Department of Energy

Ohio Field Office
Fernald Closure Project
175 Tri-County Parkway
Springdale, Ohio 45246

SEP 20 2006

DOE-0202-06

Mr. James A. Saric, Remedial Project Manager
United States Environmental Protection Agency
Region V-SRF-5J
77 West Jackson Boulevard
Chicago, Illinois 60604-3590

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

Dear Mr. Saric and Mr. Schneider:

RE-SUBMISSION OF THE FINAL REMEDIAL ACTION REPORT FOR OPERABLE UNIT 1 - WASTE PITS REMEDIAL ACTION

Reference: 1. USEPA Letter, James Saric to Johnny Reising "Approval of Final OU1 Remedial Action Report Feed Materials Production Center, Fernald, OH," dated August 30, 2006

2. Ohio EPA Letter, Thomas Schneider to Johnny Reising, "Disapproval – Final Remedial Action Report for OU1," dated September 8, 2006

Enclosed are three copies of the Final Remedial Action Report For Operable Unit 1 – Waste Pits Remedial Action (August 2006) with the corrected Ohio EPA contact phone number on Page 27 as requested by the Ohio Environmental Protection Agency (Ohio EPA) (Reference 2). The only other change was to go ahead and revise Figure 1-1 of the report to be consistent with the OU2 and OU4 Remedial Action Reports recently submitted.

If you have any questions, please contact me at (513) 648-3139.

Sincerely,

Johnny Reising

Johnny W. Reising
Director

Enclosures:

c w/enclosures
M. Cullerton, Tetra Tech

c w/o enclosures
J. Chiou, Fluor Fernald, Inc., MS88
D. Dalga, Fluor Fernald, Inc., MS88
F. Johnston, Fluor Fernald, Inc., MS12
D. Sizemore, Fluor Fernald, Inc., MS01

Final Remedial Action Report for Operable Unit 1 – Waste Pits Remedial Action Project

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1.0 INTRODUCTION

This document serves as the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Final Remedial Action Report (closeout report) for Operable Unit 1 at the U.S. Department of Energy's (DOE's) Fernald Closure Project (FCP) located near Cincinnati, Ohio. Remediation requirements for Operable Unit 1 were defined in the 1995 Record of Decision (ROD) for Operable Unit 1 [DOE 1995a].

This document has been prepared to meet U.S Environmental Protection Agency (EPA) guidance for CERCLA site closeout as described in EPA OSWER Directive No. 9320.2-09A-P, *Closeout Procedures for National Priorities List Sites* (January 2000). As stated in this directive, the aim of the guidance is to communicate EPA's key principles and expectations for remedial action closeout, along with "best practices" based on CERCLA program experience that should be consulted for closing out National Priorities List (NPL) sites in a consistent and reasonable manner across the program. The guidance recommends a standard closeout report outline that has been followed in the preparation of this Operable Unit 1 Final Remedial Action Report.

Operable Unit 1 is one of five CERCLA operable units at the FCP and consists of various waste storage pits, termed "the waste pits" in the FCP's regulatory documents. Specifically, large quantities of liquid and solid waste generated by processing operations were stored or disposed of in Waste Pits 1 through 6 and the Clearwell, or were burned in the Burn Pit.

During the fall of 2004, EPA and DOE identified the manner in which the time-sequenced individual closeout reports would be coordinated across the five operable units. This approach recognizes that the source-control remedial actions (i.e., Operable Units 1, 2, and 4), decontamination and dismantlement (D&D) and legacy waste disposition activities (Operable Unit 3), the majority of soils remediation (part of Operable Unit 5), and the closure of the FCP's on-site disposal facility (OSDF) are all targeted for completion in 2006; while groundwater restoration (part of Operable Unit 5) will continue beyond 2006. The remaining activities that extend beyond 2006 are: 1) continued restoration activities for the Great Miami Aquifer; 2) the performance monitoring and final certification activities necessary to demonstrate completion of aquifer restoration; and 3) the final D&D and removal of groundwater related facilities and any affected soils above final remediation levels beneath the groundwater facilities as required. As the mechanism to communicate the agreed-to closeout report strategy, EPA and DOE issued a fact sheet in the spring of 2005 [DOE 2005] describing the coordination approach across the operable units, which is described in detail in Section 1.5. This Operable Unit 1 closeout report has been prepared in accordance with that strategy.

Operable Unit 1 is one of five operable units identified in the Amended Consent Agreement (ACA) and consists of the waste pits and their associated facilities. In accordance with agreements reached between DOE and EPA to communicate the overall remedial action closeout report strategy across the operable units, the closeout report for Operable Unit 1 is designed to document the completion of offsite disposal of the contents of the waste pits, including the excavation, processing, loadout, and shipment of these wastes. The remaining operable unit scope (soil remediation within the Operable Unit 1 boundary, and D&D of Operable Unit 1 remediation facilities) would be documented in the closeout reports for Operable Units 5 and 3, respectively.

This closeout report is organized into ten major sections and nine appendices. Section 1.0 provides an overview of the FCP and the overall remedial activities comprising the FCP's sitewide cleanup program. Section 2.0 provides an overview specific to Operable Unit 1 and the remedial actions that were selected in the Operable Unit 1 Record of Decision (ROD) and its subsequent modifications. Section 3.0 addresses construction activities associated with the Operable Unit 1 remedial actions, and Section 4.0 provides an annotated chronology of the key events contributing to successful completion and documentation of the Operable Unit 1 remedial actions. Sections 5.0 and 6.0 address performance standards, quality control, and final inspections and certifications, while Section 7.0 summarizes operations and maintenance information, as appropriate. Section 8.0 summarizes remedy cost information, and compares actual remedial costs with the original estimates contained in the Operable Unit 1 ROD. Section 9.0 identifies lessons learned during remedy implementation, and Section 10.0 summarizes key Operable Unit contact information.

1.1 Fernald Closure Project Overview

The FCP is a 1050-acre government-owned contractor-operated facility located in southwestern Ohio approximately 18 miles northwest of downtown Cincinnati. The facility is located just north of Fernald, Ohio, a small farming community, and lies on the boundary between Hamilton and Butler counties. Of the total site area, approximately 852 acres are in Crosby Township in Hamilton County and 200 acres are in Ross and Morgan Townships in Butler County.

The Atomic Energy Commission (AEC), predecessor to the U.S. Energy Research and Development Administration (ERDA) and then the DOE, established the Feed Materials Production Center (FMPC) in conformance with AEC orders in the early 1950s. In 1951, National Lead Company of Ohio, Inc., (now NLO) entered into a contract with the AEC as the Management and Operations Contractor for the facility. This contractual relationship lasted until January 1, 1986. Westinghouse Materials Company of Ohio (WMCO), a wholly owned subsidiary of Westinghouse Electric Corporation, then assumed management responsibilities for the site operations and facilities. In 1991, Westinghouse renamed this subsidiary the Westinghouse Environmental Management Company of Ohio (WEMCO). During that same year, DOE renamed the site the Fernald Environmental Management Project (FEMP) to reflect the site's revised mission. On December 1, 1992, Fernald Environmental Restoration Management Company (FERMCO) (now Fluor Fernald) assumed responsibility for the site as the Environmental Restoration Management Contractor for DOE. The FEMP was renamed the FCP on January 27, 2003.

1.2 Mission of the Site

The primary mission of the FMPC during its 37 years of operation was the processing of uranium feed materials to produce high purity uranium metals. These high purity uranium metals were then shipped to other DOE or U.S. Department of Defense facilities for use in the nation's weapons program. Manufacture of the uranium metal products generally occurred in seven of the FCP's more than 50 production, storage, and support buildings

that comprised what was known as the 140-acre production area. During the 37 years of production operations, nearly 500 million pounds of uranium metal products were produced. The site also served as the nation's key federal repository for thorium-related nuclear products, and it also recycled uranium used in the reactors at the Hanford site.

In accomplishing the site mission, liquid and solid wastes were generated by the various operations between 1952 and 1989. Before 1984, solid and slurried wastes from FMPC processes were deposited in the on-property waste storage area. This area, located west of the former production areas, includes six low-level radioactive waste storage pits, two earthen-bermed concrete silos containing K-65 residues, one concrete silo containing metal oxides, one unused concrete silo, two Lime Sludge Ponds, a Burn Pit, a Clearwell, and a Solid Waste Landfill. After 1984, operations wastes were containerized for eventual shipment to off-site disposal facilities. Contaminants from material processing and related activities were released into the environment through air emissions, wastewater discharges, storm water runoff, and leaks and spills.

1.3 Regulatory History

The CERCLA Remedial Investigation/Feasibility Study (RI/FS) process at the FEMP began in 1986, in accordance with a Federal Facility Compliance Agreement (FFCA) between DOE and the EPA to cover environmental impacts associated with the FMPC. The FFCA was intended to ensure that environmental impacts associated with activities at the facility would be thoroughly and adequately addressed. In response to the FFCA, a site-wide RI/FS was initiated pursuant to CERCLA, as amended by the Superfund Amendments and Reauthorization Act (SARA). Production operations at the facility were suspended in 1989 and the facility was placed on the National Priorities List. The FFCA was amended in 1990 by a Consent Agreement (under §120 106[a] of CERCLA) that revised the milestone dates for the RI/FS and provided for implementation of removal actions. The Consent Agreement was amended in September 1991 to revise schedules for completing the RI/FS process. The ACA provided for implementation of the operable unit concept. The FMPC was partitioned into five operable units to promote a more structured and expeditious cleanup. The schedule for preparation of a remedial investigation report and feasibility study report for each operable unit was included in the ACA.

The Ohio Environmental Protection Agency (Ohio EPA) Office of Federal Facilities Oversight also oversees cleanup activities at the site as a support agency primarily through the December 1988 Consent Decree and its January 1993 Amendment. Ohio EPA conducts environmental monitoring, public outreach, restoration and remediation oversight at the FCP, as well as maintaining authority for Resource Conservation Recovery Act (RCRA) enforcement. The 1996 Director's Final Findings and Orders (DF&O) between the DOE/Fluor Fernald and the Ohio EPA provide orders for closure activities relative to several Hazardous Waste Management Units (HWMUs) established at the site to satisfy both RCRA and CERCLA requirements.

1.4 Sitewide Operable Units and Cleanup Strategy

For purposes of investigation and study, the remedial issues and concerns that were similar in location, history, type/level of contamination, and inherent characteristics were grouped into operable units under the 1991 ACA. Specifically, the site was divided into five operable units. Four of the operable units (1 through 4) are considered contaminant "source" operable units as they represent the physical sources of contamination that have affected the site's environmental media. The fifth operable unit (Operable Unit 5) is considered the "environmental media" operable unit as it represents the environmental media affected by past production operations and waste disposal practices (i.e., beyond the contaminant "source" operable unit boundaries), as well as the pathways of

contaminant migration at the site. The four contaminant "source" operable units and the fifth environmental media operable unit are described below:

- Operable Unit 1: Waste Pit Area. Waste Pits 1 through 6, Clearwell, Burn Pit, berms, liners, and affected soil residing within the operable unit boundary.
- Operable Unit 2: Other Waste Units. Flyash Piles, other South Field disposal areas, Lime Sludge Ponds, Solid Waste Landfill, berms, liners, and affected soil residing within the operable unit boundary.
- Operable Unit 3: Former Production Area. Former production and production-associated facilities and equipment (including all above- and below-grade improvements), including, but not limited to, all structures, equipment, utilities, drums, tanks, solid waste, waste, product, thorium, effluent lines, a portion of the K-65 transfer line, wastewater treatment facilities, fire training facilities, scrap metal piles, feedstocks, and coal pile. Note that all affected soil beneath the facilities falls within Operable Unit 5.
- Operable Unit 4: Silos 1 through 4. Contents of Silos 1, 2, 3 (Silo 4 has remained empty); the silos structures, berms, decant sump tank system, and affected soil residing within the operable unit boundary.
- Operable Unit 5: Environmental Media. Affected groundwater, surface water, soil not included in the definitions of Operable Units 1, 2, and 4, sediment, flora and fauna.

