefficients of variation of monitoring parameters or constituents in the background [baseline] groundwater quality. [OAC 3745-54-98 (A)(4)]
• any other relevant information. [OAC 3745-27-10 (D)(2)(d)]	-

Parameter selection focuses on establishing baseline conditions for individual cells of the OSDF and provides the initial rationale for post-baseline monitoring and monitoring in capped cells. Parameters selected for the baseline sampling and analysis approach of the OSDF groundwater monitoring program were selected using site-specific contamination data generated during the previous RI/FS processes in accordance with the regulatory considerations presented above.

The remainder of this section presents the site-specific monitoring parameters. These lists correspond to an alternate monitoring program parameters list as defined in the regulations. It is thought that these indicator parameters will provide sufficient and reliable indication of potential releases throughout the operation of the OSDF. However, future considerations for potential modifications of the parameter list are also discussed at the end of Section 4.4.3.

4.4.2 Initial Leak Detection Monitoring Parameters List

An alternate leak detection monitoring parameters list should include both primary (i.e., chemical-specific) parameters and supplemental indicator parameters. As suggested by the regulatory considerations summarized in Table 4-1, primary parameters should consist of selected site-specific chemical constituents which are expected to be of significant amounts in the monitored facility, and which are persistent, mobile, and differentiable from existing background conditions when released. The supplemental indicator parameters may include general groundwater quality parameters, which will have rapid and detectable changes in response to variations in chemical compositions in groundwater under the monitored facility, potentially as a result of a leak.

Fourteen primary parameters and four supplemental indicator parameters are proposed for the initial groundwater leak detection monitoring for the OSDF (i.e., baseline monitoring). Samples collected in the perched groundwater and Great Miami Aquifer monitoring wells for the initial baseline analyses, as well as samples collected in all four monitoring components during and after waste placement, will be analyzed for these 18 parameters. This subsection presents the rationale for the selection of the primary and supplemental indicator parameters.

4.4.2.1 Primary Parameters

In general, organic constituents are more mobile but less persistent than most inorganic constituents and radionuclides. Because inorganic constituents and most radionuclides are present in natural soil, if the OSDF was constructed in a pristine site, organic constituents may be the preferred primary monitoring parameters for early leak detection purposes. However, because all three types of constituents have been detected in the media (i.e., perched groundwater and the Great Miami Aquifer), in order to be differentiable from background conditions in case of a release, a good leak detection monitoring parameter must also be present in significant abundance or at relatively high source strengths in the OSDF.

Constituent-specific quantity, persistence, and mobility data were considered during the development of the WAC for the OSDF. Therefore, information from the OSDF WAC development process was first reviewed to select the primary parameters for leak detection monitoring purposes. The WAC for the OSDF were developed for 42 constituents during the Operable Unit 5 FS; 41 of the WAC are included in the final Operable Unit 5 Record of Decision (as discussed later, one compound, magnesium, was eliminated following completion of the FS). As discussed in this section, 18 of the 41 WAC are numerical limits and 23 are non-numerical limits that were established to satisfy regulatory screening criteria for RCRA-regulated constituents.

The maximum acceptable leachate concentrations for constituents that will be present in the OSDF were determined by fate and transport modeling. The constituent-specific leaching potential, solubility, mobility, and benefits of the engineering controls in the OSDF were considered in the modeling process. These maximum acceptable leachate concentrations were converted into solid phase WAC at the end of the process. These solid phase WAC represent the maximum concentrations for soil and debris that can be disposed of in the OSDF.

To assist in selecting the primary parameters, the actual soil concentrations for each of the 18 constituents of concern (COCs) for which numerical WAC were developed are also reviewed in order to provide a clear perspective regarding which COCs may approach their corresponding WAC concentrations and therefore are more likely to be detectable when released from the OSDF.

During the Operable Unit 5 FS, two categories of COCs were evaluated in the WAC development process. The first category includes all site-specific groundwater pathway COCs that were identified in the Operable Unit 5 RI. As a result of the process, 12 numerical WAC were developed for the groundwater pathway COCs. The second category includes those Fernald site constituents that need to be managed and accounted for under RCRA regulations. Six additional numerical WAC were developed for the RCRA-regulated constituents, bringing the total numerical WAC for the OSDF to 18. The following subsections summarize the WAC development process for these two categories of constituents, as derived from the sitewide WAC development process described in the Operable Unit 5 FS. Figure 4-6 summarizes the process in flow chart fashion.

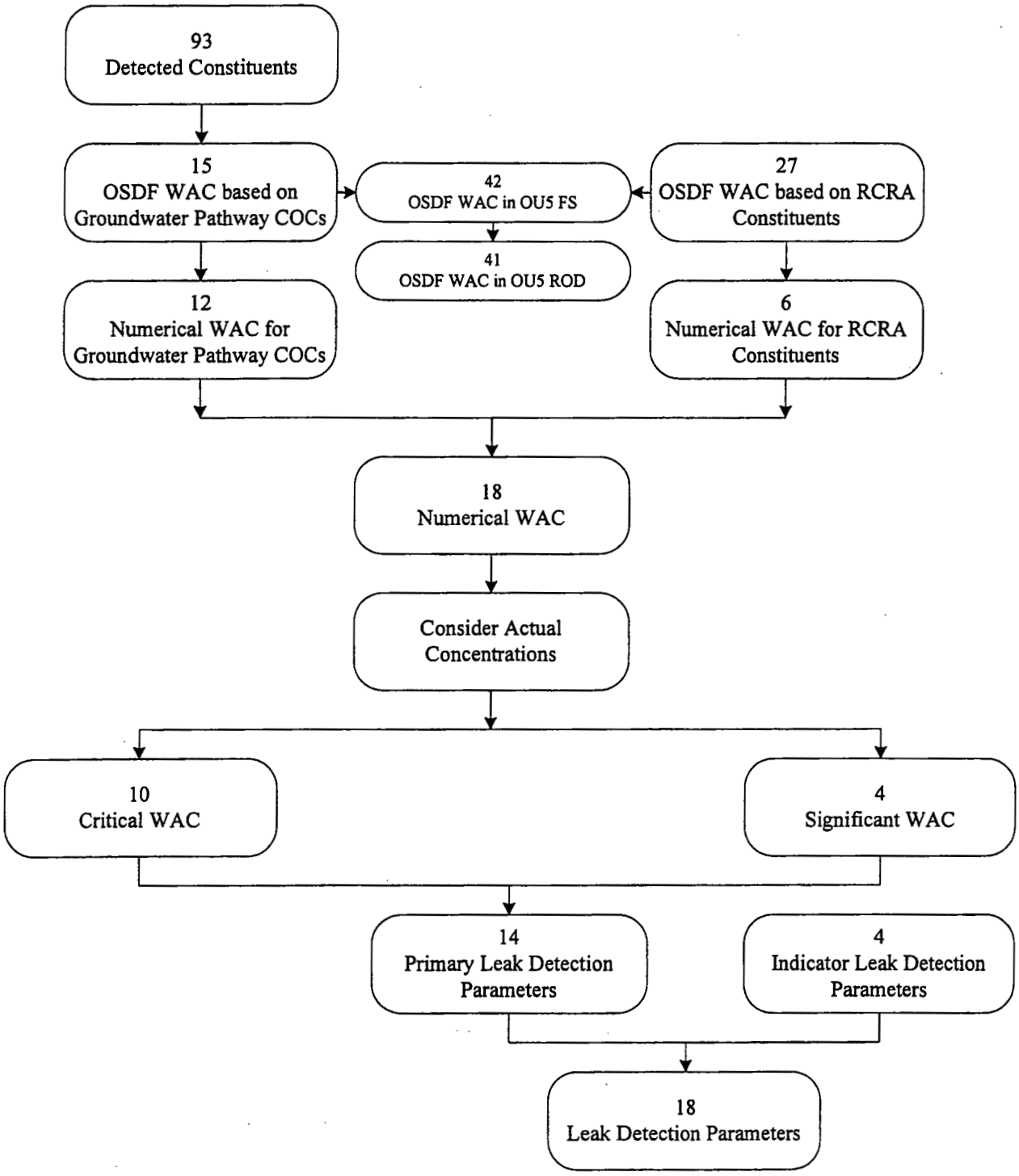


Figure 4-6. Groundwater/Leak Detection Parameter Selection Process

4.4.2.1.1 Groundwater Pathway COCs

Initially, only the WAC for groundwater pathway COCs were developed. WAC were determined necessary for 15 groundwater pathway COCs selected from Table F.2-2 of Appendix F of the Operable Unit 5 FS. Among all the detected soil and groundwater constituents at the Fernald site, these 15 COCs have potential to reach and impact the Great Miami Aquifer through the glacial till under natural conditions (i.e., before being disposed in the OSDF) within 1000 years. Table F.2-2 also lists all the other constituents screened for potential cross-media impacts. Overall 53 organics, 25 inorganics, and 15 radionuclides were evaluated in the groundwater COC selection process, including all the RCRA constituents that have been detected in soil and groundwater at the Fernald site.

After considering the engineering controls provided by the OSDF in the modeling procedures, 12 of the original 15 groundwater pathway COCs were found to require a numerical WAC. Compliance with the 12 numerical WAC, when determining what materials can be disposed in the OSDF, will be required for long-term protection of the Great Miami Aquifer. Table 4-2 lists the 15 COCs considered and the WAC that were developed. The technical approach of fate and transport modeling conducted to develop the COC-specific WAC has been summarized in Section F.5 in the Operable Unit 5 FS.

Upon further review of the initial WAC development process contained in the Operable Unit 5 FS, EPA, OEPA, and DOE concurred that magnesium does not present a significant threat to human health. Therefore, magnesium was eliminated from further consideration and a WAC for magnesium was not presented in Table 9-6 of the Operable Unit 5 Record of Decision.

The numerical WAC for the 12 groundwater pathway COCs will likely be the main controlling factors for the disposal of contaminated soil in the OSDF. The 12 groundwater pathway COCs, which have numerical WAC, have significantly higher mobility and persistence, and therefore should be considered as prime candidates when selecting the indicator parameters for the detection monitoring program for the OSDF.

The numerical WAC for the 12 groundwater pathway COCs in Table 4-2 only define the maximum allowable soil concentrations that can be safely disposed of in the OSDF; they do not indicate what level of soil concentrations will actually be encountered during soil remediation. In order to frame the relative significance of these 12 WAC, the maximum soil concentrations for the 12 constituents that are expected in the OSDF following soil placement are provided in Table 4-3.

TABLE 4-2

WAC FOR GROUNDWATER PATHWAY COCS

COC	WAC
Radionuclides (pCi/g):	
Neptunium-237	3.12×10^{9}
Strontium-90	5.67×10^{10}
Technetium-99	2.91×10^{1}
Total uranium - (mg/kg)	1.03×10^{3}
Organics (mg/kg):	
Alpha-Chlordane	2.89×10^{0}
Bis(2-chloroisopropyl)ether	2.44×10^{-2}
Bromodichloromethane	9.03×10^{-1}
Carbazole	7.27×10^{4}
1,2-Dichloroethane	*
4-Nitroaniline	4.42×10^{-2}
Vinyl Chloride[1]	1.51×10^{0}
Inorganics (mg/kg):	
Boron	1.04×10^{3}
Chromium VI[1]	*
Magnesium	*
Mercury[1]	5.66×10^{4}

*Denotes constituents that will not exceed designated Great Miami Aquifer action level within 1000-year performance period, regardless of starting concentration in the disposal facility.
[1]RCRA constituent.

TABLE 4-3

EXPECTED MAXIMUM COC CONCENTRATIONS IN THE OSDF

COC	Maximum Concentration[1]	Maximum WAC	MAX/WAC
Radionuclides (pCi/g):			
Neptunium-237	2.63×10^{0}	3.12×10^{9}	8.43×10^{-10}
Strontium-90	6.49×10^{0}	5.67×10^{10}	1.14×10^{-10}
Technetium-99	2.91×10^{1}	2.91×10^{1}	1.00×10^{0}
Total uranium - (mg/kg)	1.03×10^{3}	1.03×10^{3}	1.00×10^{0}
Organics (mg/kg):			
Alpha-Chlordane	5.10×10^{-3}	2.89×10^{0}	1.76×10^{-3}
Bis(2-chloroisopropyl)ether	2.44×10^{-2}	2.44×10^{-2}	1.00×10^{0}
Bromodichloromethane	7.00×10^{-3}	9.03×10^{-1}	7.75×10^{-3}
Carbazole 2.50×10^{-1}	7.27×10^{4}	3.44×10^{-6}	
4-Nitroaniline 4.42×10^{-2}	4.42×10^{-2}	1.00×10^{0}	
Vinyl Chloride[2]	1.51×10^{0}	1.51×10^{0}	1.00×10^{0}
Inorganics (mg/kg):			
Boron	1.43×10^{1}	1.04×10^{3}	1.38×10^{-2}
Mercury	1.30×10^{0}	5.66×10^{4}	2.30×10^{-4}

[1]Lower value between the WAC and the maximum soil concentration presented in Table F.3.4-3, Operable Unit 5 RI.
[2]Also consider tetrachloroethene and trichloroethene in soil.

As shown in Table 4-3, the expected maximum soil concentrations in the OSDF reveal that only five of the 12 groundwater pathway COCs with numerical WAC (technetium-99, total uranium, vinyl chloride, bis(2-chloroisopropyl)ether, and 4-nitroaniline) are expected to approach their respective WAC concentrations. The other seven COCs will have maximum soil concentrations in the OSDF that are much less than their corresponding WAC. This information regarding overall abundance is also an important consideration for selecting indicator parameters for the leak detection monitoring program.

4.4.2.1.2 RCRA Constituents

After the WAC for the groundwater pathway COCs were developed, WAC for 27 additional RCRA-regulated constituents (termed the RCRA COCs) were evaluated. Development of WAC for these specific constituents was considered necessary from a regulatory standpoint to address a requirement that the RCRA COCs not be eliminated in any COC screening step during the RI/FS process. The intention was to demonstrate compliance with RCRA regulations by providing a mechanism for keeping track of the fate of materials contaminated with RCRA constituents during the remediation.

the additional constituents were determined to need a numerical WAC. The details of the RCRA constituent WAC development process are provided in Attachment F.5.I of the Operable Unit 5 FS. Table 4-4 summarizes the results.

The six additional numerical WAC in Table 4-4 are actually not expected to affect any disposal decisions for contaminated waste, soil, and debris from Operable Units 2, 3, and 5. As shown in Table 4-4, the WAC for chloroethane and toxaphene are close to pure product concentration (i.e., 1.00×10^6 milligrams per kilogram [mg/kg]). The WAC for tetrachloroethene, trichloroethene, 1,1-dichloroethene, and 1,2-dichloroethene are higher than the highest detected soil concentrations, which were used in the previous screening process summarized in Table F.2-2 of the Operable Unit 5 FS. The maximum detected soil concentrations presented in Table F.3.4-3 of the Operable Unit 5 RI for tetrachloroethene, trichloroethene, 1,1-dichloroethene, and 1,2-dichloroethene are 1.6×10^0, 8.90×10^1, 3.90×10^{-2}, and 3.4×10^{-1} mg/kg, respectively.

In general, the 15 groundwater pathway COCs listed in Table 4-2 already include all the constituents detected in soil and groundwater at the Fernald site which may have potential to impact the Great Miami Aquifer and, therefore, are more likely to be detectable in the monitoring system in case of a leak from the OSDF.