During the time period 1994 to 1996, DOE and EPA signed the final RODs for each operable unit – in cooperation with the Ohio EPA and the Fernald Citizen's Advisory Board – which set in motion the major cleanup requirements and approaches that collectively define the FCP cleanup. The RODs employ a combination of off-site and on-site disposal, under which approximately 77 percent of the remedial waste volume (the site's lower concentration, higher volume materials) are to be disposed of in the engineered OSDF while approximately 23 percent (the site's higher concentration, lower volume materials) are to be sent off site for disposal, primarily at permitted facilities in Utah, Nevada, and Texas.

At the time the RI/FS activities were completed and the RODs put in place, an estimated 31 million pounds of uranium products, 2.5 billion pounds of waste, 255 buildings and structures, and 2.75 million cubic yards of contaminated soil and debris were identified as requiring action. In addition, a 223-acre portion of the Great Miami Aquifer was found to be contaminated at levels above radiological drinking water standards. Under the sitewide approach, the final remedial actions contained in the operable unit RODs are:

- Production and support facility D&D.
- On-site disposal of contaminated soil, above-and below-grade debris, and Operable Unit 2 other waste unit materials, provided OSDF waste acceptance criteria (WAC) are met.
- Off-site disposal of the contents of the silos, the waste pit materials, nuclear product inventories, containerized low-level and mixed waste inventories, and the quantities of soil and debris that do not meet OSDF WAC.
- Extraction and treatment of contaminated groundwater to restore the contaminated portions of the Great Miami Aquifer to meet Safe Drinking Water Act requirements.

At completion, approximately 975 acres of the 1,050-acre property will be restored for use as an undeveloped park, the target land use selected in the Operable Unit 5 ROD [DOE 1996a], and approximately 75 acres will be dedicated to the footprint of the OSDF. The Great Miami Aquifer will be restored to drinking water standards, and long-term stewardship actions and requisite institutional controls will be put in place consistent with the target land use.

Taken together, the individual RODs for the operable units provide a sitewide cleanup approach that encompasses all contaminant source areas and all affected environmental media at the site. Collectively, the RODs provide a natural link between the remediation of the sources of contamination and the media affected. Each ROD progressively built on the decisions of the earlier RODs, yielding a cohesive and comprehensive remedy for the FCP. The ROD signature dates and progressive sequence of decisions adopted under the RODs are shown below:

- Operable Unit 3 ROD for Interim Remedial Action (July 22, 1994) – Provided accelerated approval for the D&D of the FCP's buildings and structures.
- Operable Unit 4 ROD for Final Remedial Action (December 7, 1994) – Provided for the remediation of Silos 1 through 4, affected soil within the operable unit boundary, and other sources of contamination within the boundary. The D&D of all remedial facilities constructed for the Operable Unit 4 remedial action are to be addressed as part of Operable Unit 3.
- Operable Unit 1 ROD for Final Remedial Action (March 1, 1995) – Provided for the remediation of the waste pit contents, caps, and liners, affected soil within the operable unit boundary, and other sources of contamination within the boundary. The D&D of all remedial facilities constructed for the Operable Unit 1 remedial action are to be addressed as part of Operable Unit 3.
- Operable Unit 2 ROD for Final Remedial Action (June 8, 1995) – Provided for the remediation of the Active and Inactive Flyash Piles, South Field disposal area, Lime Sludge Ponds, Solid Waste Landfill, affected soil within the operable unit boundary, and other sources of contamination within the boundary. This decision set in motion the approval of onsite disposal at the FCP and construction of the OSDF; however, at the time it was formally limited to the disposal of the Operable Unit 2 wastes since the Operable Unit 5 and 3 decisions related to waste disposition (on site or off site) were not yet final.
- Operable Unit 5 ROD for Final Remedial Action (January 31, 1996) – Provided for the remediation of the FCP's on-site and off-site environmental media. This ROD addressed the cleanup of the Great Miami Aquifer at all locations, and the remediation of affected site-wide soil and sediment outside the source operable unit boundaries. It also addressed the monitoring of air, surface water, groundwater, sediment, and biota. The Operable Unit 5 ROD finalized the concept of a site-wide OSDF, and further incorporated the "balanced approach" concept into FCP on-site and off-site waste disposition decisions. The D&D of all remedial facilities constructed to support the Operable Unit 5 groundwater remedial action were to be addressed as part of Operable Unit 3.
- Operable Unit 3 ROD for Final Remedial Action (September 24, 1996) – Provided a final disposition decision for the D&D materials generated through the Interim Remedial Action ROD. Consistent with the Operable Unit 5 decision, the final decision document adopted on-site disposal as the selected remedy for disposition of the D&D debris. It also adopted earlier decisions as part of the "balanced approach" to send the FCP's containerized waste inventories and nuclear materials off site. The ROD also acknowledged that the D&D of new remedial facilities constructed at the site would be addressed as part of Operable Unit 3.

1.5 Site-Wide Remedial Action Closeout Report Strategy -- Spring 2005 Fact Sheet

In the spring of 2005, DOE and EPA developed a Fact Sheet to clarify and describe the strategy for producing the closeout reports for the CERCLA operable unit remedial actions completed for the FCP. Where affected media (primarily soils within an operable unit boundary) was a part of the source operable unit remedy, it was determined to be appropriate to accommodate the documentation of the remediation of those soils under the Operable Unit 5 closeout report. Therefore, only the source waste material would be addressed in their respective Final Remedial Action Reports, while the contaminated media within the source unit boundaries would be addressed under Operable Unit 5. In essence, this fact sheet adopted the following strategy for submitting remedial action closeout reports for EPA approval, summarized in Figure 1-1:

Figure 1-1 Summary of CERCLA Remedial Action Closeout Reports and Schedule

Operable Unit	Key Closeout Activity	Where Documented	Remaining Scope	Where Documented
Operable Unit 1 Waste Pits	Waste pit contents successfully dispositioned off site	Final Remedial Action Report for Operable Unit 1 (Summer 2006)	Soil Remediation within Operable Unit 1 boundary	Interim Remedial Action Report for Operable Unit 5 (Fall 2006)
			D&D of Operable Unit 1 Remediation Facilities	Final Remedial Action Report for Operable Unit 3 (Fall 2006)
Operable Unit 2 Other Waste Units	Wastes from Solid Waste Landfill, Lime Sludge Ponds, Fly Ash Piles, and Southfield successfully placed in OSDF or dispositioned off site as required	Final Remedial Action Report for Operable Unit 2 (Fall 2006)	Soil Remediation within Operable Unit 2 boundary	Interim Remedial Action Report for Operable Unit 5 (Fall 2006)
Operable Unit 3 Production Area Facilities	D&D of site-wide facilities (except for groundwater infrastructure); completion of Legacy Waste disposal	Final Remedial Action Report for Operable Unit 3 (Fall 2006)	None	NA
Operable Unit 4 Silos	Silo 3 material successfully disposed offsite; Silos 1 & 2 material successfully treated, packaged, and transported offsite into temporary storage.	Final Remedial Action Report for Operable Unit 4 (Fall 2006)	Soil Remediation within Operable Unit 4 boundary	Interim Remedial Action Report for Operable Unit 5 (Fall 2006)
			D&D of Operable Unit 4 Remediation Facilities	Final Remedial Action Report for Operable Unit 3 (Fall 2006)
			Permanent offsite disposal of Silos 1 & 2 material	Addendum to the Final Remedial Action Report for Operable Unit 4 (post-closure)
Operable Unit 5 Environmental Media	Groundwater remediation infrastructure is installed and operating.	Interim Remedial Action Report for Operable Unit 5 (Fall 2006)	D&D of groundwater facilities once groundwater remedy is complete; certification of surface water and sediments	Final Remedial Action Report for Operable Unit 5 (post-closure)
	Completion of all soil remediation site wide, except for beneath long-term groundwater facilities	Interim Remedial Action Report for Operable Unit 5 (Fall 2006)	Soil remediation and certification beneath groundwater facilities	Final Remedial Action Report for Operable Unit 5 (post-closure)
	The On-Site Disposal Facility is capped	Interim Remedial Action Report for Operable Unit 5 (Fall 2006)	Long-term care and monitoring	Final Remedial Action Report for Operable Unit 5 (post-closure)

- Proceed with formal closeout of Operable Unit 1 when the waste pit contents and liners have been successfully dispositioned off site. The remaining operable unit scope (soil remediation within the Operable Unit 1 boundary, and D&D of Operable Unit 1 remediation facilities) would be documented in the closeout reports for Operable Units 5 and 3, respectively. Soil remediation underlying the waste pits would be completed and documented in the Soil Remediation Area 6 Certification Report.
- Proceed with formal closeout of Operable Unit 2 when the waste materials from the Solid Waste Landfill, Lime Sludge Ponds, Fly Ash Piles, and the Southfield Area have been successfully placed in the OSDF, or dispositioned off site as necessary based on OSDF WAC restrictions. The remaining operable unit scope (soil remediation within the Operable Unit 2 waste unit boundaries) would be documented in the closeout report for Operable Unit 5. Remediation of the soil underlying the Solid Waste Landfill and Lime Sludge Ponds would be completed and documented in the Soil Remediation Areas 6A and 6I Certification Reports, respectively. The remediation of soil underlying the Active and Inactive Flyash Piles and the South Field Area have already been completed and certified as a part of Soil Remediation Area 2 Phase 1 (Southern Waste Units).
- Proceed with formal closeout of Operable Unit 3 when the D&D of sitewide facilities – including the remediation facilities constructed for Operable Units 1 and 4 – are complete and all legacy-era containerized wastes have been successfully dispositioned off site.
- Proceed with formal closeout of Operable Unit 4 when the silo contents for Silos 1&2 and Silo 3 have been successfully dispositioned off site. The remaining operable unit scope (soil remediation within the Operable Unit 4 boundary, and D&D of Operable Unit 4 remediation facilities and the empty silo structures) would be documented in the closeout reports for Operable Units 5 and 3, respectively. Remediation of the soil underlying the Operable Unit 4 boundary will be completed and documented under Soil Remediation Area 7.
- Proceed with an interim Remedial Action Report for Operable Unit 5 that recognizes that Great Miami Aquifer restoration activities will continue beyond DOE's 2006 baseline closure date. As an interim Remedial Action Report, the three major subsections will address completion of soil restoration activities (including those within the Operable Units 1, 2 and 4 boundaries) and closure of the OSDF, but will also need to recognize that ongoing aquifer restoration activities, future D&D of groundwater infrastructure, and final soil remediation (as necessary beneath the remaining groundwater infrastructure) remain as open items that will be closed out with a future final Remedial Action Report for Operable Unit 5 once groundwater actions are complete. The interim Remedial Action Report under Operable Unit 5 will therefore consist of three independent subsections: soils remediation, OSDF closeout, and aquifer restoration activities.

2.0 OPERABLE UNIT 1 BACKGROUND

Operable Unit 1 is a 37-acre area located in the northwest portion of the site. Beginning in 1952, the waste pits were constructed to store slurried or dry residues resulting from various stages of uranium processing. Over a 37-year period, these wastes were stored or disposed of in six waste pits (referred to as Waste Pits 1, 2, 3, 4, 5, and 6), the Burn Pit, and the Clearwell. The waste pits vary in size, ranging from ½ an acre to 5 acres, and varying in depth from approximately 12 feet to 42 feet. The waste pits were estimated to contain approximately 600,000 cubic yards of waste material. Figure 2-1, which was taken just after excavation began, shows the location of the various waste pits.