4.4.2.1.3 Selected Primary Parameters

Based on information presented in Tables 4-2 through 4-4, 14 constituents are considered to be the initial primary parameters list for OSDF leak detection monitoring purposes. Table 4-5 summarizes these constituents and the rationale for their selection. Table 4-5 also indicates whether each of the 14 constituents is listed in OAC 3745-27-10 Appendix I as a regulatory default parameter.

Four of the 18 constituents which have numerical WAC listed in Tables 4-2 or 4-4 (i.e., chloroethane, toxaphene, neptunium-237, and strontium-90) were not selected because of their expected actual maximum concentrations in the OSDF and their comparatively high WAC values which indicate less likely potential impacts and detectability in case of a leak from the OSDF. However, four RCRA constituents which are not groundwater pathway COCs (i.e., tetrachloroethene, trichloroethene, 1,1-dichloroethene, and 1,2-dichloroethene) were selected since their expected maximum soil concentrations are reasonably close to the WAC.

TABLE 4-4

WAC FOR ADDITIONAL RCRA CONSTITUENTS

RCRA Constituents	Detected and Previously Screened	WAC	OAC 3745-27-10 Appendix I
Organics (mg/kg):			
Acetone	yes	*	Yes
Benzene	yes	*	Yes
Carbon tetrachloride	yes	*	Yes
Chloroethane	no	3.92×10^5	Yes
Chloroform	yes	*	Yes
Chloromethane	no	*	Yes
1,1-Dichloroethane	yes	*	Yes
1,1-Dichloroethene	yes	1.14×10^1	Yes
1,2-Dichloroethene	no	1.14×10^1	Yes
Endrin	no	*	No
Ethylbenzene	yes	*	Yes
Heptachlor	no	*	No
Heptachlor epoxide	no	*	No
Hexachlorobutadiene	no	*	No
Methoxychlor	no	*	No
Methylene chloride	yes	*	Yes
Methyl ethyl ketone	yes	*	Yes
Methyl isobutyl ketone	no	*	Yes
Tetrachloroethene	yes	1.28×10^2	Yes
1,1,1-Trichloroethane	yes	*	Yes
Trichloroethene	yes	1.28×10^2	Yes
Toluene	yes	*	Yes
Toxaphene	no	1.06×10^5	No
Xylenes	yes	*	Yes
Inorganics (mg/kg):			
Barium	yes	*	Yes
Lead	yes	*	Yes
Silver	yes	*	Yes

*Denotes constituents that will not exceed designated Great Miami Aquifer action level within 1000-year performance period, regardless of starting concentration in the disposal facility.

TABLE 4-5

PROPOSED PRIMARY PARAMETERS LIST

Constituents of Concern	Rationale	Appendix I
Radionuclides (pCi/g):		
Technetium-99	likely detectable when released	No
Total uranium - (mg/kg)	likely detectable when released	No
Organics (mg/kg):		
Alpha-Chlordane	likely detectable when released	No
Bis(2-chloroisopropyl)ether	likely detectable when released	No
Bromodichloromethane	likely detectable when released	Yes
Carbazole	likely detectable when released	No
1,1-Dichloroethene	significant RCRA constituent	Yes
1,2-Dichloroethene	significant RCRA constituent	Yes
4-Nitroaniline	likely detectable when released	No
Tetrachloroethene	significant RCRA constituent	Yes
Trichloroethene	significant RCRA constituent	Yes
Vinyl Chloride	likely detectable when released and significant RCRA constituent	Yes
Inorganics (mg/kg):		
Boron	likely detectable when released	No
Mercury	likely detectable when released and significant RCRA constituent	No

The 14 constituents identified in Table 4-5 that were selected as the primary leak detection monitoring parameters have a potential of entering the environment in measurable quantities and are likely to be more differentiable from background conditions. These 14 constituents will provide a reliable indication of potential releases from the OSDF to the groundwater.

4.4.2.2 Supplemental Indicator Parameters

In addition to the primary parameters discussed in the preceding subsection, four general groundwater contamination indicator parameters were also proposed to supplement the selected chemical constituents in the initial leak detection monitoring parameters list. These supplemental indicator parameters are comprised of the following:

- pH;
- Specific Conductance;
- Total Organic Halogens (TOX); and
- Total Organic Carbon (TOC)

These general groundwater contamination indicator parameters are typically used to aid in the detection of releases from disposal facilities. These supplemental indicator parameters provide an added means to detect contaminant migration, and will be useful as indicators for general groundwater quality degradation.

Although the initial indicator parameters will likely provide sufficient and reliable indications of potential releases throughout the operational life of the OSDF, efficiency of the parameters list may still be improved based on the collected data obtained over the course of the program. Any proposed modifications based on the accumulated database will involve EPA and OEPA review and approval before adoption, as discussed below.

4.4.3 Parameter List Modifications

The sections above identify the process for selecting parameters for initial baseline sampling and analysis (i.e., leak detection indicator parameters). It is anticipated that during the data collection process for OSDF, recommended refinements to the monitoring lists will be made periodically. These recommendations will either be made as part of the annual review process (which is documented in the annual site environmental reports), or included in the technical memoranda (which document the establishment of baseline conditions). All changes will be approved by EPA and OEPA prior to implementation. To date, the following changes have been recommended, approved, and implemented.

The Technical Memorandum for the On-site Disposal Facility Cells 1, 2, and 3 Baseline Groundwater Conditions documented the results of baseline groundwater monitoring activities through December 2000. The results indicated that it would be appropriate for Cells 1, 2, and 3 post-baseline monitoring to focus on the four constituents that had sufficient number of detections to allow for statistical analysis. The four constituents are total organic carbon, total organic halogens, boron, and total uranium.
Beginning in August 2002, analysis for these constituents has been performed quarterly in the LCS, LDS, horizontal till well, and the Great Miami Aquifer wells for Cells 1, 2, and 3. In addition, as recommended in the technical memorandum, all leak detection indicator constituents are analyzed in the annual samples collected from Cells 1, 2, and 3 LCS and LDS. If a constituent is detected in either the LCS or LDS, then confirmatory sampling for that constituent will consist of three consecutive quarterly samples from the horizon in which it was detected. Depending on the magnitude and/or persistence of the constituent detected in the LCS or LDS, sampling for the detected constituent in the next lower horizon may occur. If the constituent is detected in the next lower horizon, then confirmatory sampling will again be conducted

for three consecutive quarters. This strategy, performed as necessary, is based on detected constituents to ensure that a thorough evaluation of all detected constituents is completed.

With respect to the commitment identified in the technical memorandum, the 2003 annual sample collection at Cells 1 through 3 for the site-specific leak detection indicator parameters coincided with the annual sampling of the LCS identified above. For 2003 there was one detection for 4-nitroaniline of 1.01 μg/L from the Cell 1 LCS which was below the contract required detection limit of 5 μg/L, as well as the estimated quantitation limit of 20 μg/L listed in the method. Due to the very low estimated detected concentration, it was determined that confirmatory sampling was not necessary; however, this constituent will be analyzed again in 2004 along with the other annual analyses. Additionally, technetium-99 was detected at the Cell 3 LCS (9.89 pCi/L). Confirmatory sampling of technetium-99 in the Cell 3 LCS began in the first quarter of 2004 and will continue for the following two quarters. Data will be evaluated as they are available and a determination will be made regarding continued sampling.

In 2002 there were relatively high concentrations of sulfate in the Cells 4 and 5 LCS water prior to waste placement, indicating a sulfate source (possibly gypsum) in the gravel comprising the LCS layer. Due to sulfate's high mobility and the presence of an ongoing source in the LCS/LDS layers, it was identified as a leak detection indicator parameter and added to the monitoring requirements at all OSDF locations beginning in 2003 (refer to Appendix B for monitoring frequencies in each cell).

An additional subsequent future re-evaluation of the program (e.g., a review of monitoring results accompanying final capping) is envisioned before the long-term, post-closure leak detection monitoring parameters list is ultimately finalized. The following subsections also describe some of the considerations of future additions and deletions to the parameter lists. As previously mentioned, all additions and deletions to the indicator list will be identified to EPA and OEPA and approved prior to implementation. Variances and revisions to the Project-Specific Plan and this plan will be made as necessary.

4.4.3.1 Eliminating Monitoring Parameters

An indicator parameter will be considered for elimination from the current program (or the long-term leak detection monitoring parameters list) when the baseline data indicate significant fluctuations and/or very high concentrations in horizontal till or Great Miami Aquifer monitoring wells. When the baseline concentrations of a constituent are high, a leak from the OSDF may not be noticeable from monitoring results due to background interferences. When the background concentrations fluctuate significantly, there will be a high chance of a false positive of a leak. In either case the constituent cannot be considered a reliable indicator for leak detection purposes. Additionally, those constituents that do not have a

significant percentage of detectable concentrations in samples collected to establish baseline conditions will be recommended for elimination of post-baseline monitoring.

An indicator parameter will also be considered for elimination from the long-term leak detection monitoring parameters list if it is not detected in the LCS leachate samples collected during active waste placement. Any constituents not detected in the LCS leachate samples after waste placement are likely to be absent, insoluble, or of insignificant abundance in the OSDF. Therefore, it may not be necessary to analyze these constituents further for leak detection purposes, and a proposal for EPA and OEPA approval of the constituents' elimination will be developed.

4.4.3.2 Adding Monitoring Parameters

Based on the analytical results of the annual grab sample of leachate collected in LCS for the Appendix I and PCB parameters specified in OAC 3745-27-10 and 19 (see Section 5.0 for more details), detected constituents will be evaluated to determine whether the original indicator parameters list is sufficient for leak detection purposes. As mentioned before, most of the Appendix I constituents have already been detected in perched groundwater under the Fernald site and were considered when selecting the initial leak detection indicator parameters. It is expected that these constituents will also be detected in future OSDF leachate samples. However, they will not necessarily be adequate indicators of a release. Therefore, constituents detected in the annual OSDF LCS samples will not be automatically added to the leak detection indicator parameters list, unless they meet the criteria discussed below.

The need to add a new indicator parameter will be considered when its detected concentrations in the annual OSDF LCS samples are much higher than the concentrations that exist currently in the contaminated media underlying the facility (which were evaluated during the initial parameter selection process). An indicator parameter will be added when it can be demonstrated that routine analysis of the constituent in the leak detection monitoring system can significantly enhance the early detection capability of the monitoring program. Evaluations of the annual leachate grab sampling data will be conducted to determine the need for adjustments to the current parameter list; the results of the evaluations will be reported in accordance with the OAC 3745-27-19(M) reporting requirement.

As indicated in Section 3.2.2, although constituents which are not part of the limited indicator parameter list for leak detection may be detected in the annual grab, it is not anticipated that the concentrations will be high enough to warrant revision of the leak detection parameter list. However, a review of the data will

be conducted (and reported through the annual site environmental reports) to determine whether any new indicator constituents should be added to the site-specific leak detection indicator parameter list. A constituent will be added if: (1) concentrations observed in the annual sample are much higher than the perched water concentrations at the Fernald site; and (2) routine analysis of the constituent can significantly enhance early detection capability. Additions will be documented through the annual site environmental reports.

4.5 LEAK DETECTION SAMPLE COLLECTION

The following subsections discuss the sample collection for the four components of the leak detection program: the LCS and LDS drainage layers (flow and water quality), the horizontal till wells in the glacial till (water quality), and the monitoring wells in the Great Miami Aquifer (water quality). The subsections discuss the establishment of baseline conditions in the perched groundwater and Great Miami Aquifer, and post-baseline sampling that will accompany all four components during active cell operations and after each cell is capped.

4.5.1 Establishment of Baseline Conditions

In order to accurately determine whether there has been a leak from the OSDF, it is necessary to establish representative baseline conditions in the natural environment underlying the facility, from which to draw future comparisons. As discussed in Section 2.0, both the perched groundwater system and the Great Miami Aquifer in the vicinity of the OSDF contain uranium and other Fernald site-related constituents at levels above background. Many of these constituents are also included in the OSDF analytical parameter list discussed in Section 4.4. It is therefore important to establish pre-existing conditions (i.e., constituent concentration levels and variability) for all of the OSDF analytical parameters so that accurate assessments of future data trends in the perched system and the Great Miami Aquifer can be made.

The Fernald site's existing information concerning pre-existing contaminant conditions in the subsurface is derived from the Operable Unit 5 RI and the OSDF Pre-Design Investigation. This existing information has been sufficient for the purposes of risk assessment, the development of conceptual and detailed designs for the Fernald site's remedial actions, and the formulation of conservative assumptions for fate and transport modeling. The existing information is not of such detail, however, to permit the statistical evaluations, precise spatial and temporal comparisons, and comprehensive data trending that accompanies a leak detection program. More information regarding data variability and seasonal influences is needed in the immediate vicinity of the OSDF for both the perched system and the Great Miami Aquifer.

As indicated in Section 3.0, the Ohio Solid Waste regulations require that, for detection monitoring, at least four independent samples be taken from each well to determine the baseline water quality during the first 180 days after implementation of the groundwater detection monitoring program (OAC 3745-27-10(D)(5)(a)(ii)*(a)*). Note that baseline monitoring may possibly continue after initiation of waste placement and during active cell operations. Appendix B is the Project-Specific Plan, which includes sampling frequencies for each specific cell where baseline/background conditions need to be established.

For both the perched groundwater and Great Miami Aquifer wells, once the data from the initial sampling events have been procured, DOE will evaluate whether sufficient information is available to establish baseline. At this juncture, an appropriate statistical method and associated statistical measure to establish pre-existing baseline conditions will be selected. This identification is anticipated to be made on a cell-specific basis for both the perched groundwater and Great Miami Aquifer components of the program. If the amount of data is insufficient for this purpose, additional baseline samples will be collected. The initial planned sampling intervals will be scheduled far enough in advance of waste placement to allow for additional sampling if necessary to augment the baseline database.

In the event that one or more monitoring points (for example, the perched water wells) produce insufficient water volume for sampling the full suite of analytical parameters, the data accumulation period for establishing that monitoring point's baseline might be extended (at a sampling frequency independent of the frequency for the other monitoring points which have a baseline) until sufficient data are obtained for that monitoring point.

This approach and frequencies (identified in Appendix B) exceed the minimum State of Ohio regulatory requirements for background sampling and should provide sufficient information to conduct future comparative evaluations.

4.5.2 Post-Baseline Monitoring (During Active Cell Operations and After Cells are Capped)

Flow measurements and water quality analysis for the LCS and LDS commence after waste placement is initiated. Post-baseline monitoring of the Great Miami Aquifer and perched water commence after baseline conditions have been established.

As identified in Section 3.2.1.4, the Ohio Solid Waste regulations require a semiannual sampling frequency for detection monitoring but also allow for the proposal of an alternate sampling program (OAC 3745-27-10(D)(5)(a)(ii)*(b)* and (b)(ii)*(b)*, and 3745-27-10(D)(6)). During active cell operations (more specifically, post-baseline monitoring prior to cell capping), the sampling frequency for the OSDF groundwater/leak detection monitoring program will be quarterly for the indicator parameters, which exceeds the semiannual frequency requirement. After each cell is capped, it is anticipated that site-specific leak detection indicator parameter monitoring for each of the four components (i.e., LCS, LDS, horizontal till well, and Great Miami Aquifer wells) will be performed semiannually to continue to meet regulatory requirements. It is anticipated that final capping of the individual cells will generally result in a decrease in the overall quantity of leachate produced and a potential corresponding change in leachate composition.

4.5.2.1 Flow Monitoring in the LCS and LDS

Leachate collected by the LCS from each cell flows by gravity to the Enhanced Permanent Leachate Transmission System (EPLTS) permanent lift station. Anticipated leachate production rates in the LCS were determined during the design of the OSDF (see Section 7.1 of the OSDF Calculation Package [GeoSyntec 1997]) as follows:

	LCS, each cell, gallons per acre day		LCS, baseline design flow rate per cell, gallons per day
	Average	Peak	
Initial stage (10 ft. or less waste)	1,145	1,754	
Intermediate stage (>10 ft. of waste)	696	1,754	11,401
After closure	0.002	0.024	0.16

The initial stage is when construction of the liner system has been completed, and waste placement starts and continues until 10 feet of waste has been placed in the cell. The intermediate stage is the placement of waste from the initial 10 feet of waste until cell closure. After closure is the period after the cell has been capped.

The amount of liquid removed from the OSDF via the LCS is recorded in accordance with the graded approach depicted below. This graded approach is patterned after federal hazardous waste landfill regulation 40 CFR 264.303(c)(2), and also satisfies Ohio solid waste rule OAC 3745-27-19(M)(4):

Tier	LCS Flow Monitoring Frequency
Prior to Placement of Final Cover on the Last OSDF Cell	
0	Record at least monthly.
Post Closure (After Placement of Final Cover on the Last OSDF Cell)	
1	Record at least monthly, except as provided by the following.
2	If the liquid level stays below the "pump operating level" for two consecutive months, record at least quarterly, except as provided by the following.
3	If the liquid level stays below the "pump operating level" for at least two consecutive quarters, record at least semiannually.

NOTE: The post-closure point of measurement is the EPLTS permanent lift station. If at any time during the post-closure care period the "pump operating level" is exceeded when on quarterly (Tier 2) or semiannually (Tier 3) recording schedule, the recording schedule will revert to monthly (Tier 1) until the requirement is met to move to the next higher numbered tier.

"Pump operating level" is that liquid level based on pump activation level, sump dimensions, and the level that avoids backup into the LCS drainage layers in the OSDF cells, and minimizes head in the EPLTS permanent lift station. The pump operating level for the EPLTS permanent lift station is to be developed later (as discussed in Section 6.0) after the final cover has been placed over the last cell of the OSDF. It is anticipated that this will be established via trend analysis on leachate flow monitoring measurements prior to and after closure of the last cell of the OSDF.

Additionally, trend analyses of these LCS flow monitoring measurements are conducted on those cells that are capped in order to provide indication of changes in trends in system performance far enough in advance to allow application of appropriate follow-up inspection and corrective action as necessary. The required notifications and response actions for leachate flow monitoring are discussed in Section 6.0.

The amount of liquid removed from each LDS is recorded in accordance with the following graded approach, consistent with the approach for the LCS:

Tier	LDS Flow Monitoring Frequency
Prior to Placement of Final Cover on an Individual OSDF Cell	
0	Record weekly.
Post Closure (After Placement of Final Cover on an Individual OSDF Cell)	
1	Record at least monthly, except as provided by the following.
2	If the liquid level in the LDS stays below the "action leakage rate" for two consecutive months, record at least quarterly, except as provided by the following.
3	If the liquid level in the LDS stays below the "action leakage rate" for at least two consecutive quarters, record at least semiannually.

NOTE: These are intended to apply individually to each cell of the OSDF. If at any time during the post-closure care period the "action leakage rate" is exceeded at a cell on quarterly (Tier 2) or semiannually (Tier 3) recording schedule, the recording schedule for that cell will revert to monthly (Tier 1) until the requirement is met to move to the next higher numbered tier.

"Action leakage rate" is that liquid level based on LDS collection tank dimensions, and the level that avoids backup into the LDS drainage layer. The action leakage rate for each LDS collection tank is to be developed later (as a future amendment to this plan, and as discussed in Section 6.0) based on measurements after the final cover has been placed over that cell. It is anticipated that this action leakage rate will be established via trend analyses on closed cells prior to closure of the last cell of the OSDF. (Refer to Plates M-1 through M-7 from the October 2001 EPLTS drawings [Cells 1 – 6] and Plates M-1 through M-6 from September 2003 Valve House 7/8 drawings [Cells 7 and 8] for the configuration of valve houses and associated LDS collection tanks.)

Additionally, trend analysis of the LDS flow monitoring measurements are conducted on those cells that are capped in order to provide an indication of changes in trends in system performance far enough in advance to allow application of appropriate follow-up inspection and corrective action as necessary. The required notifications and actions are discussed in Section 6.0.

4.5.2.2 Water Quality Monitoring in the LCS and LDS

During active cell operations, water quality monitoring for the LCS and LDS drainage layers within each cell (for leak detection monitoring purposes) is performed quarterly. The samples will be analyzed for parameters contained in Section 4.4; more specifically, those identified in the Project-Specific Plan provided in Appendix B.

Prior to collecting the sample, the volume contained in the LCS and LDS tanks or flowing through the individual LCS and LDS transfer lines is estimated to determine whether sufficient volume is present for the full suite of analytes (see discussion in Appendix B for the setting of priorities). In case there is an absence of liquid in the LCS and/or LDS drainage layers such that water quality sampling cannot be conducted, it will be inferred that no leak from the cell has occurred.

While it is desired that the samples be collected from the LCS and LDS during the same time interval to enhance the comparability of the data, the overriding requirement is that enough fluid be present in the individual system to collect sufficient volume for the analyses.

As identified above, after each cell is capped it is anticipated that water quality monitoring for indicator parameters will be conducted semiannually to continue to meet regulatory requirements.

4.5.2.3 Water Quality Monitoring of the Perched Groundwater and Great Miami Aquifer

After the perched groundwater and Great Miami Aquifer baselines are established, the groundwater monitoring wells for both of these components are sampled quarterly (during active cell operations) to address the potential for seasonal variation in the analytical parameters. Four quarters of sampling over one year are generally accepted for providing seasonal variation in groundwater chemistry. Because of the existing contamination in the Great Miami Aquifer and the perched groundwater, and the current remediation activities underway site-wide, the sampling frequency is quarterly until future conditions warrant otherwise. The samples will be analyzed for parameters contained in Section 4.4 (more specifically, those parameters identified in the Project-Specific Plan provided in Appendix B).

Sampling both the perched groundwater and the Great Miami Aquifer groundwater during the same time frame is desired in order to enhance the comparability of the data; however, the overriding requirement is that enough fluid be present in the individual monitoring point to collect sufficient volume for the analyses.

Prior to collecting the sample, the volume contained in the monitoring point is estimated in order to determine whether sufficient volume is present for the full suite of analytical parameters (see Appendix B for a discussion on setting priorities for low sample volume). The sufficiency of volume is of particular concern in the till monitoring point; if no liquid is found in the till monitoring point, it will be inferred that no leak from the cell has occurred. However, if water exists in the well, it will not be inferred that a leak has occurred, and water volume measurements will be taken and plotted versus time in order to assist in the holistic approach of determining a leak.

As identified above, after each individual cell is capped, it is anticipated that water quality monitoring for indicator parameters will be conducted semiannually to continue to meet regulatory requirements.

4.6 LEAK DETECTION DATA EVALUATION PROCESS

The leak evaluation strategy for each OSDF cell is two-fold:

- Trend analysis for the LCS, LDS, the glacial till, and the Great Miami Aquifer will help pinpoint potential leak-related influences within each leak detection program element; and
- The monitoring results from all elements will be correlated and evaluated holistically to determine whether a release has occurred and if a response action is necessary.

These components are discussed in the next two sections.

4.6.1 Trend Analysis

The initial flow and water quality data obtained from the LCS, LDS, and the groundwater monitoring components are used to begin a qualitative trend analysis of the volume of leachate produced by each cell and the corresponding concentrations of analytes in each monitoring component. Each cell is evaluated independently; consequently, an "intra-well" trend analysis will be used. As part of the establishment of baseline conditions, an identification of an appropriate statistical method for the trend analysis is made following the receipt and review of all baseline data. The identified method will be presented to EPA and OEPA for approval at the conclusion of the baseline activity. The type of statistical method is selected after sufficient sampling events have been completed for each baseline, and is provided in a technical memorandum to the EPA and OEPA for approval. Control charts have been the statistical method of choice for Cells 1 through 3.

The intra-well trend analysis approach can be applied to data from all the elements — the LCS, LDS, and the groundwater monitoring components. This approach is most advantageous; however, there are issues associated with groundwater given the inherent difficulties in distinguishing potential releases from the OSDF from existing above-background levels of monitoring constituents in the area of the OSDF. Regardless, point-by-point intra-well trending comparisons will be performed for the Great Miami Aquifer wells and horizontal till wells.

As indicated above in Section 4.5.2.1, action leakage rate(s) for the LDS are to be developed later after the final cover has been placed over the last cell of the OSDF. The pump operating level for the EPLTS permanent lift station will also be developed later, based on measurements after the final cover has been placed over the last cell of the OSDF. It is anticipated that this will be established via trend analysis on LCS flow monitoring measurements prior to and after closure of the last cell of the OSDF.

4.6.2 Correlation of Monitoring Data

If liquid is collected from the LDS, it does not necessarily mean that the OSDF's leachate is leaking through the primary liner into the LDS. Liquid in the LDS could be from sources other than from within a particular cell. To determine whether liquid in the LDS is leachate and the primary liner of a cell is leaking, a correlation must exist between the LCS and LDS analyte concentrations. A correlation must also exist between the increases in volume of liquid in the LCS and the LDS ("flow monitoring data"). If volume increases and analyte concentrations between the two systems correlate, then a leak through the primary composite liner system will be suspected. The significance of the suspected leak with regard to the protection of the environment depends on the concentrations of the analytes found in the LDS and the volume of liquid present. Analyte concentrations and volume-versus-time plots of groundwater collected from the till monitoring wells will be correlated with LCS and LDS data to detect a leak in the secondary composite liner system that contains the three-foot compacted clay liner.

The primary purpose for the data collected in the Great Miami Aquifer is to establish a baseline from which to determine if leakage from the OSDF is detrimentally affecting the Great Miami Aquifer. It is recognized that an exhaustive characterization of the Great Miami Aquifer has already been conducted from which to determine Fernald site impacts (from sources other than the OSDF), and to establish Fernald site-specific constituents of concern and associated final remediation levels. From this, a protective remedy for the Great Miami Aquifer has been developed, the success of which will be tracked through IEMP monitoring of site-specific indicator constituents. This has been documented in the Operable Unit 5 RI and FS Reports, the Operable Unit 5 Record of Decision, and the IEMP.

A secondary purpose for the Great Miami Aquifer data collected through the OSDF monitoring plan is to supplement the IEMP remedy performance monitoring data that will be collected for the aquifer. Groundwater data for those OSDF leak detection constituents that are also common to the IEMP groundwater remedy performance constituents are used in the IEMP data interpretations as the data become available. Groundwater data collected for those unique OSDF leak detection constituents which are not being monitored by the IEMP groundwater monitoring program are used only for the establishment of the OSDF baseline and subsequent leak detection monitoring.

5.0 LEACHATE MANAGEMENT MONITORING PROGRAM

As discussed in Section 3.0, the Ohio Solid Waste Disposal regulations require an overall leak detection strategy to comply with the leachate management and monitoring requirements in OAC 3745-27-19(M)(4) and OAC 3745-27-19(M)(5). To fulfill these requirements, the leachate management monitoring strategy provides:

1. A means to track the quantity of leachate collected for treatment and discharge, reported at least monthly;
2. A means to verify that the engineering components of the leachate management system will operate in accordance with OAC 3745-27-19, Operational Criteria for a Sanitary Landfill Facility;
3. A description of the site-specific leachate treatment and discharge elements to ensure that the leachate collected from the facility is properly managed; and
4. Collection and analysis of an annual leachate grab sample for Appendix I and PCB parameters per OAC 3745-27-10 and 19 to confirm, on an ongoing basis, the adequacy and appropriateness of the selected site-specific leak detection indicator parameters.

Item 1 of the requirements above is fulfilled by the flow monitoring component of the leak detection monitoring strategy. Flow measurements will take place at least monthly during active cell operations for both the LCS and LDS drainage layers (see Section 4.5.2.2). Item 2 of the requirements above is fulfilled by Section 3.0 of the OSDF Systems Plan, which describes the operation and maintenance activities for the OSDF's leachate management system to be employed during active cell operations.

Items 3 and 4 are described in Sections 5.1 and 5.2, respectively. Additionally, item 4 is discussed in Section 4.0 (e.g., Section 4.4.3.2).

5.1 LEACHATE TREATMENT AND DISCHARGE MANAGEMENT

All leachate from the OSDF is currently treated within the on-site AWWT facility prior to discharge at a National Pollutant Discharge Elimination System (NPDES)-permitted outfall to the Great Miami River (PF 4001). Current plans are to convert the AWWT facility (CAWWT) as waste stream treatment requirements are eliminated and remediation proceeds. Following completion of the CAWWT, leachate will be treated in the CAWWT and will be discharged at the NPDES-permitted outfall to the Great Miami River. Modifications to the treatment process included in the CAWWT design will ensure that the same unit treatment processes are used for treatment of leachate. Following is a description of the management approach for leachate treatment, along with a description of the treatment system and the leachate

monitoring needs to ensure proper operation of the treatment facility and compliance with the NPDES Permit.

All leachate, collected through the LCS and LDS drainage layers, is currently routed to Phase II of the AWWT facility for treatment. Phase II was constructed to treat a variety of sitewide process water, storm water, and remediation wastewater generated during the Fernald site's remedial actions. AWWT Phase II includes treatment processes for a broad spectrum of contaminants and includes alum coagulant, clarification, filtration, carbon adsorption, and ion exchange.

Leachate is collected from both the LCS and LDS layers of each cell of the OSDF, whenever such fluids are present. The leachate flows by gravity from each cell to their respective valve house, and from their drains through the EPLTS to the control valve house into the permanent lift station. From the permanent lift station, leachate is currently pumped into the Bio-Surge Lagoon, which is the primary collection point for remedial wastewater to be delivered to the AWWT Phase II facility.

The soil remediation of the Bio-Surge Lagoon (slated to begin in November 2004) will require that the leachate flows be directed to the SWRB for subsequent treatment at AWWT Phase I or Phase II. When the conversion of the AWWT expansion facility to the new CAWWT facility is completed in February 2005, leachate collected in the SWRB (including other storm water flows) will be directed to the CAWWT facility. The discharge of leachate to the CAWWT via the SWRB will continue until the SWRB is removed from service in October 2005 to support soil remediation of the area encompassing the SWRB. The CAWWT facility is a planned 1,800-gpm facility divided into a 1,200-gpm treatment train dedicated to groundwater, and a 600-gpm treatment train used for the treatment of storm water and remediation wastewater including leachate. The CAWWT 600-gpm treatment train will contain the same unit operations as the current AWWT Phase II system with the exception of clarification/sedimentation. All discharges from the current AWWT facility and the future CAWWT will be through the NPDES Outfall PF 4001. Note that a passive treatment system for OSDF leachate is being evaluated for potential use at the Fernald site post-closure.

5.2 CONFIRMATION OF LEAK DETECTION INDICATOR PARAMETERS

The final leachate management monitoring requirement entails the annual confirmation of the site-specific leak detection indicator parameters. The purpose of this annual sampling is to confirm the appropriateness of the site-specific leak detection indicator parameters in the event that leachate composition changes over

time, as described in OAC 3745-27-10(D)(2). An annual leachate grab sample is obtained and analyzed for parameters listed in Ohio Solid Waste regulation OAC 3745-27-10 and 19 (i.e., Appendix I and PCBs). This sampling is necessary to fulfill the reporting requirement in OAC 3745-27-19(M)(5), which requires reporting the data from an annual grab sample of leachate.