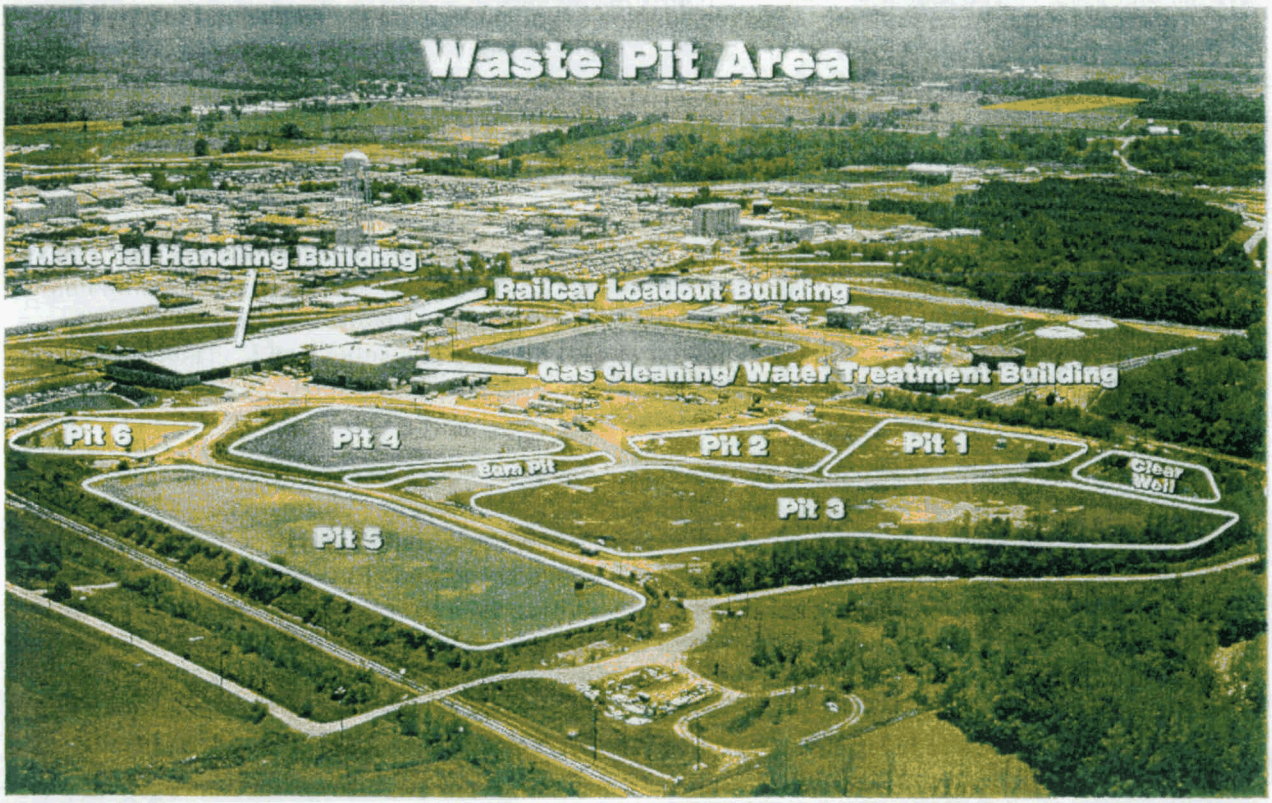


Figure 2-1: Waste Pits area prior to initiation of excavation activities (Summer 1999).

2.1 Results of the Operable Unit 1 RI

Study area investigations for Operable Unit 1 included activities performed under the Characterization Investigation Study (CIS) in 1986-1987 and the RI/FS Program, performed in multiple stages between 1987 and 1992. These investigations encompassed all affected media, and included samples from all of the waste pits. Findings of the Operable Unit 1 RI conducted in accordance with the ACA referenced above, and as documented in the Operable Unit 1 RI Report [DOE 1994a] and the Operable Unit 1 FS Report [DOE 1994b] concluded that the wastes of Operable Unit 1 presented a potentially unacceptable risk to human health and the environment and had to be remediated. Important to developing potential remedial alternatives was the large volume of contaminated material associated with the waste pits in addition to the heterogeneous nature of the waste. The location of the waste pits to the Great Miami Aquifer and the saturated nature of the waste itself added an increase risk for groundwater contamination.

Radiological contaminants were identified as the principal sources of risk associated with the waste pit area. There were also risks associated with volatile and semi-volatile organics and heavy metals. As a result of these findings, a 'no action' alternative would not have been appropriate for the waste pit area because there would be no reduction in toxicity and mobility of the contaminants.

2.2 Removal Actions

Under CERCLA, a removal action is defined as a "short-term cleanup often completed prior to a more formal ROD process." Removal actions were conducted within the waste pit area as an effort to minimize or stabilize the release or threat of release of contaminants to public health and welfare and/or the environment. The actions were initiated to accelerate cleanup activities to address releases or potential releases of hazardous substances. Five removal actions were conducted within Operable Unit 1 in the early 1990s. The goal of these removal actions was to minimize release of contaminants to air and water. The removal actions were:

- Removal Action No. 2: Waste Pit Area Runoff Control, as documented in the Waste Pit Area Stormwater Runoff Control Removal Action Work Plan [DOE 1992a]
- Removal Action No. 6: Control of Exposed Material in Pit 6, as documented in the Waste Pit Six Removal Action Work Plan [DOE 1990]
- Removal Action No. 11: Waste Pit 5 Experimental Treatment Facility, as documented in the Pit 5 Experimental Treatment Facility Removal Action Work Plan [DOE 1991]
- Removal Action No. 18: Control of Exposed Material in Pit 5, as documented in the Waste Pit 5 Exposed Material Removal Action Work Plan [DOE 1992b]
- Removal Action No. 22: Waste Pit Area Containment Improvement, as documented in the Waste Pit Area Containment Improvement Removal Action 22 Work Plan [DOE 1992c]

These removal actions were initiated and completed in the early 1990s. No additional removal activities were necessary in the waste pit area until start-up of remediation efforts. Appendix D of this Remedial Action Report provides a summary of these removal actions as well as references to the removal action work plans prepared prior to conducting removal activities.

2.3 Operable Unit 1 Selected Remedy

The Operable Unit 1 remedy as identified in the Operable Unit 1 ROD was: removal, treatment, and off-site disposal at a permitted commercial disposal facility. The following components describe the approach used towards remediation of Operable Unit 1.

- Construction of waste processing and loading facilities and equipment.
- Removal of water from open waste pits for treatment at the site's wastewater treatment facility.
- Removal of waste pit contents, caps and liners, and excavation of surrounding contaminated soil
- Preparation (e.g., sorting, crushing, shredding) of waste.
- Treatment of the waste by thermal drying as required to meet Envirocare WAC (the selected off-site disposal facility located in Clive, Utah; recently purchased by Energy Solutions).
- Waste sampling and analysis prior to shipment to ensure that the off-site disposal facility WAC are met.
- Off-site shipment of waste for disposal at Envirocare.
- Decommissioning and removal of the drying treatment unit and associated facilities, as well as miscellaneous structures and facilities within the operable unit.
- Disposition of remaining Operable Unit 1 residual contaminated soils in the on-site disposal facility, consistent with the selected remedy for contaminated process area soils as documented in the Operable Unit 5 ROD.

2.4 Operable Unit 1 Post-ROD Decision Changes

The selected remedy, as presented above, identified the mechanisms under which the Operable Unit 1 waste materials would be managed to support off-site disposal. Consistent with the Operable Unit 1 ROD, facilities were designed and constructed to support the excavation, treatment, load-out, and shipment of the Operable Unit 1 waste materials.

As those mechanisms were formulated, facilities constructed, and remedial action activities implemented, it became clear that some FCP soils and other waste materials would require disposition off-site. The ability to accommodate those materials was integrated into the Operable Unit 1 remedial action approach. Accordingly, an Explanation of Significant Differences (ESD) was prepared to document the cost effectiveness and safety advantages associated with using the Operable Unit 1 remedial infrastructure to process for disposal, other FCP waste streams originating outside of Operable Unit 1. The Final ESD for Operable Unit 1 was approved in September 2002 [DOE 2002].

Additionally, experience gained during site preparation activities, initiation of operations, waste processing and the continual evaluation for process improvements led to the conclusion that original ROD elements could be modified further. Subsequently, an Amendment to the Operable Unit 1 ROD was prepared to address the following changes:

- Aligning the surface and subsurface soil Final Remediation Levels (FRLs) found in the Operable Unit 1 ROD with the approved FRLs for soil in the Operable Unit 5 ROD.
- Placement of Pit 4 soil cover materials meeting on-site waste acceptance criteria into FCP's OSDF for permanent disposal.
- Aligning the final cover design for the waste pit area as originally designated in the Operable Unit 1 Feasibility Study and ROD, with the current design from the July 1998 "Draft Final Natural Resource Impact Assessment and Natural Resource Restoration Plan" for the site.
- Along with these changes, the ROD Amendment also provided clarification to terminology.

The Final Record of Decision Amendment for Operable Unit 1 Remedial Actions, reflecting the above, was signed in November 2003 [DOE 2003a].

In addition, as discussed in Section 1.5, a fact sheet was issued in the spring of 2005 to outline how the closeout reports would be prepared to communicate the remedial action closeout process.

2.5 Integrated Closeout of Operable Unit 1's RCRA Hazardous Waste Management Units

In June 1996, Ohio EPA issued a DF&O to identify the requirements and strategy for the closeout of the FCP's HWMUs in conjunction with the site's CERCLA remediation activities. Ohio EPA has regulatory jurisdiction for the closeout of the HWMUs as part of their RCRA regulatory authority at the site. The 1996 DF&O identified the following integration approach and documentation strategy:

- All parties desire to avoid duplication of effort at the facility and to integrate the Ohio EPA RCRA hazardous waste closure requirements into the requirements of CERCLA as detailed in the ACA.
- The HWMUs fall within the scope of Operable Units 1 and 3. Operable Unit 5 includes the contaminated environmental media associated with the site, including the media adjacent to and underlying the HWMUs.
- Attachment A to the DF&O identifies the 30 individual HWMUs that are to be closed through a RCRA/CERCLA process.

- The DF&O designated the Operable Unit 1 and 3 CERCLA remedial action closeout reports as the formal deliverables to provide certification that the removal, treatment, and/or disposal of the HWMUs identified in Attachment A (of the DF&O) has been completed (consistent with the Ohio EPA Closure Guidance Items 3.14 and 3.16). The Operable Unit 1 ROD identifies the removal, treatment, and disposal requirements for the HWMUs.
- The DF&O designated the Operable Unit 5 remedial action closeout report as the formal deliverable to provide certification that media contamination associated with the HWMUs has been remediated to achieve health-protective remediation standards (consistent with Ohio EPA Closure Guidance Item 3.16). The Operable Unit 5 ROD provides the health-protective remediation standards for soil and groundwater for the intended post-remediation land use, and designates the use of institutional controls to achieve the intended land use (consistent with the Ohio EPA Closure Guidance Items 3.11 and 3.12).

Consistent with the DF&O, this remedial action closeout report serves as the certification statement of the formal closeout of the HWMUs listed in Attachment A of the DF&O that reside in Operable Unit 1. Appendix C of this report provides details relative to the closeout of the HWMUs that reside in Operable Unit 1. As a companion to this Operable Unit 1 report, the Operable Unit 3 report addresses the HWMUs that reside within Operable Unit 3, and the Operable Unit 5 report addresses the remediation of the affected environmental media adjacent to and below the HWMU geographic footprints, and the achievement of health-protective cleanup standards.

2.6 Remedial Design Summary

The remediation design was accomplished to satisfy the overall goal of the Operable Unit 1 ROD, to remediate all the Operable Unit 1 components in a timely, efficient, and cost-effective manner, ensuring compliance with all applicable or relevant and appropriate requirements (ARARs), and protecting human health and the environment. Specifically, the remedial design addressed the main elements of the Operable Unit 1 remedy as identified in the Operable Unit 1 ROD, and its Amendment, including the excavation of all pit waste and contaminated liner material, the processing of that material, as necessary, to meet the waste acceptance criteria of the disposal facility, and the shipment of this material by rail to an off-site disposal facility for disposal. The Final Remedial Design Work Plan [DOE 1995b] and its Addendum [DOE 1996b] provided general information for the expected design. The general structure of the Remedial Design package addresses the equipment and facilities directly associated with the processing of waste; the waste excavation plan and pre-operational schedule; and the site preparation package and the project preoperational plans to support the construction and other pre-operation activities of the waste processing facility.