While it is anticipated that the results from analysis of the annual grab of leachate may indicate the presence of parameters not included in the leak detection indicator parameter list, it is not anticipated that these other parameters will exist in the leachate at concentrations high enough to warrant their addition to the leak detection indicator parameter list. However a review of the data will be conducted (and reported through the annual site environmental reports) to determine if any new indicator constituents should be added to the site-specific leak detection indicator parameter list. A constituent will be added if: (1) concentrations observed in the annual sample are much higher than the perched water concentrations at the Fernald site; and (2) routine analysis of the constituent can significantly enhance early detection capability. The leak detection leachate analysis will ensure that the character of the leachate will not adversely impact the treatment facility or the treatment facility effluent receiving stream (the Great Miami River).

In order to gain pre-waste placement information, a sample from both the LCS and LDS is collected and analyzed for the annual leachate monitoring parameter list. This is not a regulatory requirement, but was added to the monitoring requirements in order to obtain baseline information. This requirement was initiated in 2002.

A subsequent future re-evaluation of the program (e.g., a review of monitoring results accompanying final capping) is envisioned before the long-term, post-closure leak detection monitoring parameters list is ultimately finalized. As previously mentioned, all additions and deletions to the indicator list will be identified to EPA and OEPA and approved prior to implementation.

5.3 FUTURE CONSIDERATIONS

The frequency for sampling leachate for parameters necessary to determine proper management within the site treatment facility may need to be modified over time. Section 6.0 provides further information concerning the process for altering any of the components of this plan.

6.0 REPORTING

6.1 ROUTINE REPORTING RESPONSIBILITIES

As indicated in Section 4.5, after the baseline sampling events are completed, DOE will evaluate whether sufficient data are available to ascertain the type of distribution of the data, and from that, select an appropriate statistical method and associated statistical measure. This determination is anticipated to be made based on parameters, monitoring points, systems (i.e., glacial till and Great Miami Aquifer), and cells. Also, once sufficient samples are in hand to establish a baseline for a sampling point, the leak detection program sampling frequency for that point will be reduced to quarterly during active cell operations. These cell-specific evaluations are and will be summarized in cell-specific technical memoranda, which will be submitted to EPA and OEPA for review. The technical memoranda will serve as the mechanism to propose modifications to this initial groundwater/leak detection and leachate monitoring plan in areas such as, but not limited, to the following:

- Modification of leak detection monitoring parameters list for routine monitoring based on considerations presented in Section 4.4
- Modification of sampling frequency for LCS, LDS, glacial till, or Great Miami Aquifer monitoring points, based on considerations presented in Section 4.5
- Modification of leachate management monitoring parameters based on considerations presented in Section 5.2
- Establishment of a parameters list for statistical analysis
- Establishment of frequency for statistical analysis
- Establishment of an appropriate statistical method and associated statistical measurements
- Establishment of an action leakage rate for the LDS
- Establishment of a pump operating level for the LCS
- Temporary suspension or cessation of sampling and attendant statistical analysis for monitoring points (either singly or in combination)
- Modifications to address future needs resulting from the completion of aquifer restoration and/or the entry of the OSDF into the post-closure care mode.

Where appropriate, the approved the technical memoranda will be attached as addenda to this plan, formally resulting in an amended groundwater/leak detection and leachate monitoring plan.

To provide an integrated approach to reporting OSDF monitoring data, LCS and LDS flow data and concentrations, along with groundwater monitoring results, trending results, and interpretation of the data will be provided in the annual site environmental reports. Presenting data in one report will facilitate a qualitative assessment of the impact of the OSDF on the aquifer, as well as the operational characteristics of OSDF caps and liners. Additionally, the available monitoring data and interpretation of that data will be made available in other IEMP data summaries (e.g., the IEMP mid-year data summaries).

6.2 NOTIFICATIONS AND RESPONSE ACTIONS

If the flow rate into the LDS exceeds the action leakage rate (see Section 4.5.2.1) for any LDS sump, the actions presented in Table 6-1 will be implemented. Note that some of these response actions (i.e., those that do not pose an immediate and substantial threat to human health or the environment) might best be served by a corrective action (see Section 9.0 of the OSDF Post-Closure Care and Inspection Plan).

If it is determined that both the cap and primary liner have failed, then an OSDF response action will be required. A response action might include initiating cap repair, investigating whether or not contamination has breached the compacted clay liner component of the secondary composite liner system that lies beneath the LDS, increasing monitoring, or a combination of these. Potential leakage through the clay liner will be assessed by using the horizontal till well installed beneath the liner penetration box area and secondary liner; however, till well monitoring cannot be considered all-conclusive for detecting a leak. Comparison of the data from all four systems is needed to determine if a leak has occurred. If it is determined that a leak has adversely impacted the groundwater (till and/or Great Miami Aquifer), then a groundwater quality assessment monitoring program will be developed and initiated to determine the nature, rate, and extent of contaminant migration. Groundwater monitoring might also be increased to determine if leakage from the OSDF has entered the Great Miami Aquifer, although given the distances involved it would be unlikely that leakage from the OSDF would be able to migrate to the Great Miami Aquifer in the short time frame between leak detection and response.

TABLE 6-1

NOTIFICATION AND RESPONSE ACTIONS

Step	Timeframe	Action
1	Within 7 days of the determination of the exceedance.	Notify both the following in writing: ☐ EPA Region 5 Regional Administrator 77 West Jackson Boulevard Chicago, Illinois 60604-3590 ☐ Ohio Director of Environmental Protection 1800 Watermark Drive P.O. Box 1049 Columbus, Ohio 43266-0149
2	Within 14 days of the determination of the exceedance.	Submit to both of the individuals identified in Step 1 a written preliminary assessment as to the: ☐ Amount of liquids. ☐ Likely sources of liquids. ☐ Possible location, size, and cause of any leaks. ☐ Short-term actions taken and planned.
3	As practicable to meet Step 7.	Determine to the extent practicable the location, size and cause of any leak.
4	As practicable to meet Step 7.	Determine: ☐ Whether receipt of impacted materials should be ceased or curtailed. ☐ Whether any impacted materials within the OSDF or any individual cell/phase should be removed for inspection, repairs, or controls.
5	As practicable to meet Step 7.	Determine any other short- or long-term actions to take to stop or mitigate the leaks.
6	As practicable to meet Step 7.	In order to conduct Steps 3-5: ☐ Assess the source of liquids, and amounts of liquids by source; and ☐ In order to identify the source of liquids and the possible location of any leaks, and the hazard and mobility of the liquid, conduct a fingerprint, hazardous constituent, or other analyses of the liquids in the LDS; and ☐ Assess the seriousness of any leaks in terms of potential for escaping into the environment. OR ☐ Document why such assessments are not needed.
7	Within 30 days of the notification given in Step 1.	Submit to both of the individuals identified in Step 1 a written report of the: ☐ Results of the analyses & determinations made under Steps 3-6 (to the extent completed). ☐ Results of action taken. ☐ Actions ongoing (i.e., analyses and determinations under Steps 3-6 not yet completed) or planned (see Section 9.0 of the OSDF Post-Closure Care and Inspection Plan).
8	Monthly thereafter, as long as the flow rate in the LDS exceeds the action leakage rate.	Submit to both of the individuals identified in Step 1 a written report summarizing the: ☐ Results of actions taken. ☐ Actions planned.

SOURCE: Federal Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities, Subpart NCLandfills, Response Actions, 40 CFR 264.304(b) and 265.303(b).

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APPENDIX A

OSDF ARARs AND OTHER REGULATORY REQUIREMENTS

APPENDIX A

OSDF ARARS AND OTHER REGULATORY REQUIREMENTS

ARARs and to be considered criteria (TBCs) — for OSDF groundwater detection monitoring, OSDF leachate monitoring, and OSDF response action — that should be addressed by this plan are provided here, as obtained from the *Final Record of Decision for Remedial Actions at Operable Unit 2 (OU2 ROD)* [DOE, 1995b], the *Record of Decision for Final Remedial Action at Operable Unit 3 (OU3 ROD)* [DOE, 1996d], the *Final Record of Decision for Remedial Actions at Operable Unit 5 (OU5 ROD)* [DOE, 1996b], or the *Permitting Plan and Substantive Requirements for the On-Site Disposal Facility* [DOE, 1996c]. Additional regulatory requirements that are appropriate guidance for formulation of this plan have been also identified and included.

TABLE A-1

OSDF GROUNDWATER/LEAK DETECTION AND LEACHATE MONITORING PLAN COMPLIANCE STRATEGY ARARs AND OTHER REGULATORY REQUIREMENTS

Citation	Requirement
	PLANS
Ohio Municipal Solid Waste Rules-Sanitary Landfill Facility Permit to Install Application OAC 3745-27-06(C)(9)(a)	• Prepare a "groundwater detection monitoring plan" as required by OAC 3745-27-10, and if applicable a "groundwater quality assessment plan" and/or "corrective measures plan" required by OAC 3745-27-10.
	• Prepare a "leachate monitoring plan" to ensure compliance with OAC 3745-27-19(M)(4) and (5).
	GROUNDWATER/LEAK DETECTION MONITORING
Ohio Municipal Solid Waste Rules-Groundwater Monitoring Program for a Sanitary Landfill Facility OAC 3745-27-10(A)	(1) The owner or operator of a sanitary landfill facility shall implement a "groundwater monitoring program" capable of determining the quality of groundwater occurring within the uppermost aquifer system and all significant zones of saturation above the uppermost aquifer system underlying the landfill facility, with the following elements: (a) A "groundwater detection monitoring program" which includes: (i) a "groundwater detection monitoring plan" in accordance with OAC 3745-27-10(B) through (D); (ii) a monitoring system in accordance with OAC 3745-27-10(B); (iii) sampling and analysis procedures, including an appropriate statistical method, in accordance with OAC 3745-27-10(C); and (iv) detection monitoring procedures, including monitoring frequency and a parameter list, in accordance with OAC 3745-27-10(D). (2) Schedule for implementation of detection monitoring. (4) For purposes of this rule, the groundwater monitoring program is implemented upon commencement of sampling of groundwater wells.
Ohio Municipal Solid Waste Rules-Ground Water Monitoring System OAC 3745-27-10(B)	(1) The "groundwater detection monitoring program" shall consist of sufficient number of wells, installed at appropriate locations and depths, to yield groundwater samples from both the uppermost aquifer system and any significant zones of saturation that exist above the uppermost aquifer system that: (a) represent the quality of the background groundwater that has not been affected by past or present operations; and (b) represent the quality of the groundwater passing directly downgradient of the limits of solid waste placement. (4) The number, spacing, and depth of groundwater monitoring wells shall be: (a) based on site specific hydrogeologic information; and (b) capable of detecting a release from the facility to the groundwater at the closest practicable location to the limits of waste placement.
Ohio Municipal Solid Waste Rules- Ground Water Sampling, Analysis, and Statistical Methods OAC 3745-27-10(C)	(1) The "groundwater monitoring program" shall include consistent sampling and analysis procedures and statistical methods that are protective of human health and the environment and that are designed to ensure monitoring results that provide an accurate presentation of groundwater quality at the background and downgradient well. (a) Sampling and analysis procedures employed must be documented in a written plan. (b) The statistical method selected by the owner or operator must be in accordance with OAC 3745-27-10(C)(6)&(7). (6) After completing collection of the background data, the owner or operator shall specify one of the following statistical methods to be used in evaluating groundwater quality; the statistical method chosen must be conducted separately for each of the parameters required to be statistically evaluated: (a) a parametric analysis of variance (ANOVA); or (b) an analysis of variance (ANOVA) based on ranks; or (c) a tolerance or prediction interval procedure; or (d) a control chart approach; or (e) another statistical method.

TABLE A-1
(Continued)

Citation	Requirement
	GROUNDWATER/LEAK DETECTION MONITORING (Cont'd.)
	(7) Performance standards for statistical methods. (a) The statistical method used to evaluate groundwater monitoring data shall be appropriate for the distribution of chemical parameters or leachate and leachate-derived constituents. If shown to be inappropriate, then the data should be transformed or a distribution free theory test should be used. If the distributions for the constituents differ, more than one statistical method may be needed. (e) The statistical method shall account for data below the limit of detection with one or more statistical procedures that ensure protection of human health and the environment. Any practical quantitation limit (PQL) used in the statistical method shall be the lowest concentration level that can be reliably achieved within the specified limits of precision and accuracy during routine laboratory operating conditions that are available to the facility. (f) If necessary, the statistical method shall include procedures to control or correct for seasonal and spatial variability as well as temperal correlation in the data. (9) The number of samples collected to establish groundwater quality data shall be consistent with the appropriate statistical procedures.
Ohio Municipal Solid Waste Rules-Ground Water Detection Monitoring Program OAC 3745-27-10(D)	(2) Alternate monitoring parameter list. The owner or operator of a sanitary landfill facility may propose to delete any of the Appendix I parameters of this rule. The alternative monitoring parameter list may be approved if the removed parameters are not reasonably expected to be in or derived from the waste contained or deposited in the landfill facility. The following factors should be considered: (a) which of the parameters in Appendix I shall be deleted; (b) types, quantities, and concentrations of constituents in wastes managed at the landfill facility; (c) the concentrations of Appendix I constituents in the leachate from the relevant unit(s) of the landfill facility; (d) any other relevant information. (3) Alternate inorganic parameter list. The owner or operator of a sanitary landfill facility may propose that an alternative list of inorganic indicator parameters to be used in lieu of some or all of the inorganic parameters listed in Appendix I of this rule. The alternative inorganic indicator parameters may be approved if the alternative list will provide a reliable indication of inorganic releases from the facility to the groundwater. The following factors should be considered: (a) the types, quantities, and concentrations of constituents in wastes managed at the facility; (b) the mobility, stability, and persistence of waste constituents or their reaction products in the unsaturated zone beneath the facility; (c) the detectability of the indicator parameters, waste constituents, and their reaction products in the ground water; and (d) the concentrations or values and coefficients of variation of monitoring parameters or constituents in the background groundwater quality. (5) Monitoring parameters, frequency, location. The owner or operator shall monitor the groundwater monitoring well system (a) and (b)during the active life of the facility (including final closure and the post-closure care period, (ii) at least semiannually by collecting: *(a)* during the initial one hundred and eighty days after implementing the groundwater detection monitoring program (the first semiannual sampling event), a minimum of four independent samples from each monitoring well. Collect and analyze a minimum of eight independent samples during the first year of sampling. *(b)* After the first year during subsequent semiannual sampling events, at least one sample for each monitoring well. (iii) beginning with receiving the results from the first monitoring event under (D)(5)(a)(ii)(b) of this rule and semiannually thereafter, by statistically analyzing the results. (6) Alternative sampling and statistical analysis frequency. The owner or operator of a sanitary landfill facility may propose an alternative frequency for groundwater sampling and/or statistical analysis. The alternative frequency may be approved provided it is not less than annual. The following factors should be considered: (a) lithology of the aquifer system and all stratigraphic units above the uppermost aquifer system; (b) hydraulic conductivity of the uppermost aquifer system and all stratigraphic units above the uppermost aquifer system; (c) groundwater flow rates for the uppermost aquifer system and all zones of saturation above the uppermost aquifer system; (d) minimum distance between the upgradient edge of the limits of waste placement of the landfill facility and the downgradient monitoring well system; and (e) resource value of the uppermost aquifer system. NOTE: Table B-3 of the OU5 ROD @ p. B.3-25 states "an alternate list of monitoring parameters will be required."