Two distinct phases were undertaken to document the design efforts to be implemented to support these Operable Unit 1 remedial actions:

- Design of Site Improvements. The Site Improvement Plan, which was a part of the Operable Unit 1 Remedial Design Pre-Final Design Package [DOE 1996c], addressed the activities necessary for construction of Operable Unit 1 remedial facilities and support facilities such as the on-site rail improvements (primarily the north railyard area). Included in the site improvement plan were estimates for borrow material requirements, primarily being satisfied by grading of the north rail yard. The Operable Unit 1 Stockpile was designed and constructed to accept soils generated from Operable Unit 1 site preparation activities and soils generated from other projects that exceeded the OSDF WAC. The design amendment allowed more time for preparation of the stockpile area and installation of the stormwater management pond and control facilities; as well as proper disposition of contaminated soils and debris generated during site preparation and other FCP project activities.

- Design of Remediation Facilities. The design of the remediation facilities was implemented later under a contracting strategy whereby the subcontractor (IT/Shaw) became responsible for developing and implementing a design which met the Operable Unit 1 ROD requirements, providing a product that would be loaded into railcars for shipment and disposal off site. This design was detailed in the Final Waste Pits Remedial Action Project (WPRAP) Remedial Design Package (DOE 1998a) approved by the EPA and Ohio EPA. This Design Package reflected facilities necessary to process the material so as to meet disposal facility waste acceptance requirements (e.g., for size, moisture, etc.). This Design Package also provided details concerning potential stack emissions from the dryer facility, waste excavation and blending plans, erosion and dust control, and storm water management.

3.0 CONSTRUCTION ACTIVITIES

The purpose of this section is to summarize the physical activities undertaken to implement the selected remedy, as documented in the Remedial Action Work Plan [DOE 1997]. Specifically, this section first provides a summary of construction activities implemented in support of the planned remedial actions. This section then describes the remediation activities that took place following construction.

3.1 Facility Construction

Various site preparation activities were implemented to improve and upgrade Operable Unit 1 for subsequent construction of the remedial facilities. Site improvement activities needed to support remediation facilities and activities were initiated on April 1, 1996. Initiation of these activities demonstrated the beginning of substantial, continuous, on-site remedial action (in accordance with the CERCLA) within 15 months of signing the Operable Unit 1 ROD (i.e., by June 1, 1996), as required under CERCLA. Attainment of this milestone was documented in a May 28, 1996 letter to EPA and the Ohio EPA [DOE 1996d]. The site improvements included activities to directly support installing and operating the remediation facility, such as the installation of the rail scale, site clearing and grading, and construction of a storm water management system. These improvements also included construction of an on-site rail system (e.g., track installation, on-site trestle upgrades, etc.) to support the off-site shipment of wastes to Envirocare, and upgrades to three off-site trestles needed to safely support the proposed additional train traffic. These activities were essentially completed in December 1997.

IT Corporation began limited construction activities in July 1998, while the EPA and the Ohio EPA completed their review of the Remedial Design Package. These were essentially site preparation activities that would not be impacted by Remedial Design Package comments/issues raised by EPA and Ohio EPA. On November 13, 1998, full construction activities began following approval of the Remedial Design Package. This included the construction of the larger structures, including the: material handling, railcar loadout, railcar preparation and liner storage, maintenance, and warehouse buildings; as well as the dryers, and the gas cleaning and wastewater treatment systems. These activities were essentially completed in November 1999.

The construction of these facilities was necessary to support the general steps required to fulfill the objectives of the remedial action, specifically, waste excavation and initial segregation, preparation of the excavated waste materials (i.e., sorting, blending, and size reduction), thermally drying waste requiring moisture reduction, blending of the processed material, and storage and loadout for transport to Envirocare.

Environmental controls constructed in support of the remediation facility were utilized to control erosion and sedimentation, suppress dust, control air emissions, and manage storm water and wastewater in the waste pit area and its associated plant facilities area.

3.2 First Loadout

On February 23, 1999, Operable Unit 1 initiated loadout activities, thereby achieving the March 1, 1999 Enforceable Milestone for initiating operations (i.e., loading of waste) as defined in the Remedial Action Work Plan. This first loadout activity represented the first phase of a sequenced approach to bringing the Operable Unit 1 remediation facility into full production, allowing material to be processed while the remaining facility construction was being completed. Under the first loadout, soils and soil-like materials from Soil Piles 6 and 7 were transferred via conveyor to the material handling building for blending and eventual loadout into railcars within the railcar loadout building. The approach for the performance of first loadout was detailed in the First Loadout Work Plan for Operable Unit 1 [DOE 1999a], which was reviewed and approved by EPA and Ohio EPA.

3.3 Transportation and Disposal

Operable Unit 1 rail operations include the coordination of empty and full railcar movements; maintenance of railcars, locomotives, and trackage; coordination with CSX Transportation/Union Pacific Railroad relative to receipt/return of trains, as well as tracking during transport; coordination with Envirocare for final disposal; and planning for and support of emergency response planning activities. The first train to leave the FCP transporting contaminated materials from Operable Unit 1 to Envirocare left on April 29, 1999.

On June 30, 1998, the DOE awarded a contract to Envirocare for disposal of low-level radioactive waste from the FCP, as well as other DOE sites. Under this contract, which was managed through the DOE Ohio Field Office, Operable Unit 1 representatives worked closely with Envirocare to establish a waste profile (i.e., the specific limits for Operable Unit 1 waste that Envirocare would accept), and to ensure compliance with Envirocare's WAC.

Prior to shipping waste to Envirocare, Operable Unit 1 was required to obtain an exemption from DOE Order 5820.2A, which required disposal of DOE wastes at DOE facilities. Operable Unit 1 was granted the exemption in November 8, 1994, allowing for the disposal of approximately 640,000 cubic yards of Operable Unit 1 waste to be disposed at Envirocare. The exemption was amended in February 1999 to include various materials from other FCP projects, including above OSDF WAC soils, sludges from the FCP's Advanced Wastewater Treatment facility, and legacy waste, that were similar to Operable Unit 1 pit waste material and would thus, meet the waste profiling requirements. The FCP later revised the exemption, (April 15, 2003), to revise the quantities identified in the February 1999 exemption amendment.

Transportation and disposal-related activities were also addressed in the Transportation and Disposal Plan [DOE 1998b] and its secondary documents. The plan and its related documents describe how rail transportation and disposal operations were conducted for Operable Unit 1, including on-site and off-site rail operations, inspections and maintenance, emergency response, training and waste disposal at Envirocare. The plan was written assuming all Operable Unit 1 pit waste would be shipped with a low specific activity (LSA-1) designation. As remedial activities were underway, it became necessary to seek authorization from the U.S. Department of Transportation (DOT) to transport LSA-II via the Operable Unit 1 system. In other words, the 'strong tight packaging' required under DOT for shipment of LSA-II material was applied to the Operable Unit 1 rail car and liners. The DOT authorized the exemption in May 2002.

3.4 Excavation of Waste Pit Material

Initiated in September 1999, this phase involved excavating Waste Pits 1, 2, 3, 5, 6, and the Clearwell. Excavated material was transported to the material handling building for processing, as necessary, to meet Envirocare WAC (i.e., for moisture content and contaminant levels). The material was then transferred into the railcar loadout building storage bins, sampled to ensure WAC compliance, and loaded into railcars for shipment to Envirocare. The specifics associated with these, as well as other remediation activities were detailed in the Waste Pits Remedial Action Package [DOE 1999b].

Of the approximately 600,000 cubic yards of Operable Unit 1 waste materials, a substantial portion required moisture reduction beyond that which could be achieved by mechanical blending. In December 1999, Operable Unit 1 initiated dryer operations to process pit waste through one of two gas-fired, indirect dryers. This reduced waste material moisture levels to meet Envirocare WAC. Dryer operations were completed in October 2004.

The pit excavation activities discussed above did not include either Pit 4 or the Burn Pit. Pit 4 was segregated for individual work activity planning because of its potential unique inventory characteristics (e.g., thorium fines,

which had potential fire/explosion hazards associated with it). Pit 4 excavation activities began in January 2003 and were essentially completed in December 2003. The Burn Pit was segregated due to historical records that indicated waste solvents from the National Electric Coil (NEC) facility were disposed of in environmental media within, or adjacent to, the Burn Pit. Prior to initiating excavation activities in the Burn Pit, a sampling and remediation plan to address this NEC solvent disposal was prepared and implemented, which addressed the need for the potential removal of impacted material above RCRA-regulated regulatory thresholds. Findings of an extensive investigation into the potential presence of residual concentrations of solvent contamination above regulatory thresholds concluded that there was no technical or regulatory based need to further isolate the study area soils or manage them differently from other excavated soils in the waste pit area. Thus, soil from the area could therefore be aggregated, sampled, and processed through the Material Handling Building (MHB) and Railcar Loadout Building (RLB) and shipped off-site along with the other Operable Unit 1 materials. The Ohio EPA concurred with this investigation and its findings by letter of July 14, 2003 [OEPA 2003].

3.5 Waste Processing

Once waste was excavated, waste preparation took place in the MHB. Waste preparation activities included receiving excavated materials from the pits, followed by blending, further separation by screening, and size reduction of materials. Portions of the processed material were then selected for drying while the balance of the waste material bypassed the dryers and was later blended back into the process. Blended, processed material was placed in storage bins to await sampling and loadout into railcars.

Sampling for chemical and radiochemical analyses was taken as the material was placed into the storage bins. The samples were composited to generate a representative bin sample and were analyzed to ensure compliance with DOT shipping requirements and Envirocare's Radioactive Waste Profile. Specific sampling and compositing methods were described in the Sampling and Analysis Plan (SAP) for Waste Pit Material (contained in the Waste Pits Remedial Action Package). The waste material sampling and analysis strategy was revised in early 2005, to provide for the in-situ sampling of remaining waste material (to expedite remaining waste shipments) and to remove the requirement for TCLP analyses (based on significant data already gathered to characterize the waste pits).

Water management associated with these activities consisted of collecting, sampling, treating (as necessary) and discharging water from multiple sources. Water managed included process wastewater, nonprocess wastewater, noncontact storm water, excavation water and contact storm water from inside excavation areas, and noncontact storm water within the waste pit area.

Process and nonprocess wastewater and contact storm water were collected and transferred to the Wastewater Treatment System (WTS) prior to discharge to the Bio Surge Lagoon (BSL). Process wastewater included gas cleaning system (GCS) water, and water from process areas such as the MHB, truck wash, and support facilities.

Noncontact stormwater outside the pit area that did not contain contaminated materials and was either directed to the Waste Pit Area Runoff Control Basin, or the Stormwater Management (SWM) Pond. Contact stormwater and excavation water was collected and transferred to the WTS for treatment prior to disposition to the BSL.

Off-gas treatment from dryer operations was captured and managed through the GCS. The GCS treated the off-gas for toxic, particulate, and radiological emissions. Emissions from the GCS were via an exhaust stack that was considered a point source and required to meet the stack discharge limits set for the project. Prior to

emissions passing through the exhaust, the filtered off-gas passed through a Thermal Oxidizer as an effective means for the treatment of any remaining volatile organic compounds (VOCs) and carbon monoxide.

Appendix B to this report provides various schematics representing the remediation/treatment processes discussed above. Table 3-1 provides a summary of the material shipped to Envirocare via the waste pits project, consistent with the project reporting strategy contained in the spring 2005 Fact Sheet.