TABLE A-1
(Continued)

Citation	Requirement
	GROUNDWATER/LEAK DETECTION MONITORING (Cont'd.)
Ohio Hazardous Waste General Facility Standards-New Facilities Rules-Required Programs OAC 3745-54-91; 40 CFR 264.91	Owners or operators subject to the groundwater protection rules must conduct a monitoring and response program as follows: (1) whenever hazardous constituents from a regulated unit are detected at the compliance point, the owner or operator must institute a compliance monitoring program. "Detected" is defined as statistically significant evidence of contamination. (2) whenever the groundwater protection standard is exceeded, the owner or operator must institute a corrective action program. "Exceeded" is defined as statistically significant evidence of increased contamination. (3) whenever hazardous constituents from a regulated unit exceed concentration limits in groundwater between the compliance point and the downgradient facility property boundary, the owner or operator must institute a corrective action program. (4) in all other cases, the owner or operator must institute a detection monitoring program.
Ohio Hazardous Waste General Facility Standards-New Facilities Rules-Groundwater Protection Standard OAC 3745-54-92; 40 CFR 264.92	The owner or operator must comply with conditions specified in the facility permit that are designed to ensure that hazardous constituents detected in the groundwater from a regulated unit do not exceed the specified concentration limits (specified in the permit) in the uppermost aquifer underlying the waste management area beyond the point of compliance. The groundwater protection standard will be established when hazardous constituents have been detected in the groundwater.
Ohio Hazardous Waste General Facility Standards-New Facilities Rules-Hazardous Constituents OAC 3745-54-93; 40 CFR 264.93	(A) The permit will specify the hazardous constituents to which the groundwater protection standard applies. Hazardous constituents are those that have been detected in the groundwater in the uppermost aquifer underlying a regulated unit and that are reasonably expected to be in or derived from waste contained in a regulated unit, unless excluded under paragraph B of this rule. (B) A constituent will be excluded from the list of hazardous constituents specified in the facility permit if it is found that the constituent is not capable of posing a substantial present or potential hazard to human health or the environment. The following will be considered: (1) Potential adverse effects on groundwater quality, considering: (a) the physical and chemical characteristics of the waste in the regulated unit, included its potential for migration; (b) the hydrogeological characteristics of the facility and surrounding land; (c) the quantity of groundwater and the direction of groundwater flow; (d) the proximity and withdrawal rates of groundwater users; (e) the current and future use of groundwater in the area; (f) the existing quality of groundwater, including other sources of contamination and their cumulative impact on the groundwater quality; (g) the potential for health risks caused by human exposure to waste constituents; (h) the potential damage to wildlife, crops, vegetation, and physical structures caused by exposure to waste constituents; (i) the persistence and permanence of the potential adverse effects.
Ohio Hazardous Waste General Facility Standards-New Facilities Rules-General Groundwater Monitoring Requirements OAC 3745-54-97; 40 CFR 264.97	(G) In detection monitoring or where appropriate in compliance monitoring, data on each constituent specified in the permit [or in the monitoring plan] is to be collected from background wells and wells at compliance point(s). The number and kinds of samples collected to establish background shall be appropriate for the form of statistical test employed. The sample size should be as large as necessary to ensure with reasonable confidence that a contaminant release to the groundwater from a facility will be detected. The owner or operator will determine an appropriate sampling procedure and interval for each constituent. (H) The owner or operator is to specify one of the following statistical methods to be used in evaluating groundwater monitoring data for each constituent to be specified ... Use of any of the following statistical methods must be protective of human health and the environment: (1) a parametric analysis of variance (ANOVA); (2) an analysis of variance (ANOVA) based on ranks; (3) a tolerance or prediction interval procedure; (4) a control chart approach; or (5) another statistical method.

TABLE A-1
(Continued)

Citation	Requirement
	GROUNDWATER/LEAK DETECTION MONITORING (Cont'd.)
Ohio Hazardous Waste General Facility Standards-New Facilities Rules-Detection Monitoring Program OAC 3745-54-98; 40 CFR 264.98	(A) The owner or operator must monitor for indicator parameters (e.g., specific conductance, total organic carbon, or total organic halogen), waste constituents, or reaction products that provide a reliable indication of the presence of hazardous constituents in groundwater. The director [of OEPA] will specify the parameters or constituents to be monitored in the facility permit, after considering the following factors: (1) types, quantities, and concentrations of constituents to be managed at the regulated unit; (2) mobility, stability, and persistence of the waste constituents or their reaction products in the unsaturated zone beneath the waste management area; (3) detectability of the indicator parameters, waste constituents, and their reaction products in the ground water; and (4) concentrations or values and coefficients of variation of proposed monitoring parameters or constituents in the ground water background. (D) The permit will specify the frequencies for collecting samples and conducting statistical tests to determine whether there is statistically significant evidence of contamination for any parameter or hazardous constituent specified in the permit. (F) The owner or operator must determine whether there is statistically significant evidence of contamination for any chemical parameter or hazardous constituent specified in the permit at the frequency specified in the permit.
Federal Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings: Subpart D-Standards for Management of Uranium Byproduct Material Pursuant to Section 84 of the Atomic Energy Act of 1954, as Amended 40 CFR 192.30 through .34	Uranium byproduct materials shall be managed to conform to the ground water protection standard in 40 CFR 264.92, which includes detection monitoring. Alternate concentration limits for uranium can be established, as described in 40 CFR 264.95 and 264.94(b).
Environmental Monitoring DOE M 435.1-1	I.1.E.(7) Environmental Monitoring. Radioactive waste management facilities, operations, and activities shall meet the environmental monitoring requirements of DOE 5400.1, *General Environmental Protection Program;* and DOE 5400.5, *Radiation Protection of the Public and the Environment.* IV.R.(3)(a) The site-specific performance assessment and composite analysis shall be used to determine the media, locations, radionuclides, and other substances to be monitored. IV.R.(3) Disposal Facilities. (C) The environmental monitoring programs shall be capable of detecting changing trends in performance to allow application of any necessary corrective action prior to exceeding the performance objectives in this Chapter.
	LEACHATE MANAGEMENT & MONITORING
Ohio Municipal Solid Waste Rules-Operational Criteria for a Sanitary Landfill Facility OAC 3745-27-19(M)(4)&(5)	The owner annually shall report: • a summary of the quantity of leachate collected for treatment and disposal on a monthly basis during the year; location of leachate treatment and/or disposal; and verification that the leachate management system is operating in accordance with this rule; • results of analytical testing of an annual grab sample of leachate.
	OTHER REQUIREMENTS
Federal Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities, Subpart N-Landfills, Monitoring and Inspection 40 CFR 264.302	Action Leakage Rate: (a) The action leakage rate is the maximum design flow rate that the leak detection system (LDS) can remove without the fluid head on the bottom liner exceeding 1 foot. The action leakage rate must include an adequate safety margin to allow for uncertainties in the design (e.g., slope, hydraulic conductivity, thickness of drainage material), construction, operation, and location of the LDS, waste and leachate characteristics, likelihood and amounts of other sources of liquids in the LDS, and proposed response actions (e.g., the action leakage rate must consider decreases in the flow capacity of the system over time resulting from siltation and clogging, rib layover and creep of synthetic components of the system overburden pressures, etc.). (b) To determine if the action leakage rate has been exceeded, the owner or operator must convert the weekly or monthly flow rate from the monitoring data obtained under 40 CFR 264.303(c), to an average daily flow rate (gallons per acre per day) for each sump (i.e., liner penetration box). Unless the [EPA] approves a different calculation, the average daily flow rate for each sump must be calculated weekly during the active life and closure period, and monthly during the post-closure care period when monthly monitoring is required under 40 CFR 264.303(c).

OTHER REQUIREMENTS (Cont'd.)

TABLE A-1
(Continued)

Citation	Requirement
Federal Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities, Subpart N-Landfills, Monitoring and Inspection 40 CFR 264.303(c)	An owner or operator required to have a leak detection system must record the amount of liquids removed from each leak detection system sump as follows: (1) During the active life and closure period, at least once each week. (2) After the final cover is installed, in accordance with the following graded approach- • at least monthly; or • if the liquid level in the sump stays below the pump operating level for two consecutive months, at least quarterly; or • if the liquid level in the sump stays below the pump operating level for two consecutive quarters, at least semiannually; but • if at any time during the post-closure care period the pump operating level is exceeded at units on quarterly or semiannual recording schedules, the owner or operator must return to monthly recording of amounts of liquids removed from each sump until the liquid level again stays below the pump operating level for two consecutive months. NOTE: There are no requirements in Ohio hazardous waste or Ohio solid waste rules regarding leak detection system flow monitoring.
Federal Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities, Subpart N-Landfills, Response Actions 40 CFR 264.304	(a) The owner or operator of landfill units subject to 264.301(c) or (d) must have an approved response action plan before receipt of waste. The response action plan must set forth the action to be taken if the "action leakage rate" has been exceeded [in any leak detection system sump]. (b) At a minimum, the response action plan [see entry 2 above] must describe the following actions to be taken: (1) Notify the Regional Administrator in writing of the exceedance within 7 days of the determination; (2) Submit a preliminary written assessment to the Regional Administrator within 14 days of the determination, as to the amount of liquids, likely sources of liquids, possible location, size, and cause of any leaks, and short-term actions taken and planned; (3) Determine to the extent practicable the location, size, and cause of any leak; (4) Determine whether waste receipt should cease or be curtailed, whether any waste should be removed from the unit for inspection, repairs, or controls, and whether or not the unit should be closed; (5) Determine any other short-term or longer-term actions to be taken to mitigate or stop any leaks; and (6) Within 30 days of the notification that the action leakage rate has been exceeded, submit to the Regional Administrator the results of the analysis specified in (3), (4) and (5) [above], the results of action taken, and actions planned. Monthly thereafter, as long as the flow rate in the leak detection system exceeds the action leakage rate, the owner or operator must submit to the Regional Administrator a report summarizing the results of any remedial actions taken and actions planned. (c) To make the leak and/or remedial action determinations in paragraphs (b)(3), (4) and (5) [above], the owner or operator must: • Asses the source of liquids, and amount of liquids by source; • Conduct a fingerprint, hazardous constituent, or other analyses of the liquids in the leak detection system to identify the source of liquids and possible location of any leaks, and the hazard and mobility of the liquid; and • Assess the seriousness of any leaks in terms of potential for escape to the environment; or • Document why such assessments are not needed.

APPENDIX B

PROJECT-SPECIFIC PLAN
FOR THE ON-SITE DISPOSAL FACILITY MONITORING PROGRAM

PROJECT-SPECIFIC PLAN FOR THE ON-SITE DISPOSAL FACILITY MONITORING PROGRAM

Project Number 20100-PSP-0001
Revision 7

June 2004

Prepared by
Fluor Fernald

Prepared for
Fernald Closure Project

PROJECT-SPECIFIC PLAN FOR THE ON-SITE DISPOSAL FACILITY MONITORING PROGRAM

PROJECT NUMBER 20100-PSP-0001
REVISION 7

JUNE 2004

APPROVALS:

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TABLE OF CONTENTS

Page

List of Figures i
List of Tables i
List of Acronyms and Abbreviations ii

1.0 Introduction 1
1.1 Purpose 1
1.2 Scope 1
1.3 Key Project Personnel 2

2.0 Sampling Program 4
2.1 Sampling at Cells 4 through 8 4
2.2 Sampling at Cells 1, 2, and 3 5
2.3 Additional Sampling Requirements 5
2.3.1 LCS and LDS Sample Collection 5
2.3.2 HTW Sample Collection 6
2.3.3 GMA Sample Collection 6

3.0 Additional Sampling Program Requirements 12
3.1 Quality Assurance Requirements 12
3.2 Changes to the Project-Specific Plan 12
3.3 Quality Control Samples 12
3.4 Equipment Decontamination 12
3.5 Disposition of Wastes 13
3.6 Data Management 13

References 14

LIST OF FIGURES

Figure 1-1 OSDF Well Locations 3

LIST OF TABLES

Table 1-1 Key Project Personnel 2
Table 2-1 Summary of Sampling Requirements for OSDF 7
Table 2-2 Baseline Monitoring Requirements for the LDS, LCS, Glacial Till, and Great Miami Aquifer ... 8
Table 2-3 Annual Sampling and Analysis Requirements for the OSDF Leachate Collection System 9
Table 2-4 Post-Baseline Monitoring Requirements for Cells 1, 2, and 3 11

LIST OF ACRONYMS AND ABBREVIATIONS

ASL	Analytical Support Level
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CLP	Contract Laboratory Program
DQO	data quality objective
GMA	Great Miami Aquifer
GWLMP	Groundwater/Leak Detection and Leachate Monitoring Plan
HTW	horizontal till well
IEMP	Integrated Environmental Monitoring Plan
L	liter
LCS	leachate collection system
LDS	leak detection system
mL	milliliter
NTUs	nephelometric turbidity units
OSDF	On-Site Disposal Facility
PSP	Project-Specific Plan
QC	Quality Control
SCQ	Sitewide CERCLA Quality Assurance Project (SCQ).
SED	Sitewide Environmental Database
TOC	total organic carbon
TOX	total organic halogens
V/FCN	Variance/Field Change Notice

1.0 INTRODUCTION

1.1 PURPOSE

This project-specific plan (PSP) was developed in support of the Groundwater/Leak Detection and Leachate Monitoring Plan (GWLMP) for the On-Site Disposal Facility (OSDF). The GWLMP divides the OSDF monitoring program into two primary elements: (1) a leak detection component, which will provide information to verify the ongoing performance and integrity of the OSDF, and its impact on groundwater; and (2) a leachate monitoring component, which will satisfy requirements for leachate collection and management. This PSP discusses requirements for sampling groundwater monitoring system, leachate collection system (LCS), and leak detection system (LDS) for both baseline and post-baseline phases. All sampling and analysis activities will be consistent with the data quality objective (DQO) GW-024, Revision 6 (FCP 2004).

1.2 SCOPE

The construction of the OSDF is being completed in phases with eight individual cells (see Figure 1-1) and a ninth contingency cell planned. Each individual cell will be constructed with a LCS to collect infiltrating rainwater and a LDS to provide early detection of leakage from the individual cells. Additionally, groundwater within the glacial till will be monitored using a series of horizontal till wells constructed beneath each cell and the Great Miami Aquifer (GMA) will be monitored by conventional monitoring wells located upgradient and downgradient of each OSDF cell.

The monitoring strategy, as outlined in the GWLMP, recognizes the various operating phases of the OSDF including periods before, during, and after waste placement. This PSP addresses sample requirements for establishment of baseline conditions and post-baseline (i.e., during active cell operations and after cells are capped) monitoring requirements.