Table 3-1 Operable Unit 1 Train Shipments

Unit Train #	Date Shipped	Tons Shipped	Unit Train #	Date Shipped	Tons Shipped	Unit Train #	Date Shipped	Tons Shipped	Unit Train #	Date Shipped	Tons Shipped
1	4/26/99	5,813	40	6/27/01	6,675	79	3/12/03	6,775	118	6/2/04	5,918
2	5/17/99	5,390	41	7/17/01	6,463	80	4/4/03	6,461	119	6/17/04	7,001
3	5/28/99	5,600	42	7/31/01	6,996	81	4/11/03	6,463	120	6/25/04	6,464
4	6/16/99	5,069	43	8/15/01	6,455	82	4/30/03	6,569	121	7/7/04	6,462
5	7/7/99	5,700	44	8/31/01	6,353	83	5/9/03	6,891	122	7/14/04	5,919
6	7/21/99	5,603	45	9/26/01	6,568	84	5/23/03	6,679	123	7/28/04	6,465
7	8/4/99	5,392	46	9/29/01	6,459	85	6/6/03	6,674	124	8/11/04	6,467
8	9/2/99	5,280	47	10/19/01	6,460	86	6/16/03	6,888	125	10/1/04	6,458
9	9/29/99	5,390	48	11/9/01	6,460	87	6/25/03	6,879	126	10/6/04	6,455
10	10/8/99	6,423	49	11/20/01	6,459	88	7/2/03	6,446	127	10/14/04	6,678
11	10/20/99	5,689	50	12/11/01	6,459	89	7/16/03	6,667	128	10/20/04	6,569
12	11/3/99	5,382	51	12/20/01	6,460	90	7/25/03	6,680	129	11/10/04	6,032
13	11/11/99	5,347	52	2/1/02	6,459	91	8/1/03	6,456	130	11/22/04	5,060
14	11/23/99	6,463	53	2/20/02	6,458	92	8/13/03	6,456	131	12/10/04	6,458
15	12/8/99	5,385	54	3/8/02	6,458	93	8/23/03	6,778	132	12/29/04	6,461
16	12/21/99	5,706	55	3/22/02	6,455	94	8/29/03	6,781	133	12/31/04	6,571
17	1/12/00	6,463	56	4/17/02	6,781	95	9/12/03	6,460	134	1/15/05	6,454
18	1/27/00	6.455	57	5/17/02	6,675	96	9/19/03	6,564	135	1/21/05	6,454
19	2/24/00	6,388	58	5/31/02	6,027	97	10/1/03	6,457	136	1/28/05	6,456
20	3/14/00	6,454	59	6/14/02	6,893	98	10/15/03	5,931	137	2/12/05	6,448
21	4/25/00	6,453	60	6/28/02	6,677	99	10/25/03	6,461	138	2/23/05	6,455
22	5/10/00	6,408	61	7/12/02	6,566	100	11/5/03	6,455	139	2/25/05	6,456
23	5/25/00	6,455	62	7/24/02	6,461	101	11/15/03	6,457	140	3/4/05	6,130
24	6/24/00	6,456	63	8/2/02	6,462	102	11/19/03	6,463	141	3/11/05	6,448
25	6/28/00	6,453	64	8/16/02	6,456	103	12/3/03	6,467	142	3/18/05	6,445
26	7/19/00	6,452	65	8/28/02	6,452	104	12/12/03	6,447	143	3/24/05	6,454
27	8/2/00	6,455	66	9/13/02	6,462	105	12/19/03	6,455	144	3/30/05	6,455
28	8/16/00	6,453	67	9/25/02	6,889	106	1/7/04	6,458	145	4/7/05	5,903
29	9/20/00	6,991	68	10/9/02	6,468	107	1/21/04	6,377	146	4/13/05	6,339
30	11/21/00	6,645	69	10/23/02	6,358	108	1/28/04	6,426	147	4/21/05	6,458
31	12/14/00	6,774	70	11/6/02	6,464	109	2/13/04	6,444	148	4/28/05	6,458
32	12/20/00	6,454	71	11/20/02	5,924	110	2/25/04	6,450	149	5/4/05	5,909
33	2/6/01	6,456	72	11/26/02	5,925	111	3/11/04	6,463	150	5/11/05	6,450
34	2/28/01	6,458	73	12/13/02	6,676	112	3/24/04	6,459	151	5/18/05	6,559
35	3/13/01	6,565	74	12/20/02	6,677	113	3/31/04	6,452	152	5/26/05	6,459
36	4/24/01	6,457	75	1/17/03	6,573	114	4/7/04	6,459	153	6/3/05	6,452
37	5/8/01	6,459	76	1/24/03	6,383	115	4/30/04	6,465	154	6/15/05	6,453
38	5/24/01	6,998	77	2/12/03	6,569	116	5/5/04	6,458			
39	6/14/01	6,674	78	2/28/03	6,470	117	5/26/04	6,455			

Table 3-1 reflects that a total of 975,100 tons of waste was sent to the Envirocare site through the Waste Pits Project. Of that total, an estimated 150,000 tons consisted of materials from other FCP projects processed through the waste pits facilities, consistent with the intent of the Operable Unit 1 ESD (as discussed in Section 2.4).

In general (not including the material from other FCP projects), the volume of waste materials processed through the waste pits facilities was consistent with what had been anticipated through the RI/FS. Specifically, in the FS, it had been estimated that approximately 710,000 cubic yards of material (including pit waste, covers, liners, and subsoils) would be excavated in support of the waste pits remediation activities. This total reflected approximately 628,200 cubic yards of waste material (i.e., pit material, covers, and liners) and 81,800 cubic yards of soils (an estimated 3 feet of soils from below the waste pits). The FS assumed that half of the soils would be sent off-site for disposal with the waste pit material, and that the remaining soils would be dispositioned consistent with the selected remedies for contaminated process area soils as documented in the Operable Unit 5 ROD. The actual waste pits material (including the covers and liners) processed through the waste pits facilities was estimated to be about 631,000 cubic yards (which reflects about 8,000 cubic yards of Pit 4 cover material going to the OSDF). In terms of subsoils, the actual quantity varied pit by pit. In some cases, no subsoils were removed, while in others a couple of feet of subsoils excavated through the waste pits project to achieve the remediation standards discussed in Section 6 of this report. On average, the amount of subsoils excavated did not vary significantly from the estimated foot and a half that would be processed through the facility for disposal off-site. In summary, there was basically no growth in volume (i.e., the pits were well-defined and although there were variations, the total cubic yardage was consistent with estimated yardage).

A comparison of anticipated versus actual tonnage, however, shows that the actual tonnage from the waste pits processing activities was less than had been estimated in the FS. The FS had estimated that 1,053,300 tons of material from the waste pits area would be generated through waste pit operations and be shipped off-site for disposal. The actual final tonnage for the waste pits material (including the covers and liners) was, in fact, estimated to be about 737,400 tons. For comparison purposes, if one and a half feet of subsoils had been processed through the facility for disposal off-site, as well, this would have totaled approximately another 75,000 tons, for a total of about 812,400 tons, or over 200,000 tons less than the quantity estimated in the FS. This difference could be reflective of several things, including assumptions of pit densities and assumptions of expected water loss through waste processing activities. In actuality, a total of approximately 825,100 tons of material from the waste pits area (including pit material, covers, liners, and subsoils) was generated through the waste pits facilities, along with the 150,000 tons of material from other FCP projects.

4.0 CHRONOLOGY OF EVENTS

The following table provides a summary of the events for Operable Unit 1 remediation, and associated dates of those events, starting with planning and execution of the associated removal actions.

Summary of Events for Operable Unit 1 Remediation

Event	Date
Operable Unit 1 Decision Related Documents	
Operable Unit 1 Record of Decision	March 1995
Explanation of Significant Differences	September 2002
Amendment of the Operable Unit 1 Record of Decision	November 2003
Operable Unit 1 Related Umbrella Documents	
Transportation and Disposal Plan for Operable Unit 1	July 1998
Operable Unit 1 Remedial Design Documents	
Remedial Design Work Plan for Remedial Actions at Operable Unit 1	July 1995
Addendum to Remedial Design Work Plan for Remedial Actions at Operable Unit 1	1996
Operable Unit 1 Remedial Design Pre-Final Design Package	March 1996
Amendment to the Operable Unit 1 Remedial Design Pre-Final Design Package	June 1996
Waste Pits Remedial Action Project Remedial Design Package	August 1998
Operable Unit 1 Remedial Action Documents	
Operable Unit 1 Remedial Action Work Plan	January 1997
First Loadout Work Plan for the Waste Pits Remedial Action Project	February 1999
Waste Pits Remedial Action Project Remedial Action Package	July 1999
Remedial Action Field Activities	
Initiation of Site Preparation Work	April 1996
Completion of Site Preparation Work	December 1997
Remediation Facility Construction Start	July 1998
Remediation Facility Construction Completion	November 1999
Initiation of Loadout Activities	February 1999
First Train Shipment	April 1999
Start of Waste Pit Excavation Activities	September 1999
Start of Dryer Operations	December 1999
Completion of Dryer Operations	October 2004
Completion of Pit 6 Excavation Activities	August 2004
Completion of Pit 5 Excavation Activities	September 2004
Completion of Pit 4 Excavation Activities	October 2004
Completion of Clearwell Excavation Activities	October 2004
Completion of Pit 1 Excavation Activities	March 2005
Completion of Pit 2 Excavation Activities	March 2005
Completion of Pit 3 Excavation Activities	March 2005
Completion of Burn Pit Excavation Activities	March 2005
Completion of Loadout Activities	May 2005
Last Train Shipment of Waste Pit Materials	June 2005

5.0 PERFORMANCE STANDARDS AND CONSTRUCTION QUALITY CONTROL

This assessment of the Operable Unit 1 remedial actions is focused primarily on the removal of the waste material from the pits and its shipment off site in accordance with established remediation schedules, while managing this material for WAC compliance upon receipt at Envirocare. The assessment also focuses on meeting other discharge requirements for secondary wastes generated through this remediation effort, such as wastewater and stack emissions.

The data used in performing this assessment were gathered through the SAP for Environmental Media and the SAP for Waste Pit Materials (both contained in the Waste Pits Remedial Action Package). The objectives for the SAP for Waste Pit Materials are to satisfy requirements of the Operable Unit 1 ROD for additional RCRA testing of Operable Unit 1 materials and Envirocare's requirements for waste generators to adequately complete the Radioactive Waste Profile Record and characterize their waste materials prior to shipment to the Envirocare facility. The SAP for Waste Pit Materials, in conjunction with the Envirocare profile, ensures that the analytical requirements have been met. The Operable Unit 1 SAP for Waste Pit Materials also defines the characterization needed to ensure the waste material meets DOT requirements for shipping the waste as LSA-I material prior to railcar loadout. The quality assurance/quality control program described in each of these SAPs is derived from the FCP Quality Assurance Program Description and the Sitewide CERCLA Quality (SCQ) Assurance Project Plan [DOE 2003b].

Table 5-1 provides a summary of the bin sample analytical data, including the minimum and maximum results. Bin sampling of waste takes place after the waste has been mixed or processed through the dryer. Sampling is performed as the material is being loaded into the bins of the railcar loadout building.

For comparison purposes, Table 5-1 also presents the concentration range, as approved by Envirocare, for the Operable Unit 1 waste profile. This profile reflects the expected range of characteristics for the Operable Unit 1 wastes, demonstrating that the anticipated characteristics of the Operable Unit 1 wastes are within the bounds of the Envirocare WAC. Although some of the inorganics had concentrations above the waste profile, Envirocare does not require that the profile be changed, as long as the levels do not get close to the Toxicity Characteristic Leaching Procedure (TCLP) limits.

Envirocare sampling of this material, upon receipt, showed that all Operable Unit 1 materials transported to Envirocare, and unloaded, met the Radioactive Waste Profile requirements. Although screening of the waste pit materials occasionally indicated higher than expected levels of thorium-230, Operable Unit 1 was able to blend this material such that it met the Radioactive Waste Profile requirements.