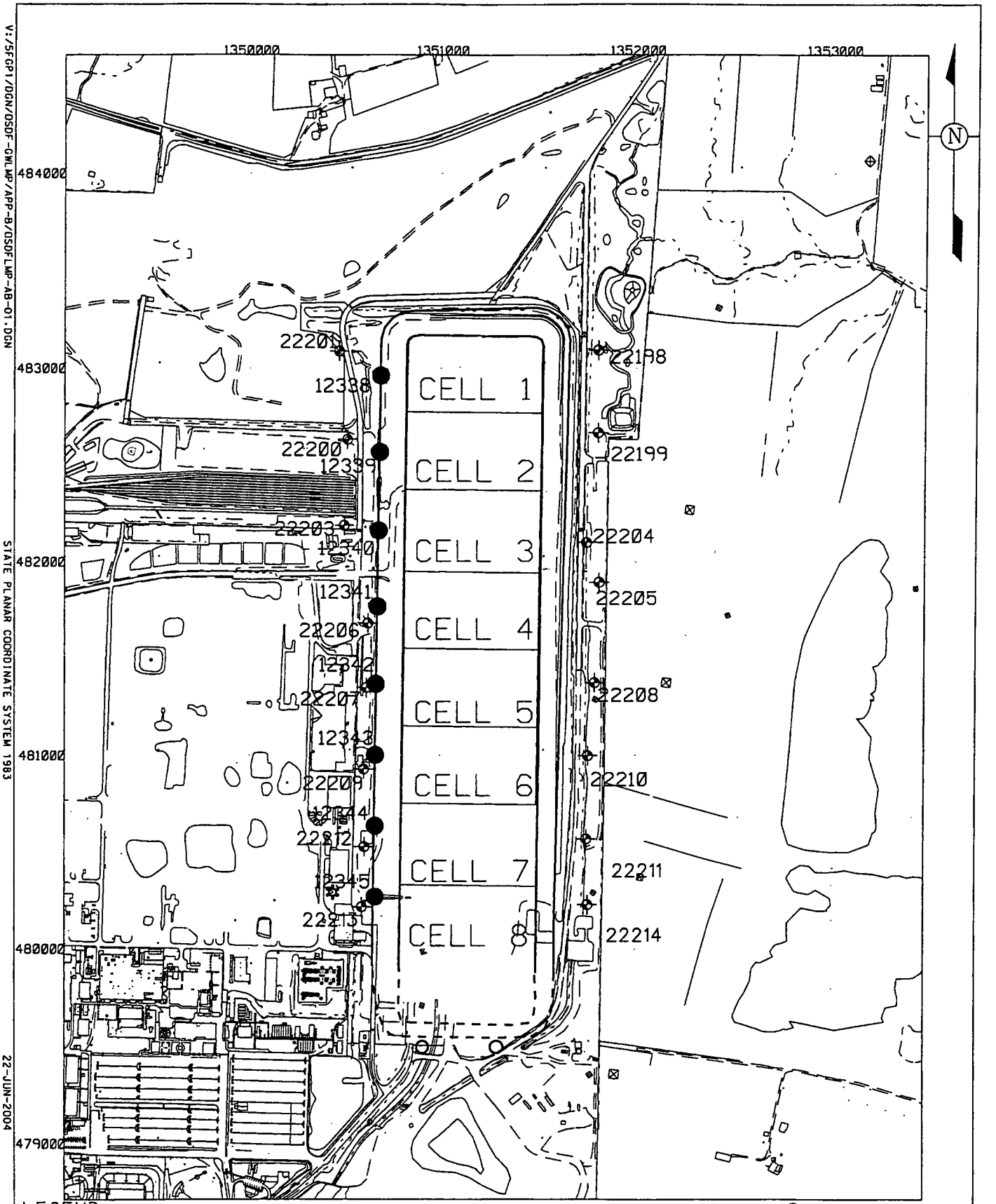
1.3 KEY PROJECT PERSONNEL

The key project personnel for this project are listed in Table 1-1:

TABLE 1-1

KEY PROJECT PERSONNEL

Title	Primary	Alternate
Project Manager	Bill Hertel	Karen Voisard
Field Sampling Lead	Karen Voisard	Dan Foster
Laboratory Contact	Chuck White	Heather Medley
Data Management Lead	Cindy Tabor	Chuck White
Quality Assurance Contact	Reinhard Friske	Darren Wessel
Health and Safety Contact	Gregg Johnson	Jeff Middaugh



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LEGEND:

- FERNALD SITE BOUNDARY
- PROPOSED GMA DETECTION MONITORING WELL
- GMA DETECTION MONITORING WELL
- HORIZONTAL TILL WELL (HTW)

SCALE

700 350 0 700 FEET

DRAFT

FIGURE 1-1. OSDF WELL LOCATIONS

2.0 SAMPLING PROGRAM

To determine whether there has been a leak from the OSDF, it is necessary to establish representative baseline conditions for all OSDF analytical parameters in the perched groundwater system and the GMA. For each cell, baseline samples will be collected for both the perched system and each of the GMA wells for all of the site-specific parameters listed in Table 2-1. Generally, during the pre-waste placement period, one baseline sampling round per month is planned. After waste placement begins, baseline sampling frequency will be adjusted to one round every other month.

Once the cell-specific baseline sampling is complete, the sampling frequency will be modified to quarterly for the remainder of the active life of each individual cell unless otherwise specified. Preferably, all horizons for a particular cell will be sampled during the same time frame to enhance the comparability of the data.

Specific monitoring requirements for each cell are provided in Sections 2.1 and 2.2. Under the scope of this PSP, Cells 4, 5, 6, 7, and 8 are under baseline monitoring and Cells 1, 2, and 3 are under post-baseline monitoring. Analytical detection limits, at a minimum, will meet the applicable final remediation levels identified in the Integrated Environmental Monitoring Plan (IEMP), Revision 3 (DOE 2003). A summary of sampling requirements for each OSDF cell is presented in Table 2-1.

2.1 SAMPLING AT CELLS 4 THROUGH 8

Sampling will be as follows:

- One sample from the LCS and LDS will be collected immediately prior to placement of waste for the parameters listed in Tables 2-2 and 2-3.
- Quarterly sampling of the LCS and LDS will begin immediately after waste placement and continue during active cell operations for the parameters listed on Table 2-2.
- One sample per year will be collected from each LCS following the start of waste placement in each cell and will be analyzed for the parameters listed on Tables 2-2 and 2-3.
- Monthly samples from the horizontal till well (HTW) and GMA will be collected immediately following well completion. Samples will be analyzed for the parameters listed in Table 2-2. Bi-monthly samples (Table 2-2) will be collected from the HTW and GMA after waste placement begins until there is sufficient data to establish baseline conditions (i.e., 12 sample results at a standardized frequency and at a sufficient data quality).

2.2 SAMPLING AT CELLS 1, 2, AND 3

Monitoring for Cells 1, 2 and 3 will be comprised of the following:

- Annual samples will be collected from the LCS for the parameters listed in Tables 2-2 and 2-3.
- Annual samples will be collected from the LDS for the parameters listed in Table 2-2.
- Quarterly samples will be collected from the LCS, LDS, HTW and GMA for the parameters listed in Table 2-4.

If an analyte is detected in the annual samples from either the LDS or LCS, then confirmatory sampling will be conducted for that constituent for three quarters from the horizon in which it was detected. Depending on the magnitude and persistence of the constituent detected, sampling of the next lower horizon may be considered. The requirements for this confirmatory sampling will be documented and approved through the established variance process.

2.3 ADDITIONAL SAMPLING REQUIREMENTS

In the event insufficient volume is available for collection of the entire analytical suite, the sample sets shall be collected in accordance with the priority listed in Tables 2-2, 2-3, and 2-4. Samples will be collected from the horizontal wells, GMA wells, LCS, and LDS in accordance with the following procedures:

Field Project Prerequisites, ADM-02
Water Sample Shipment, ADM-03
Horiba Water Quality Meter, EQT-02
Liquid Sampling for WM, SMPL-02
Groundwater Level/Total Depth Measurements, SMPL-05
Collection of Field Quality Control Samples, SMPL-21.

2.3.1 LCS and LDS Sample Collection

Samples from the LCS and LDS shall be collected by entering the valve houses located on the western side of each cell. Samples will be collected directly from the sample ports on the bottom of the LCS and LDS as the lines enter the eastern side of the valve house. The LCS is located on the northern side of the valve house and the LDS is located on the southern end of the valve house. No purging of the line is required prior to sample collection. If the discharge line is dry or does not yield enough water for the entire sample suite, the sample will be collected from the LCS and LDS tanks located within the valve house. The samples from the tanks will be collected using a dedicated Teflon bailer.

2.3.2 HTW Sample Collection

The glacial till is monitored under each cell using horizontal wells installed during construction of each cell. Prior to sample collection, the horizontal wells shall be purged of three well volumes or purged to dry, whichever occurs first. Sample collection from the horizontal well shall be accomplished using a Teflon bailer in accordance with *Liquids Sampling for WM*, SMPL-02.

2.3.3 GMA Sample Collection

Each cell is monitored by two GMA wells, located east and west of each individual cell. Two additional GMA wells will be installed on the south side of Cell 8. These wells are sampled using dedicated sampling equipment in accordance with *Liquid Sampling for WM*, SMPL-02.

Beginning in May 2004, the filtering protocol, which is utilized in the IEMP for Great Miami Aquifer samples–where turbidity is greater than 5 nephelometric turbidity units (NTUs)–was implemented as part of this PSP. An objective of the IEMP and the OSDF groundwater monitoring programs is to collect and analyze representative groundwater samples. The sample analysis for metals and radionuclides should quantify species that are dissolved, occur as mobile precipitates, or are adsorbed onto mobile particles. If immobile particles to which metals are bound are allowed to remain in field-acidified samples, then the laboratory analysis will overstate the true concentration of mobile species present in the sample because acidification dissolves precipitates or causes adsorbed metals to desorb. Turbidity readings and the use of filtration to obtain a representative sample are therefore important field concerns for collection of groundwater samples.

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

TABLE 2-1

SUMMARY OF SAMPLING REQUIREMENTS FOR OSDF

Cell(s)	Monitoring Horizons[a]	Monthly[b] (Pre-Waste Placement)	Bi-Monthly[b] (Waste Placement)	Quarterly[b]	Annually[b]
1, 2, & 3	LCS	NA	NA	Table 2-4	Tables 2-2 & 2-3
	LDS	NA	NA	Table 2-4	Table 2-1
	HTW	Complete	Complete	Table 2-4	NA
	GMA	Complete	Complete	Table 2-4	NA
4 through 8	LCS	NA	NA	Table 2-2	Tables 2-2 & 2-3
	LDS	NA	NA	Table 2-2	NA
	HTW	Table 2-2	Table 2-2	Table 2-2[c]	NA
	GMA	Table 2-2	Table 2-2	Table 2-2[c]	NA

NOTE: One sample will be collected from the Cells 4 through 8 LCS and LDS immediately prior to waste placement for Tables 2-2 and 2-3 constituents.

[a]LCS = leachate collection system
LDS = leak detection system
HTW = horizontal till well
GMA = Great Miami Aquifer
[b]NA = not applicable
[c]Quarterly samples are collected after the baseline period.

TABLE 2-2

BASELINE MONITORING REQUIREMENTS FOR THE LDS, LCS, GLACIAL TILL, AND GREAT MIAMI AQUIFER

Parameter	Method	Priority[a]	ASL[b]	Holding Time	Preservation	Standard Volume	Minimum Volume	Container
Radionuclides:	SCQ[c]		D	6 months	HNO_3 to pH<2			Plastic or Glass
Technetium-99		2				1 L	500 ml	
Uranium, total		1				100 ml	10 ml	
Inorganics:	CLP[d]/SW-846[e]	7	C		HNO_3 to pH<2	1 L	600 ml	Plastic or Glass
Boron				6 months				
Mercury				28 days				
Volatile Organics: Bromodichloromethane, 1,1-Dichloroethene, 1,2-Dichloroethene (total), Tetrachloroethene, Trichloroethene, Vinyl Chloride	CLP[d]/SW-846[e]	3	C	14 days	Cool to 4°C With H_2SO_4, HCL, or solid $NaHSO_4$ to pH<2	5 X 40 ml	1 X 40 ml	Glass vial w/Teflon lined septum cap[f]
Semi-Volatile Organics: Carbazole, 4-Nitroaniline, bis(2-Chloroisopropyl)ether	CLP[d]/SW-846[e]	6	C	7 days to extraction/ 40 days from extraction to analysis	Cool to 4°C	1 L	1L	Amber glass bottle with Teflon-lined cap
Pesticides: Alpha-Chlordane	CLP[d]/SW-846[e]	8	C	7 days to extraction/ 40 days from extraction to analysis	Cool to 4°C	1 L	1 L	Amber glass bottle with Teflon-lined cap
General Chemistry:								
Total Organic Halogens (TOX)	9020B[e]	4	B	28 days	Cool to 4°C, H_2SO_4 to pH<2	500 ml	20 ml	Amber glass w/Teflon-lined cap[g]
Total Organic Carbon (TOC)	9060[e]	5	B	28 days	Cool to 4°C, H_2SO_4 to pH<2	250 ml	125 ml	Amber glass w/Teflon-lined cap
Total Dissolved Solids (TDS)(LCS only)	160.1[h], 2540C[i]	10	B	7 days	None, Cool to 4°C	500 ml	250 ml	Plastic or Glass
Nitrate/Nitrite (LCS only)	353.1[h], 353.2[h], 4500D[i], 4500E[i]	9	B	28 days	Cool to 4°C, H_2SO_4 to pH<2	100 ml	20 ml	Plastic or Glass
Sulfate[j]	375.2[h], 300.0[h], 4500E[i]	11/12	B	28 days	Cool to 4° C	250 ml	100 ml	Plastic

NOTE: In addition, this table is used for the annual monitoring at Cells 1, 2, and 3 for the LDS and LCS (LCS annual monitoring also requires the use of Table 2-3).
NOTE: Field parameters are performed at each sampling location prior to sample collection and include dissolved oxygen, pH, specific conductance, temperature, and turbidity at ASL A, Priority 1.

[a]If sufficient volume is not available for collection of a full suite at standard volume, then the minimum volume is to be collected for all analytical groups. If sufficient volume is still not available for collection of the full suite, then a partial sample is to be collected in accordance with the indicated priority rating.
[b]Analytical Support Level. The ASL may become more conservative, if necessary to meet detection limits or data quality objectives.
[c]Radiological analyses do not have standard methods; however, the performance-based analytical specifications for these parameters are provided in Appendix G of the Sitewide CERCLA Quality Assurance Project (SCQ) (DOE 1992).
[d]EPA Contract Laboratory Program (CLP) Statement of Work, Multi-Media, Multi-Concentration, most recent revision (EPA 2004, EPA 2003). Per the SCQ, where CLP is listed, SW-846 can now be used for ASL C or D.
[e]*Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, SW-846 (EPA 1998).
[f]No head space.
[g]Minimal head space – as close to zero as possible.
[h]*Methods for Chemical Analysis of Water and Wastes*, EPA 600/4-79-020 (EPA 1983).
[i]*Standard Methods for Analysis of Water and Wastewater*, 17th edition (APHA 1989).
[j]Whenever the parameters from this table are analyzed in conjunction with those in Table 2-2 (e.g., annual LCS sampling round), note that sulfate is also on Table 2-2 and is not required to be collected twice.