In 1997, the FCP formed an independent oversight organization known as the Waste Acceptance Organization (WAO) that was responsible for observing all excavations and dispositioning of waste, including the excavations associated with the removal of the Operable Unit 1 materials, and disposal off-site at Envirocare. During the Operable Unit 1 field activities, WAO was charged with implementing the manifesting system used to track material from excavation to disposal, making calls on acceptability of material for disposal at Envirocare. WAO also identified the disposition pathway and handling requirements for materials generated at Operable Unit 1, not requiring disposal at Envirocare. Finally, the completion of the removal of the Operable Unit 1 wastes was verified both by engineering survey data (which verified that the design depth had been achieved), as well as visual observation of the materials remaining at the excavation sites, with WAO serving as the primary observing entity to ensure that visual completion obligations were satisfied.

Table 5-1 WPRAP Bin Waste Analytical Data Versus OU1 Waste Profile

	Summary of Bin Sample Concentrations[a]		OU1 Waste Profile
	Maximum	Minimum[b]	Concentration Range
Arsenic	2.5 mg/L	0.0124 mg/L	0.0 – 1.350 mg/L
Barium	12 mg/L	0.0895 mg/L	0.0 – 12.800 mg/L
Beryllium	14.3 mg/kg	0.11 mg/kg	N/A
Cadmium	0.25 mg/L	0.0015 mg/L	0.0 – 0.204 mg/L
Chromium	1.25 mg/L	0.0035 mg/L	0.0 – 4.520 mg/L
Copper	3.8 mg/L	0.0021 mg/L	N/A
Lead	3 mg/L	0.0174 mg/L	0.0 – 1.480 mg/L
Mercury	0.092 mg/L	0.000041 mg/L	0.0 – 0.007 mg/L
Selenium	0.96 mg/L	0.0119 mg/L	0.0 – 0.218 mg/L
Silver	0.868 mg/L	0.0007 mg/L	0.0 – 2.340 mg/L
Zinc	27.1 mg/L	0.002 mg/L	0.0 – 2.26 mg/L
Cesium-137	9.62 pCi/g	0.05 pCi/g	0.7 – 450 pCi/g
Lead-210	787 pCi/g	1.1 pCi/g	0.0 – 2,950 pCi/g
Neptunium-237	18.8 pCi/g	0.1 pCi/g	0.0 – 85.0 pCi/g
Potassium-40	45.6 pCi/g	2.7 pCi/g	0.0 – 34.0 pCi/g
Radium-226	1862 pCi/g	1.9 pCi/g	1.4 – 2,950 pCi/g
Radium-228	463 pCi/g	0.77 pCi/g	1.3 – 558 pCi/g
Thorium-228	463 pCi/g	0.77 pCi/g	N/A
Thorium-230	7,400 pCi/g	15.4 pCi/g	2.0 – 18,400 pCi/g
Thorium-232	463 pCi/g	0.77 pCi/g	N/A
Uranium-234	23,760 pCi/g	21 pCi/g	1.2 – 33,413 pCi/g
Uranium-235	296 pCi/g	1.2 pCi/g	0.2 – 900 pCi/g
Uranium-238	23,760 pCi/g	38 pCi/g	1.2 – 35,212 pCi/g

[a]All analysis of metals (except beryllium) were performed using the TCLP analyses.
[b]NA = not applicable

The SAP for Environmental Media was developed to provide the criteria associated with sampling and analysis of environmental media, including storm water, excavation water, wastewater, and air. The objectives of the SAP for Environmental Media are to:

- Specify the basis for determining the sampling and analysis requirements for the identified environmental media
- Ensure compliance with the requirements of the Operable Unit 1 ROD, including ARARs
- Ensure that Operable Unit 1 activities do not degrade the environment through unauthorized releases
- Provide timely data to operations so as to facilitate the reliability and cost effectiveness of the above objectives.

The SAP for Environmental Media thus provides the basis for which the sampling and analysis results may be compared to ensure the above objectives have been met. For example, the sampling and analysis objectives for water discharge criteria are established in the SAP. They are intended to ensure the limits have not been exceeded, to determine the adequacy of the Operable Unit 1 WTS, and to determine whether certain other constituents are present in the discharges from the WTS to the BSL. These discharge criteria to the BSL included: 1,000 ppm of suspended solids; 300 pCi/l for Thorium-230; 50 pCi/l for Thorium-232; and 5,000 ppb for total dissolved uranium.

The SAP for Environmental Media defines the characterization efforts needed to ensure that waters generated through the Operable Unit 1 remediation activities (i.e., non-contact storm water, wastewater, excavation water, and contact storm water) meet established discharge criteria. Specifically, this characterization is used to support decisions to discharge non-contact storm water (from the SWM pond) to Paddys Run, and to discharge wastewater, excavation water, and contact storm water into the BSL after treatment through the Operable Unit 1 WTS. A limit of 20 ppb for total uranium was established for discharges from the SWM Pond to Paddys Run.

Dryer stack air monitoring is directed by the SAP for Environmental Media. Analyses for radon and radiological isotopes are used for compliance, environmental, and process control purposes. The sampling results for stack monitoring were reported to EPA and Ohio EPA on a routine basis, either through the Integrated Environmental Monitoring Plan (IEMP) quarterly status reports or, in the case of radon and isotopic stack data, electronically as the data became available. The stack emissions, as represented by this data, were well below the established regulatory limits.

6.0 FINAL INSPECTION AND CERTIFICATIONS

The scope of this Operable Unit 1 Final Remedial Action Report involves the demonstration that the waste material in each of the waste pits described in the Operable Unit 1 ROD has been removed and dispositioned, consistent with the reporting strategy and definitions contained in the spring 2005 Fact Sheet.

The waste pit materials, comprised of material from pits 1-6, the Burn Pit and the Clearwell, have been fully excavated. In addition, at least 6 inches of liner (or other native material, such as subsoils, in the case of the pits with synthetic liners) has been excavated from below the waste/liner interface, along with any additional material produced through the removal of visual waste material observed following the walkdown and completion of the 6-inch liner excavation.

All of the required waste pit materials have been shipped to Envirocare for off-site disposal. Each shipment was manifested to ensure that all of the waste was properly shipped and received by the facility.

Under the Operable Unit 1 ROD, the standard of *no visible product* is the basis for verification that all waste pit materials have been removed. Any contaminated material identified after this point would be considered part of the Operable Unit 5 soil removal and disposition activities (consistent with the spring 2005 fact sheet) and the remaining soil remediation activities would follow Operable Unit 5 soil excavation, WAC attainment demonstration, and FRL certification protocols as required by the 2003 Operable Unit 1 ROD Amendment. The Operable Unit 5 remedial action closeout report will then provide the documentation that the Operable Unit 5 soil FRLs are met for soils under the pits and in adjacent areas within the Operable Unit 1 geographic boundary; that all above-WAC materials are properly shipped off site for disposal; and the materials meeting the OSDF WAC are properly disposed of on site in the OSDF.

Once waste removal was completed in each pit, this waste/liner interface was surveyed, and the survey data compared to design drawings of the initial pit construction. Any discrepancies between the waste/liner interface, as established in the field, and the design drawings, were evaluated and a final decision made as to what the waste/liner interface should be for the purposes of removing 6 inches of liner from below this interface. Once the 6 inches of liner was removed, another survey was performed, and the results of this survey compared to the waste/liner survey to document that 6 inches of liner material had in fact been removed. Following the removal of the 6 inches of liner material, a visual inspection was performed. If, through this visual inspection, any visible waste material was found, this material was removed.

This report therefore served to demonstrate and document that all waste material, as well as 6 inches of liner (or other native material, such as subsoils, in the case of the pits with synthetic liners) from below the waste/liner interface, and any visible waste material was removed from all of the Operable Unit 1 waste units and disposed of consistent with the Operable Unit 1 ROD.

This report also certifies that HWMU closeout activities (as discussed in Section 2.5 and Appendix C) have been completed as they apply to the excavation, treatment, and off-site disposal of materials within the HWMUs that reside in Operable Unit 1. As discussed in Section 2.5, the Operable Unit 5 certification process (as communicated through the individual Remediation Area Certification Reports and ultimately the Operable Unit 5 Final Remedial Action Report) addresses the certification that the remediation of the environmental media beneath and adjacent to the HWMUs has been completed.

7.0 OPERATION AND MAINTENANCE ACTIVITIES

As an excavation and disposal remedy, there are no post-remedy operational issues or requirements for the source units/materials remediated under the scope of Operable Unit 1. Maintenance activities for these areas are generally related to controlling access to prevent re-contamination and maintaining the vegetation planted for natural resource restoration purposes. For the waste pit area, restoration will focus on the creation of additional wetlands and open water habitats. Surrounding areas will be seeded as prairie, which will be contiguous with the prairies established in the Former Production Area and the Borrow Area. These activities are conducted as part of the Operable Unit 5 resource restoration activities.

Maintenance of restored areas prior to closure is described in the individual restoration design packages. The following are the general maintenance activities that will be carried out in each restored area:

- Controlling invasive/noxious species by spot removal using manual, mechanical, or chemical methods.
- Reseeding and/or replanting of restored areas as required by implementation monitoring and adaptive management decisions to ensure appropriate vegetative cover.
- Maintain prairie and savanna ecosystems and diversity through appropriate disturbance regimes and thatch removal. Activities may include mowing, burning, or physical disturbance.
- Correcting soil erosion problems at drainage channels, stream banks, outfall structures, or wetland berms by appropriate means that are impacting or have the potential to impact restored areas.
- Repairing wildlife structures/boxes as needed.
- Clearing debris, tripping hazards, overhanging limbs, excessive weed growth, and replacing mulch on pathways and public access areas.
- Keeping access points and parking areas in good condition including the replacement of gravel and mowing and trimming as appropriate.

Legacy management is required at the FCP to ensure that the remedial actions implemented at the site continue to be effective and protective of human health and the environment. Legacy management in restored areas will include ensuring that natural and cultural resources are protected in accordance with applicable laws and regulations. Institutional controls are also implemented to limit access and land use. Institutional controls include continued federal ownership of the FCP and placing restrictions on the use of the property on the property deed before the property could be sold or transferred to another party. All the legacy management and institutional control requirements and initiatives are defined in the Comprehensive Legacy Management and Institutional Controls Plan (LMICP) [DOE 2006]. Since the LMICP is applicable to the FCP as a whole, there are no specific institutional controls related to Operable Unit 1.

8.0 SUMMARY OF PROJECT COSTS

The March 1995 Operable Unit 1 ROD identifies the remedial actions selected for Operable Unit 1. The final remedial alternative selected in the ROD was *Alternative 5B – Removal, Treatment (Drying), and Off-site Disposal at a Permitted Commercial Disposal Facility.* A summary of the estimated costs for the selected remedy at the time of its selection was provided in the 1995 ROD, with the details and backup provided in the Operable Unit 1 FS report.

This section of the remedial action closeout report compares the original estimated costs for the Operable Unit 1 remedy from the March 1995 ROD with the actual costs experienced on the project. Consistent with EPA's closeout guidance an explanation is provided when the actual costs fall outside the range of – 30 to +50 percent of the original estimate. Appendix A provides the supporting information and tabular summaries supporting the descriptions and findings presented below.

8.1 Adjustments Needed to Permit Fair Comparison of ROD Costs with Actual Costs

The cost estimate provided in the 1995 ROD for the Operable Unit 1 waste pits remedial action activities was $515 million (1994 base dollars). The ROD-based scope of work and associated cost estimates prepared at the time of the ROD included the construction activities including the construction of the auxiliary facilities including roads and support facilities, the pretreatment facility, rail sidings, rotary drying facility, in addition to the construction activities associated with waste material excavation. This scope of work also included the excavation of the pit residues, caps, liners, sub-soils beneath the pits, and affected surface soils adjacent to the pits within the Operable Unit 1 geographic boundary. Also included in the scope and estimate, is the processing (including drying) necessary to ensure that the materials from the waste pit area met the acceptance criteria of the off-site disposal facility. The scope included the shipping activities and the disposal activities at a permitted commercial disposal facility. Finally, this scope included backfilling of the waste pits area, construction of a cover system, and the long-term operation and maintenance of the cover system.

Several adjustments are necessary to permit a fair comparison of estimated ROD costs with the actual costs relative to the scope of this remedial action report. First, additional waste materials from the FCP's Operable Unit 3 containerized waste inventory were approved for bulk shipping and disposal through the Operable Unit 1 facilities. An adjustment in actual costs is therefore needed to account for this additional material. Second, the actual costs associated with subsoil excavation, shipping, and disposal (i.e., the subsoil beneath the pit liners) along with the affected surface soils adjacent to the pits and within the overall Operable Unit 1 geographic boundary were experienced and captured as part of the Operable Unit 5 soil remediation project. To remain consistent with the spring 2005 Fact Sheet reporting strategy and scope definitions for the remedial action closeout reports, costs associated with the affected subsoil beneath the pit liners, and the affected surface soils within other portions of the Operable Unit 1 geographic boundary, will be reported in the Operable Unit 5 remedial action closeout report. An adjustment is therefore made to recognize the soil remediation costs as part of the Operable Unit 5 report in order to keep the soil remediation cost comparisons consistent with the Fact Sheet. Third, an adjustment is made for consistency purposes to recognize the costs associated with decontamination, dismantlement, and disposal of the Operable Unit 1 remediation facilities constructed to support the Operable Unit 1 remedy as Operable Unit 3 costs. These costs will be accounted for in the Operable Unit 3 remedial action closeout report to facilitate the cost comparisons required in Section 8 of that report. Finally, an adjustment is made to recognize that restoration of the waste pit area, and long-term operation and maintenance of the area are

not a part of the final Operable Unit 1 costs. The restoration costs will be captured within the Operable Unit 5 costs, and reported in the Operable Unit 5 remedial action closeout report.

Lastly, the Operable Unit 1 ROD cost estimate was prepared in 1994 constant dollars and it was necessary to escalate the dollars to future dollars to permit comparison with actual costs. An annual escalation factor of 3 percent was used for all escalation calculations.

8.2 Results of the Comparison of Actual Costs with the ROD Estimated Costs

Appendix A contains a tabulation of all of the adjustments and escalations used to modify the original ROD cost estimate to facilitate its comparison to actual costs. Based on all the adjustments described above and the escalation of 1994 dollars to future dollars, the ROD adjusted escalated cost estimate is $658 million. Actual costs for the adjusted ROD tasks total to $449 million. When compared to the 2006 escalated adjusted estimate of $658 million, the cost difference is a cost differential (i.e., savings) of about 47 percent which falls just outside the lower bracket of EPA's –30 to +50 percent guideline. An explanation of the difference -- in this case a savings of 47 percent -- is therefore necessary as requested in the EPA guidance.

In examining the actual costs experienced over the 11 years of planning and executing the project, and comparing them to the original estimates at the time of the FS and ROD, it was found that the original FS used, for planning purposes, a shipping and disposal unit cost of about $307/ton, based on prevailing market conditions at that time and projected disposal rates in the future. When escalated to reflect current dollars, this estimated shipping rate equates to about $410/ton. Actual shipping and disposal costs experienced over the life of the project, on average, were found to be about $200/ton, or about half the estimated shipping and disposal rate as reflected in the ROD cost estimate. With shipping and disposal costs representing over half the Operable Unit 1 remediation costs, this rate difference in shipping and disposal costs represents approximately 82% of the cost differential (i.e., savings).

Another factor associated with the cost savings, is the lower than expected tonnage realized versus the tonnage used in developing the ROD estimate. Specifically, as discussed in Section 3.5, a total of approximately 825,100 tons of waste pit material (including pit material, covers, liners, and subsoils) was generated through the waste pits facilities, as compared to the estimate of 1,053,300 used to develop the ROD cost estimate. Since the volume (i.e., cubic yards) of such materials processed through the waste pits facilities did not differ substantially from what was planned, this tonnage differential is reflective of differences in assumptions used in developing the ROD estimate versus what was actually encountered. For example, differences in actual moisture levels, as well as moisture loss, could easily account for these tonnage differences.

9.0 OBSERVATIONS AND LESSONS LEARNED

Throughout the life of the project, ongoing activities were evaluated to ensure requirements set up for those activities were being followed and utilized to their best extent. Activities such as personnel training evaluations, continuous quality improvement, and review of technical standards provided opportunities for process improvements. The following observations and lessons learned were a few of these process improvements:

- Achieving 24/7 operating posture: The project started on a 5-day/24-hour operating schedule, but changed to a 24/7 operating schedule to ensure that the completion date could be readily maintained.
- Addition of railcars: From the initial fleet of 170, to 190, then to 250 -- to facilitate a shipping schedule that would ensure that the completion date could be maintained.
- Disposition of Pit 4 Cap material (which was demonstrated to essentially be clean cover) to OSDF to provide OSDF with needed soil, and saving approximately $4.52 million in disposal costs.
- Material from other projects managed through Operable Unit 1: Cost effectiveness and safety advantages resulted from using the Operable Unit 1 remedial infrastructure to process for disposal waste streams from other onsite projects.
- Onsite treatment of non-typical waste beneficial: Cost effectiveness and safety advantages resulted from treating UF6 cold traps in the waste pit excavation area versus shipping off-site for treatment as was originally planned for all non-typical waste.
- Noncompliant material: In the event bin samples indicate a potential for failure with respect to Envirocare WAC, the SAP contained additional sampling approaches to be taken to identify the extent of the problem; these procedures were followed as planned with the material adequately characterized and disposed.
- Revised Envirocare Waste Profile to include asbestos containing material (ACM), to provide for an alternative means of disposing of this material by the FCP.

10.0 CONTACT INFORMATION

Remedial Action Contacts

U.S. Department of Energy Contact	Fluor Fernald Contact
Public Information Fernald Closure Project U.S. Department of Energy P.O. Box 538705 Cincinnati, OH 45253-8705 513-648-3153	Fernald Closure Project Fluor Fernald P.O. Box 538704 Cincinnati, OH 45253-8704 513-648-4898
U.S. Environmental Protection Agency Contact	**Ohio Environmental Protection Agency Contact**
Remedial Project Manager U.S. EPA SRF-6J 77 W. Jackson Blvd. Chicago, IL 60604-3590 312-886-0992	Fernald Project Manager Ohio Environmental Protection Agency 401 E. Fifth St. Dayton, OH 45402-2911 937-285-6357

APPENDIX A – COST AND PERFORMANCE SUMMARY

Appendix A – Operable Unit 1 Cost and Performance Summary

ROD Unescalated 1994 Cost Estimate in RI/FS ($xM)

Includes the following work scope:

1) Construction of ancillary and remediation facilities = $24
2) Construction of rail facilities = $6
3) Excavation of 710,000 cubic yards of waste pit material, liners, covers, and subsoils = $63
4) Processing (including drying) of the wastes for shipment off-site = $78
5) Shipping and Disposal of 1,053,300 tons of waste material to commercial disposal facility = $322
6) Decontamination and dismantlement of remediation facilities = $8
7) Backfilling of waste pit area (and construction of cover) = $12
8) Post-remediation operation and maintenance costs = $2

TOTAL Unescalated 1994 Cost Estimate ($xM) = $515

Adjusted Unescalated ROD Cost Estimate ($xM)

Adjustments were made to the cost estimate provided in the RI/FS to reflect changes in the final Operable Unit 1 work scope as discussed in Section 8. Specifically, the above costs should be revised as follows, to reflect the scope changes:

1) Facility construction – no change
2) Rail construction – no change
3) Material excavation – Subsoils (other than those excavated in chasing pit waste) are captured in the Operable Unit 5 costs. Assuming 1 ½ feet of subsoils was excavated under Operable Unit 1, the total estimated quantity removed by Operable Unit 1 was 673,300 cubic yards. Using an excavation rate of approximately $89 per cubic yard (i.e., $63M/710,000), the excavation costs to reflect this new scope would be revised downward, by about $3M, to $60M.
4) Processing of waste – This should not change, because the quantity of material that was supposed to go through the facility did not substantially change.
5) Shipping and disposal – no change
6) Decontamination and dismantlement – should be removed, since it will be captured in the Operable Unit 3 costs.
7) Backfilling of waste pit area – should be removed, since it will be covered in the Operable Unit 5 costs.
8) Post-remediation operation and maintenance – Should be removed. Long-term operation and maintenance is not a part of the current scope.

TOTAL Adjusted Unescalated ROD Cost Estimate ($xM) = $490

For comparison purposes, the ROD estimate was escalated to reflect current dollars. This escalation was done on the adjusted estimate, as discussed above.

TOTAL Escalated Adjusted ROD Estimate ($xM) = $658

ACTUAL COSTS

Although the total costs for the Waste Pits Project was determined to be $479M, these costs included the shipment and disposal of waste from other FCP projects. Assuming an average cost for shipping and disposal of $200/ton, this equates to $30M in costs associated with the 150,000 tons from other FCP projects. Subtracting this from the Project total cost, results in a total cost of **$449M** the adjusted scope as reflected above and in Section 8.

COST DIFFERENTIAL

The cost differential between the total escalated adjusted ROD estimate ($658M) and the actual costs ($449M) represents a cost differential (i.e., savings) of about **47%**. In reviewing the components of these costs, the most compelling difference between the ROD estimate and the actual costs relates to the shipping and disposal costs. Specifically, the ROD estimate uses a shipping and disposal rate of about $306/ton, which when escalated to reflect current dollars equates to a rate of about $410/ton. This rate is about double the actual costs for shipping and disposal, which on average was about $200/ton. Applying these rates to the 825,100 in pit material actually shipped and disposed of, results in a difference of approximately $173M. The other item which resulted in a higher estimated cost, was the tonnage assumed for shipment and disposal. Specifically, the ROD assumed that 1,053,300 tons of material from the waste pits would need to be shipped offsite for disposal, rather than the 825,100 actually shipped offsite for disposal.

APPENDIX B – SCHEMATIC OF TREATMENT SYSTEMS

Schematics of the primary treatment systems are depicted.

Figure B-1 – Schematic of General Material/Process Flow

Figure B-2 – Schematic of Wastewater Treatment System

Figure B-3 – Schematic of Off-Gas Cleaning System

Figure B-1 Schematic of General Material/Process Flow

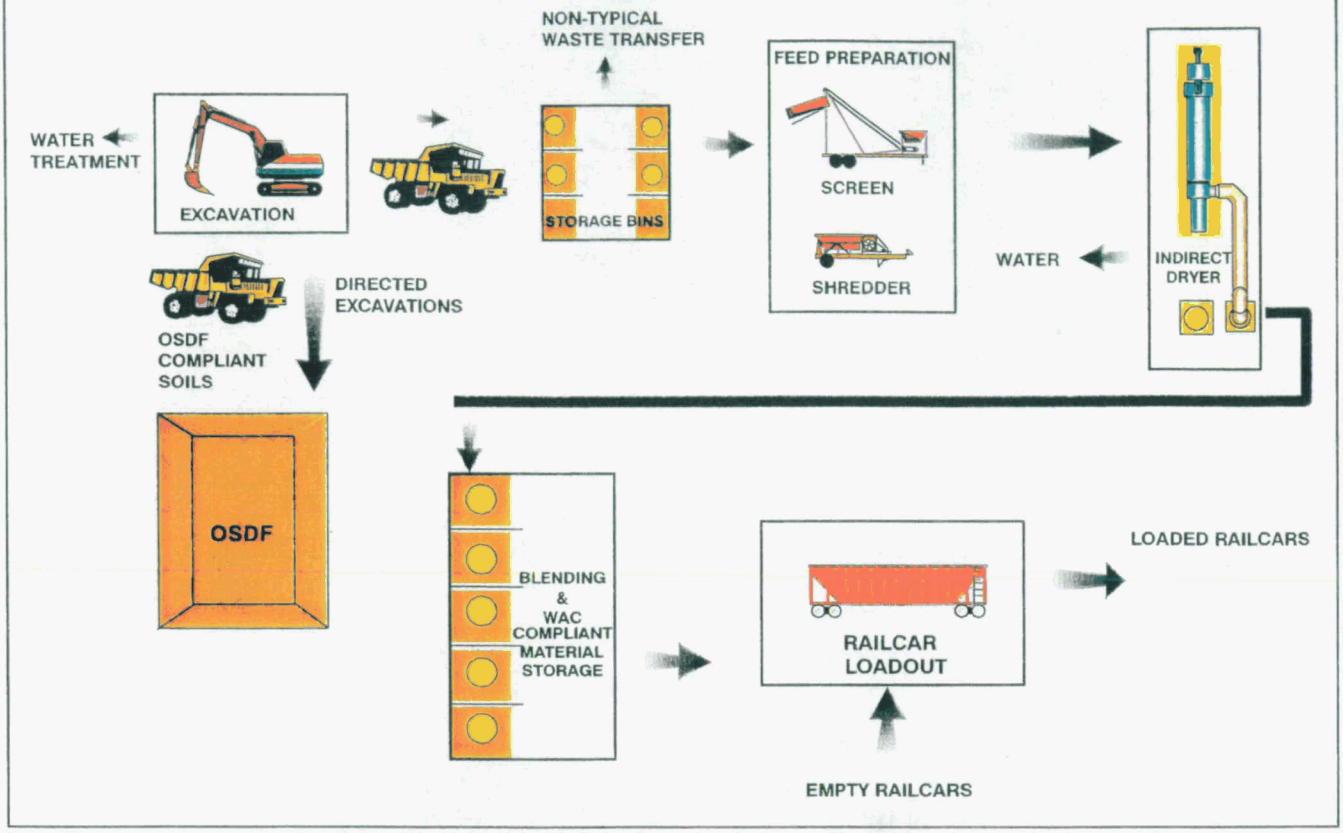


Figure B-2 Schematic of Wastewater Treatment System

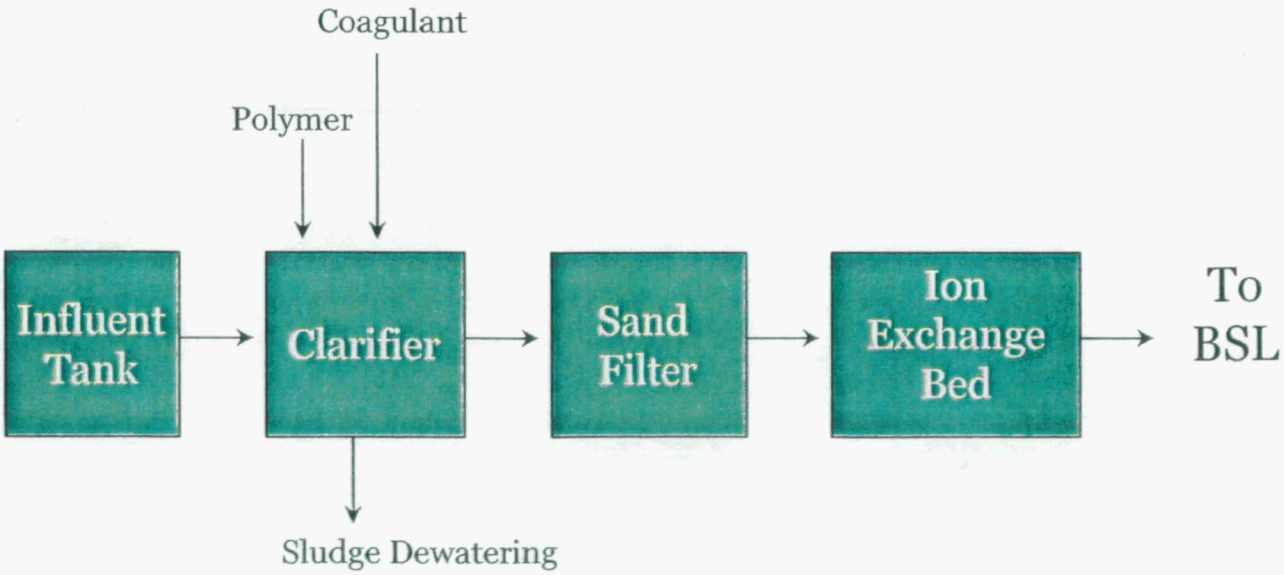
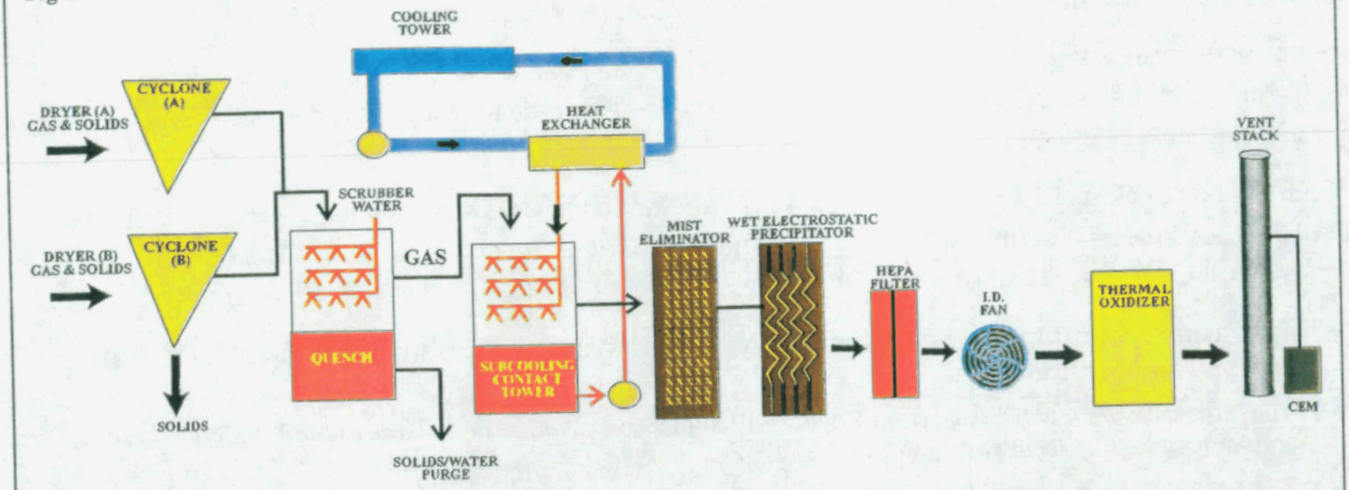


Figure B-3 Schematic of Off-Gas Cleaning System



APPENDIX C – HWMU CLOSURES

The HWMUs located within the boundaries of Operable Unit 1, are Waste Pit 4 and Waste Pit 5.

Waste Pit 4 underwent interim RCRA closure, as certified by Ohio EPA in 1989, with final closure deferred to the CERCLA program. Interim closure activities included covering the waste pit with soil and rocks overlaid with compacted clay and cover with a Hypalon liner.

Final certification of closure for Waste Pit 4 and Waste Pit 5 was completed under the Integrated RCRA/CERCLA Process described in Section V.4 of the June 1996 Integrated RCRA/CERCLA DF&O. The integrated closure process as defined by the DF&O states that:

- The Operable Unit 1 Final Remedial Action Report must state that excavation and disposition of waste pit materials has been completed;
- The Area 6 Waste Pits Certification Report will address excavation and disposition of underlying soils and include results from soil sampling used to demonstrate FRL attainment.
- The Operable Unit 5 Interim Remedial Action Report must provide a closure certification statement that specifies Waste Pit 4 and 5 have been closed and that the associated environmental media managed under the Operable Unit 5 ROD was managed in accordance with the final remedy and in accordance with the Director's closure performance standards.
- Waste Pit 4 and Waste Pit 5 are the only HWMUs located in Operable Unit 1. Excavation of all waste and waste-like material for disposal off-site was completed in October 2004.

Certification language to address final closure, underlying soils and FRL attainment, of Waste Pit 4 and Waste Pit 5 will be provided in the Operable Unit 5 Interim Remedial Action Report.

APPENDIX D – REMOVAL ACTIONS

Under CERCLA, a removal action is defined as a "short-term cleanup often completed prior to a more formal ROD process". As discussed in Section 2.2, there were five removal actions associated with Operable Unit 1 that were conducted as an effort to minimize the release or threat of release of contaminants and to accelerate cleanup activities. These removal actions were incorporated into the Operable Unit 1 ROD and are summarized below:

Removal Action 2 – Waste Pit Area Storm Water Runoff Control Removal Action

Removal Action No. 2 was implemented as a means to manage radioactively contaminated storm water runoff from Operable Unit 1. Waste storage units included in the removal action were the six waste pits, the Burm Pit, and the Clearwell. Runoff from the concrete storage silos in Operable Unit 4 was also included. Implementation of the removal action entailed a site evaluation, work plan preparation, and the execution of the recommended measures. The eight-phase removal action was completed June 15, 1992. The removal action included installing concrete drainage ditches, dikes, and culverts, which, along with existing topographic features at the time, collected the waste pit area storm water runoff. A concrete collection sump was installed south of the Clearwell to collect contaminated storm water runoff and pump it to the BSL for treatment prior to discharge. The storm water runoff from uncontaminated portions of the waste pit area was routed from the perimeter drainage areas to Paddys Run. The removal action provided runoff control and collection until construction for the selected remedy began and storm water runoff was then managed in accordance with the approved Remedial Design Package.

Removal Action 6 – Control of Exposed Material in Pit 6 Removal Action

Removal Action No. 6 was implemented to redistribute the exposed material in Waste Pit 6 such that all the solids were below the water level to reduce particulate emissions to the environment. Field activities for the removal action began on December 17, 1990 and were completed on December 19, 1990. Approximately 125 cubic yards of waste pit material were above the water cover of the 29,000 square-foot Waste Pit 6 surface area. The exposed material was subject to wind erosion and was estimated to be a contributor to the airborne dose received by the maximally exposed off-site individual from all sources of radiation at the FCP. The removal action entailed using a crane with a clamshell attachment to remove the exposed material and redistribute the material to deeper portions of the waste pit. From that point on, the water level in Waste Pit 6 was maintained such that material would not be exposed; thus eliminating a significant source of particulate emissions.

Removal Action 11 – Waste Pit 5 Experimental Treatment Facility (ETF) Removal Action

Removal Action No. 11 involved dismantling the ETF, removing the surrounding soils to prevent any potential spread of contamination beyond the immediate area, and packaging the waste materials generated during the removal action for storage pending disposition. The ETF was built in 1984 to test the feasibility of solar drying sludge material from Waste Pit 5. This facility included a sand and gravel filter bed installed over a plastic liner. Six-foot wooden walls surrounded the filter bed and the structure was covered with a green-house type enclosure. The drying experiment entailed spreading the wet material on the filter bed to facilitate drainage and evaporation; however, in February 1988, high winds removed the plastic roof from the facility and some of the sludge material was deposited on nearby surrounding soil. Field activities for this removal action began in December 1991 and were completed in March 1992. The demolished site was backfilled and capped with clay. Completion of the removal action resulted in elimination of one of the particulate sources in Operable Unit 1.

Removal Action 18 – Control of Exposed Material in Pit 5 Removal Action

Removal Action No. 18 involved dredging the exposed material below the waterline. Waste Pit 5 was removed from service in 1983. From 1983 to 1987, it received only decant water from the general sump, filtrate from the recovery plant, and nonradioactive slurries from the boiler plant and water treatment plant. Solids had built up in the east end of the waste pit to the point that they were exposed causing concern in regard to potential airborne contaminants. The exposed materials were sprayed with water to soften them. Then a dredge was used to move exposed materials to the west end of Waste Pit 5. Field activities began in September 