TABLE 2-3

ANNUAL SAMPLING AND ANALYSIS REQUIREMENTS FOR THE OSDF LEACHATE COLLECTION SYSTEM[a]

Parameter	Method	Priority[b]	ASL[c]	Holding Time	Preservation	Standard Volume	Minimum Volume	Container
Inorganics:	CLP[d]/SW-846E[e]	7	C	6 months	HNO_3 to pH < 2	1 L	300 ml	Plastic or Glass
Antimony								
Arsenic								
Barium								
Beryllium								
Cadmium								
Calcium								
Chromium								
Cobalt								
Copper								
Iron								
Lead								
Magnesium								
Manganese								
Nickel								
Potassium								
Selenium								
Silver								
Sodium								
Thallium								
Vanadium								
Zinc								
Water Chemistry:								
Ammonia	350.1[f], 350.3[f], 4500C[g], 4500F[g]	13	B	28 days	Cool to 4°C, H_2SO_4 to pH< 2	500 ml	200 ml	Plastic
Chloride	325.2[f], 300(all)[f], 4500B[g]	11	B	28 days	None	250 ml	100 ml	Plastic
Sulfate	375.2[f], 300.0[f], 4500E[g]	12	B	28 days	Cool to 4°C	250 ml	100 ml	Plastic
Total alkalinity	310.1[f], 2320B[g]	14	B	14 days	Cool to 4°C	500 ml	250 ml	Plastic
Volatiles:	CLP[d]/SW-846[e]	3	C	14 days	Cool to 4°, H_2SO_4 to pH < 2	5 X 40 ml	40 ml	Glass/Teflon-lined septum cap[h]
Acetone								
Acrylonitrile								
Benzene								
Bromochloromethane								
Bromoform								
Bromomethane								
2-Butanone								
Carbon disulfide								
Carbon tetrachloride								

TABLE 2-3
(Continued)

Parameter	Method	Priority[b]	ASL[c]	Holding Time	Preservation	Standard Volume	Minimum Volume	Container
Volatiles (Continued):	CLP[d]/SW-846[e]	3	C	14 days	Cool to 4°, H_2SO_4 to pH < 2	5 X 40 ml	40 ml	Glass/Teflon-lined septum cap[h]
Chlorobenzene								
Chloroethane								
Chloroform								
Chloromethane								
Dibromochloromethane								
1,2-Dibromo-3-chloropropane								
Ethylene dibromide[h]								
1,2-Dichlorobenzene								
1,4-Dichlorobenzene								
trans-1,4-Dichloro-2-butene								
1,1-Dichloroethane								
1,2-Dichloroethane								
trans-1,2-Dichloroethene								
1,2-Dichloropropane								
cis-1,3-Dichloropropene								
trans-1,3-dichloropropene								
Ethylbenzene								
2-Hexanone								
Methylene bromide								
Methylene chloride								
Methyl iodide								
4-Methyl-2-pentanone								
Styrene								
1,1,1,2-Tetrachloroethane								
1,1,2,2-Tetrachloroethane								
Toluene								
1,1,1-Trichloroethane								
1,1,2-Trichloroethane								
Trichlorofluormethane								
1,2,3-Trichloropropane								
Vinyl acetate								
Xylenes (Total)								
Polychlorinated Biphenyls Aroclors-1016, 1221, 1232, 1242, 1248, 1254, and 1260	CLP[d]/SW-846[e]	15	C	7 days to extraction/ 40 days from extraction to analysis	Cool to 4°C	2 L	1 L	Amber glass bottle with Teflon-lined cap

NOTE: Field parameters are performed at each sampling location prior to sample collection and include dissolved oxygen, pH, specific conductance, temperature, and turbidity at ASL A.

[a]Annual sampling also includes all constituents listed on Table 2-2.
[b]If sufficient volume is not available for collection of a full suite at standard volume, then the minimum volume is to be collected for all analytical groups. If sufficient volume is still not available for collection of the full suite, then a partial sample is to be collected in accordance with the indicated priority rating.
[c]Analytical Support Level. The ASL may become more conservative, if necessary to meet detection limits or data quality objectives.
[d]EPA Contract Laboratory Program Statement of Work, Multi-Media, Multi-Concentration, most recent revision. Per the SCQ, where CLP is listed, SW-846 can now be used for ASL C or D.
[e]*Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, SW-846.
[f]*Methods for Chemical Analysis of Water and Wastes*, EPA 600/4-79-020.
[g]*Standard Methods for the Analysis of Water and Wastewater*, 17th edition.
[h]No head space.
[i]Also referred to as 1,2-Dibromoethane.

TABLE 2-4

POST-BASELINE QUARTERLY MONITORING REQUIREMENTS FOR CELLS 1, 2, AND 3

Parameter	Method	Priority[a]	ASL[b]	Holding Time	Preservation	Standard Volume	Minimum Volume	Container
Radionuclides: Uranium, total	SCQ[c]	1	D	6 months	HNO_3 to pH<2	100 ml	10 ml	Plastic or Glass
Inorganics: Boron	CLP[d]/SW-846[e]	4	C	6 months	HNO_3 to pH<2	1 L	600 ml	Plastic or Glass
General Chemistry:								
Total Organic Halogens (TOX)	9020B[e]	2	B	28 days	Cool to 4°C, H_2SO_4 to pH<2	500 ml	20 ml	Amber glass w/Teflon-lined cap[f]
Total Organic Carbon (TOC)	9060[e]	3	B	28 days	Cool to 4°C, H_2SO_4 to pH<2	250 ml	125 ml	Amber glass w/Teflon-lined cap
Sulfate	375.2[g], 300.0[g], and 4500E[h]	5	B	28 days	Cool to 4°C	250 ml	100 ml	Plastic

NOTE: Field parameters are performed at each sampling location prior to sample collection and include dissolved oxygen, pH, specific conductance, temperature, and turbidity at ASL A, Priority 1.

[a]If sufficient volume is not available for collection of a full suite at standard volume, then the minimum volume is to be collected for all analytical groups. If sufficient volume is still not available for collection of the full suite, then a partial sample is to be collected in accordance with the indicated priority rating.

[b]Analytical Support Level. The ASL may become more conservative, if necessary to meet detection limits or data quality objectives.

[c]Radiological analyses do not have standard methods; however, the performance-based analytical specifications for these parameters are provided in Appendix G of the SCQ.

[d]EPA Contract Laboratory Program Statement of Work, Multi-Media, Multi-Concentration, most recent revision. Per the SCQ, where CLP is listed, SW-846 can now be used for ASL C or D.

[e]*Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, SW-846.

[f]Minimal head space—as close to zero as possible.

[g]*Methods for Chemical Analysis of Water and Wastes*, EPA 600/4-79-020.

[h]*Standard Methods for the Analysis of Water and Wastewater*, 17th edition.

3.0 ADDITIONAL SAMPLING PROGRAM REQUIREMENTS

3.1 QUALITY ASSURANCE REQUIREMENTS

Self-assessment and independent assessments of work processes and operations will be conducted to assure quality of performance. Self-assessments will evaluate sampling procedures and/or paperwork associated with the sampling effort. Independent assessments will be performed by a Quality Assurance representative by conducting surveillances. Surveillances will be performed at least twice per year at any time during the project and will consist of monitoring/observing ongoing project activity and work areas to verify conformance to specified requirements.

3.2 CHANGES TO THE PROJECT-SPECIFIC PLAN

Prior to the implementation of field changes, the Project Manager and Field Sampling Lead shall be informed of the proposed changes. Once the Field Sampling Lead has approved and obtained approval from the Project Manager, Data Management Lead, and Quality Assurance Contact for the field changes to the plan, the field changes may be implemented. Field changes to the plan shall be noted on a Variance/Field Change Notice (V/FCN). The V/FCN shall be approved by the Project Manager, Field Sampling Lead, Data Management Lead, and Quality Assurance Contact prior to implementation of the changes.

3.3 QUALITY CONTROL SAMPLES

Quality Control (QC) sample analyses are required as part of the GWLMP for the OSDF. A minimum of one set of field QC samples is required for each sampling event. A "sampling event" shall be defined as one cycle or round of sample collection from various locations occurring within a short time frame (i.e., several days). Duplicate and rinsate samples will be collected at a rate of one per sampling event or one per 20, whichever is more frequent. Trip blanks will be collected one per day per team when samples are collected for volatile organic analysis. Field blank samples are collected on per day. A rinsate sample will not be required for those locations with dedicated sample collection equipment. One matrix spike/matrix spike duplicate will be analyzed at a frequency of one per sampling event or one per 20, whichever is more frequent. QC samples will be analyzed for the same analytes as the normal samples.

3.4 EQUIPMENT DECONTAMINATION

All non-dedicated sampling equipment shall be decontaminated to Level II per procedure *Liquid Sampling for WM*, SMPL-02, prior to sample collection at each sample location. Sampling equipment shall also be decontaminated to Level II upon completion of sampling activities, unless equipment has been dedicated to the sample location.

3.5 DISPOSITION OF WASTES

During sampling activities, waste will be generated in various forms; disposition of all waste will be in accordance with site requirements and procedures. The various forms of waste expected to be encountered during this program are contact waste, purge water, and decontamination wastewater.

Contact waste will be minimized by limiting contact with the sample media, and by using disposable materials, whenever possible. Contact waste shall be placed into plastic garbage bags and disposed to a dumpster on site, unless radiological concerns require survey of contact waste. If contact waste is determined to be radiologically contaminated, the assigned radiological control technician/engineer shall survey, contain, label, and disposition the waste according to radiological control requirements.

All decontamination wastewater and purge water will be containerized and disposed in accordance with the Wastewater Discharge Request Form. In general, the water shall be transported to the OSDF lift station for treatment.

3.6 DATA MANAGEMENT

Information collected as a part of this monitoring program will be managed according to the guidelines below to ensure availability of documentation for verification and reference and to ensure regulatory compliance.

Field documentation, as required by the designated procedures for this sampling program (i.e., Field Activity Logs, Water Sample Collection Logs, and Chain of Custody Forms), will be carefully maintained in the field. To assure appropriate documentation was completed during field activities and that documentation was correctly completed, required documentation shall be verified by Water Monitoring personnel. Following the internal department review, field documentation shall receive validation by Quality Assurance personnel. One hundred percent of the analytical data shall be validated in accordance to the ASL specified in Tables 2-2, 2-3, and 2-4. Following data entry of the field information into the Sitewide Environmental Database (SED), the hard copy original field documentation packages shall be stored in controlled file storage cabinets, and eventually a long-term archive environment. Per regulatory guidances, these records must be maintained for a minimum of 30 years.

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APPENDIX C

FERNALD CLOSURE PROJECT DATA QUALITY OBJECTIVES, MONITORING PROGRAM FOR THE ON-SITE DISPOSAL FACILITY

FERNALD CLOSURE PROJECT

DATA QUALITY OBJECTIVES

Title: **Monitoring Program for the On-Site Disposal Facility**

Number: **GW-024**

Revision: **6**

Effective Date: **June 23, 2004**

Contact Name: **William Hertel**

APPROVALS:

Date: 6/23/04

James Chambers
DQO Coordinator

Date: 6/23/04

William Hertel
Hydrogeology

RECORDS OF ISSUES AND REVISIONS

Rev. #	0	1	2	3	4	5	6
Effective Date:	3/27/97	3/31/97	5/12/97	7/24/97	5/28/98	1/28/00	6/23/04

DATA QUALITY OBJECTIVES
On-Site Disposal Facility Monitoring Program

1.0 STATEMENT OF PROBLEM

Problem Statement: Analytical data, obtained from a multi-component monitoring system, is necessary to support the leak detection element of the On-Site Disposal Facility (OSDF) monitoring strategy.

The Records of Decision for Operable Units 2, 3 and 5 (OU2, OU3, and OU5 ROD) include the construction of an OSDF for long-term storage and containment of low-level radioactive waste. The construction of the OSDF is being completed in phases with eight individual cells and a ninth contingency cell. Each cell will be monitored on an individual basis for leak detection and possible environmental impact.

A major concern regarding the storage of waste at the Fernald site is the prevention of any additional environmental impact to the Great Miami Aquifer (GMA). To address this concern, site-specific monitoring requirements that integrate state and federal regulatory requirements were developed to provide a comprehensive program for monitoring the ongoing performance and integrity of the OSDF.

In consideration of unique hydrogeological conditions and pre-existing contamination on-site, a baseline data set (Ohio Administrative Code (OAC) 3745-27-10(D)(5)(a)(ii)(*a*); 3745-27-10(A)(2)(b) and OAC 3745-54-97(G)) will be established. In addition, an alternate sampling program (OAC 3745-27-10(D)(5)(a)(ii)(b) and (b)(ii)(b); 3745-27-10(D)(6)) will be initiated to address site-specific complexities, provide an effective monitoring program for the OSDF that meets and exceeds federal and state regulations for Treatment, Storage, and Disposal (TSD) facilities.

The OSDF monitoring program strategy utilizes OSDF system design in combination with a monitoring well network to provide data for a collective assessment of OSDF performance.

Each individual OSDF cell is constructed with a leachate collection system (LCS) and leak detection system (LDS); these systems are separate and contain sample collection points within the valve house. The LCS is designed to collect infiltrating rainwater (and storm water runoff during waste placement) and prevent it from entering the underlying environment; the leachate drainage layer drains to the west through an exit point in the liner to leachate transmission system located on the west side of the OSDF. From there, the leachate flows by gravity to a lift station and is currently pumped to the Fernald site's Bio-Surge Lagoon for subsequent treatment at the AWWT facility. The LDS is a drainage layer positioned beneath the primary composite liner; any collected fluids from that layer drain to the west where they are removed and routed for treatment as in the LCS. Flow monitoring measurements of the LCS and LDS will be conducted on a scheduled basis. Monitoring the flow and sampling of the LCS and LDS liquids will provide an assessment of migratory dynamics within each cell and determine primary liner performance.

[Note that the current site plans are for AWWT to be reduced in both size and capacity, referred to as the converted AWWT (CAWWT). With the scheduled permanent shut-down of the Bio-Surge Lagoon in November 2004, leachate will be redirected to the storm water retention basin (SWRB). During the conversion process of the AWWT facility, leachate collected in the SWRB will be routed for treatment in the AWWT. When the CAWWT is operational in February 2005, the leachate collected in the SWRB will be routed to the new CAWWT facility. Leachate will be managed in this manner until October 2005 when the SWRB is removed from service to support soil remediation in the SWRB footprint. At that time, leachate will be routed directly to the CAWWT facility for treatment.]

The monitoring well network consists of two separate systems. A horizontal till well is placed in the subsurface beneath the LCS and LDS liner penetration box within each cell. Each liner penetration box represents the lowest elevational area of each cell, by definition the most likely location for a potential leak to migrate. GMA monitoring wells are placed at the immediate boundaries of each cell, at upgradient and downgradient locations, to monitor the water quality of the aquifer and verify presence/absence of environmental impact.

Sampling of the four components mentioned above (LCS, LDS, horizontal till well, and GMA monitoring wells) will provide a four-layered holistic approach to provide early leak detection from the OSDF.

2.0 IDENTIFY THE DECISION

Analytical data provided by a monitoring program will provide the information necessary for management of the OSDF. Information derived from flow volume assessment and sample analyses will constitute the first tier of a three-tier strategy: detection, assessment, and corrective action; if it is determined from detection monitoring that a leachate leak from the OSDF has occurred, additional groundwater quality assessment studies will be initiated and corrective action monitoring plans will be developed and implemented as necessary. If the detection monitoring continues to successfully demonstrate that the performance of the OSDF is as designed, then the monitoring program will remain in the first-tier detection mode and the need for a follow-up groundwater quality assessment and/or corrective action monitoring plans will not be necessary.

OSDF monitoring strategy includes the establishment of baseline conditions in the hydrogeological environment beneath each individual cell prior to waste placement. Both perched groundwater and the GMA contain uranium and other Fernald site-related constituents at levels above background in the vicinity of the OSDF, therefore, it is necessary to establish pre-existing conditions (constituent concentration levels and variability) for applicable OSDF monitoring parameters. Actual existing baseline values will ensure accurate assessment of data trends during active cell operations and the interim prior to long-term post-closure.

3.0 INPUTS THAT AFFECT THE DECISION

An extensive characterization of wastes, to quantify environmental contamination in the area of the Fernald site provided the information to develop the Waste Acceptance Criteria (WAC) for waste entering into the OSDF. The leachability, mobility, persistence, toxicity, and stability of identified waste constituents were evaluated, and of 93 constituents, 16 were identified as having the potential to impact the aquifer within a 1000-year performance period. The 16 site-specific leak detection indicator parameters chosen as monitoring parameters will be supplemented with 4 water chemistry indicator parameters and a field analysis of water quality.

Additionally, waste treatment, storage and disposal facilities (TSD) must analyze collected leachate on an annual basis to fulfill a reporting requirement per Ohio Solid Waste regulation, Ohio Administrative Code (OAC) 3745-27-19(M)(5)). OSDF monitoring will comply by collecting a grab sample yearly and performing analysis for the parameters listed in Appendix I of OAC 3745-27-10 and polychlorinated biphenyls (PCBs).

Although the site-specific leak detection indicator parameter list was initially created for the purpose of establishing baseline, it will probably provide sufficient and reliable data for the monitoring throughout the active operation of the OSDF, however, future considerations for potential modifications of the parameter list may occur during subsequent re-evaluations of the monitoring program.

Monitoring of the liquid flow within the LCS and LDS drainage layers will be performed to provide a trend analysis that can be used as an indicator of containment system performance; changes in the trend of flow will initiate follow-up inspection and corrective action measures as necessary. A graded approach, patterned after federal hazardous waste landfill regulations 40 CFR 264.303(c)(2) and Ohio solid waste rule OAC 3745-27-19(M)(4), will be utilized to provide a quantitative monitoring control for drainage within the OSDF.

4.0 DEFINE THE BOUNDARIES OF THE STUDY

Subsurface conditions in the immediate area of the OSDF location are typical of glacial deposition; the subsurface formation is comprised of a glacial till, underlain by sand and gravel deposits which are characterized as the GMA. The GMA is a high-yield aquifer and a designated sole source aquifer under the Safe Drinking Water Act (SDWA). It supplies a significant amount of potable water for private and industrial use in Butler and Hamilton counties (Ohio); therefore, a leakage of contaminants from the OSDF could affect water quality for a large population.

Typically a detection monitoring program consists of upgradient and downgradient monitoring well installations with routine sampling for a prescribed list of parameters, consequently, detection of a statistically significant difference in downgradient water quality will indicate that release from a facility may have occurred. However, at the Fernald site, low permeability and pre-existing contamination within the overburden formation, and implementation of a site-wide groundwater remedial action for the

subsurface aquifer formation, add complexity to the development of a groundwater detection monitoring program that is consistent to the standard approach in solid and hazardous waste regulations. To accommodate such complexities, federal and state regulations do allow alternative monitoring strategies, which provide flexibility with respect to well placement, statistical evaluation of data, parameter lists, and sampling frequency. The OSDF monitoring program does incorporate an appropriate alternative monitoring strategy to ensure integrity and provide effective early warning of a leak from the facility. The program includes alternate well placement, statistical analysis, parameter lists, and sampling frequencies.

An OSDF leak would migrate vertically towards the GMA beneath it; therefore, a horizontally positioned well placed within the glacial till shall have its screen interval beneath the LCS and LDS liner penetration box of each cell as a site-specific approach to monitor a first-entry leakage from the OSDF. The GMA wells are installed immediately adjacent to the OSDF, just outside the boundary of the final composite cap configuration. Each cell will be monitored with a set of GMA monitoring wells, placed upgradient and downgradient of each cell. The OSDF will be bordered by a network of GMA monitoring wells that provide upgradient and downgradient monitoring points for the entire facility.

The parameters are limited to those indicated as having a potential to migrate from the OSDF and impact the GMA. The concentration levels of concern are those required to determine fluctuations in GMA concentrations and provide a sensitivity great enough to indicate potential impacts.

Sampling frequencies for the OSDF monitoring program meet federal and state requirements. The additional data will be used to develop an appropriate statistical procedure and to compensate for the varying temporal conditions in the groundwater flow direction and chemistry due to seasonal fluctuations.

5.0 DECISION RULE

The initial flow and water quality data obtained from the LCS, LDS, and the groundwater monitoring components, will be used to begin a statistical trend analysis of the volume of leachate produced by each cell and the corresponding concentrations of analytes in each individual monitoring component. Each cell will be evaluated independently; therefore, the preferred method of statistical evaluation for the OSDF will be an intra-well trend analysis following establishment of baseline conditions in the glacial till and GMA. The intra-well trend analysis approach will be applied to data from all of the components - the LCS, LDS, and the groundwater monitoring wells. The data received from each component will be compared for

evidence of consistent trend values that verify OSDF integrity status. Additionally, data shall also be compared between all of the monitoring components within the multi-component monitoring system of each cell. This strategy is the four-layer vertical slice/trend analysis approach.

Data collected from the OSDF monitoring program will also be used to supplement the compilation of data for the Integrated Environmental Monitoring Plan (IEMP). Groundwater data for those OSDF leak detection constituents that are also common to the IEMP groundwater remedy performance constituents will be utilized in the IEMP data interpretations as the data become available. Groundwater data collected for those unique OSDF leak detection constituents which are not being monitored by the IEMP groundwater monitoring program will be utilized only for the establishment of the OSDF baseline and subsequent leak detection monitoring. To provide an integrated approach to reporting OSDF monitoring data, the annual IEMP comprehensive annual environmental report will serve as the mechanism by which LCS and LDS volumes and concentrations will be reported, along with groundwater monitoring results, trending results, and interpretation of the data. Presenting data in one report will facilitate a qualitative assessment of the impact of the OSDF on the aquifer, as well as the operational characteristics of OSDF caps and liners. Additionally, the available monitoring data and interpretation of that data will be made available semiannually as part of the IEMP reporting process.

6.0 LIMITS ON UNCERTAINTY

In baseline establishment, the sensitivity and precision must be sufficient to define the GMA concentrations of the parameters of concern such that fluctuations will be observable, and effects impacting the Final Remediation Levels (FRLs) are observed. A false positive error would indicate that either certain parameters are present when in fact they are not, or that baseline parameters are present at higher concentrations than are actually present in the GMA. This type of error would give a false indication that the cell is leaking. A false negative error would indicate that certain parameters are not present when in fact they are. This may lead to a mistaken indication that the cell is not leaking. It is necessary to define the concentrations of the parameters of concern such that fluctuations in concentration and effects impacting the GMA will be observable.

Following baseline establishment, a false positive result in OSDF monitoring may suggest that a leak from the OSDF has occurred, when in fact, it has not. Additional monitoring assessments would be initiated in response and added costs would be incurred unnecessarily. The greater concern would be a false negative error, verifying that integrity of the OSDF was intact when in fact some component of the structure may have failed. No corrective action would be initiated and contaminants could migrate into the GMA undetected, possibly posing a threat to human health and the environment.

7.0 OPTIMIZE DESIGN

An aquifer simulation model (i.e., SWIFT and more recently VAM3D) was used to select monitoring well locations, typically one upgradient and one downgradient of each cell. These wells will be used in the detection monitoring program, as well as baseline establishment.

Standard statistical modeling studies indicate that data from a minimum of four independent sampling events are necessary to establish baseline values, however, for an improved comparative statistical analysis, more sampling events were chosen to ensure sufficient available data for baseline establishment for each GMA monitoring well location. Experience/technical knowledge gained from monitoring Cells 1 through 3 have indicated that it is necessary to collect baseline samples either monthly, bimonthly, or quarterly in order to have enough data to perform statistics on a standardized frequency dataset. The baseline frequency is selected to develop an appropriate statistical procedure, to address OSDF construction schedules, and to compensate for the varying temporal conditions in the groundwater flow direction and chemistry due to the remedial action and seasonal fluctuations.

To ensure consistency of method and an auditable sampling process, each sample will be collected per the Sitewide CERCLA Quality Assurance Plan (SCQ) for groundwater sample collection and the requirements specific to this program will be outlined in the Project Specific Plan (PSP), On-Site Disposal Facility Monitoring Program.

Laboratory QC requirements will be as specified in the SCQ, unless otherwise specified in the task order to the laboratory. One hundred percent of the data will undergo field and laboratory validation.

All chemical sample analyses will be performed at ASL C, except general water chemistry analyses which will always be ASL B and field water quality analyses, which will always be performed at ASL A. Radiological constituents will be analyzed at ASL D, unless ASL E is required to meet detection limits.

Method detection limits (MDLs) and highest allowable maximum detectable concentrations (HAMDCs) for parameters analyzed under this program are to be as low as reasonably achievable for samples collected to establish baseline conditions in the horizontal till wells and the Great Miami Aquifer monitoring wells. This is to ensure that the samples collected are capable of providing the necessary bracketing of the baseline conditions. Once cell-specific baseline conditions are established via statistical methods, detection limits for a particular constituent may be raised for that cell as warranted. Since the MDLs differ from the SCQ-specified MDLs, the ASL defaults to ASL E although other analytical and validation requirements will remain as specified for ASL/VSL D. Data from all chemical samples will be validated to a minimum of VSL D requirements or VSL B for general water chemistry analyses. The radiological analysis and validation will be conducted at ASL/VSL D. The radiological ASL D will default to ASL E when HAMDCs specified in the SCQ are not higher than the groundwater FRLs specified in the Operable Unit 5 Record of Decision.

All samples require field QC and will include trip blanks and field blanks as specified in the SCQ. Duplicates will be collected for each sampling round (sampling round is defined as one round of sample collection from various locations occurring within a short period of time, i.e., several days). Equipment rinsates will be performed when dedicated equipment is not available. One laboratory QC sample set shall be collected per each release of samples. Laboratory QC will include a method blank and a matrix spike for each analysis, as well as all other QC required per the method and SCQ.

If a well does not recharge sufficiently to collect specified volumes for all analytes or the LCS/LDS systems do not contain sufficient volume for a full suite of samples, parameters will be collected in the order of priority stated in the PSP.

Following baseline establishment, sampling of the four monitoring components (LCS, LDS, horizontal/perched and GMA wells) for each cell will follow a quarterly schedule for site-specific parameters. A yearly grab sample will be collected from the LCS for the parameters listed in Appendix I of OAC 3745-27-10 and PCBs. Sampling parameter requirements shall also be specified in the PSP.

Data Quality Objectives
Baseline Establishment for GMA Groundwater Monitoring of the OSDF

1.A. Task/Description: Baseline Establishment for GMA Groundwater Monitoring of OSDF. This sampling program will determine a baseline characterization of the GMA in the immediate vicinity of the OSDF.

1.B. Project Phase: (Put and X in the appropriate selection.)

RI ☐ FS ☐ RD ☒ RA ☐ R_VA ☐ OTHER ☐ Specify:

1.C. DQO No.: GW-024 DQO Reference No.: not applicable

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2. Media Characterization: (Put an X in the appropriate selection.)

Air ☐ Biological ☐ Groundwater ☒ Sediment ☐ Soil ☐

Waste ☐ Wastewater ☐ Surface water ☐ Other (specify) Leachate

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3. Data Use with Analytical Support Level (A-E): (Put an X in the appropriate Analytical Support Level selection(s) beside each applicable Data Use.)

Site Characterization	Risk Assessment
A ☒ B ☒ C ☒ D ☒ E ☒	A ☐ B ☐ C ☐ D ☐ E ☐
Evaluation of Alternatives	Engineering Design
A ☐ B ☐ C ☐ D ☐ E ☐	A ☐ B ☐ C ☐ D ☐ E ☐
Monitoring during remediation activities	Other (Explain)
A ☒ B ☒ C ☒ D ☒ E ☒	A ☐ B ☐ C ☐ D ☐ E ☐

4.A. Drivers: Operable Unit 2, 3, and 5 Record of Decision (ROD) and the Ohio Administrative Code for the containment of solid and hazardous waste , and the Code of Federal Regulations TSD Facility Standards.

4.B.Objective: To provide information by which verification of the ongoing performance and integrity of the OSDF and its impact on groundwater can be evaluated.

5. Site Information (Description): The Records of Decision for Operable Units 2, 3 and 5, include the construction of an On-Site Disposal Facility for long term storage and containment of low-level radioactive waste. The OSDF will consist of 8 or 9 individual cells and each cell will be monitored on an individual basis. The monitoring system developed to detect any potential leaks originating from the cells consists of

four components: a leachate detection system, a leak detection system, a till monitoring system, and a GMA monitoring system. This DQO addresses baseline characterization, facility, and ground water detection monitoring for the active cell phase of the OSDF.

6.A. Data Types with appropriate Analytical Support Level Equipment Selection and SCQ Reference: (Place an "X" to the right of the appropriate box or boxes selecting the type of analysis or analyses required. Then select the type of equipment to perform the analysis if appropriate. Please include a reference to the SCQ Section.)

1.	pH	☒	2.	Uranium	☐	3.	BTX ☐
	Temperature	☒		Full Radiologic	☒*		TPH ☐
	Specific Conductance	☒		Metals	☒*		Oil/Grease ☐
	Dissolved Oxygen	☒		Cyanide	☐		
	Turbidity	☒		Silica	☐		
4.	Cations	☐	5.	VOA	☒*	6.	Other (Specify) Total Alkalinity,
	Anions	☐		BNA	☒*		Ammonia, Chloride, TDS,
	TOC	☒		Pesticides	☒*		Sulfate, & Nitrate/Nitrite
	TCLP	☐		PCB	☒		*See specific parameters
	CEC	☐		TOX	☒		listed in PSP.
	COD	☐					

6.B. Equipment Selection and SCQ Reference:

Equipment Selection	Refer to SCQ Section
ASL A _____	SCQ Section: Appendix K (K.4.1)
ASL B _____	SCQ Section: Appendix G
ASL C _____	SCQ Section: Appendix G
ASL D _____	SCQ Section: Appendix G
ASL E _____	SCQ Section: Appendix G

7.A. Sampling Methods: (Put an X in the appropriate selection.)

Biased ☐ Composite ☐ Environmental ☐ Grab ☒ Grid ☐

Intrusive ☐ Non-Intrusive ☐ Phased ☐ Source ☐

Other (specify): _____ DQO Number: DQO #GW-024

7.B. Sample Work Plan Reference: (List the samples required. Reference the work plan or sampling plan guiding the sampling activity, as appropriate.): Background samples and routine monitoring samples: PSP

for On-site Disposal Monitoring Program, ECDC Document Number 20100-PSP-0001

7.C. Sample Collection Reference: (Please provide a specific reference to the SCQ Section and subsection guiding sampling collection procedures.) A PSP will detail sampling methodology; unless otherwise indicated in the PSP, sampling will follow requirement guidelines outlined in the SCQ, Appendix K, Section K.1 and K.4 Aqueous Sample Collection Method (Groundwater Sampling) and procedure SMPL-02 *Liquid Sampling for WM*

Sample Collection Reference: SCQ, Appendix K, K.1, K.4 ; Procedure SMPL-02 *Liquid Sampling for WM*

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8. Quality Control Samples: (Place an "X" in the appropriate selection box.)

8.A. Field Quality Control Samples:

Trip Blanks	☒	Container Blanks	☐
Field Blanks	☒	Duplicate Samples	☒
Equipment Rinsate Samples	☒	Split Samples	☐
Preservative Blanks	☐	Performance Evaluation Samples	

Other (specify) none required

8.B. Laboratory Quality Control Samples:

Method Blank	☒	Matrix Duplicate/Replicate	☒
Matrix Spike	☒	Surrogate Spikes	☒

Other (specify) none required

9. Other: Please provide any other germane information that may impact the data quality or gathering of this particular objective, task or data use: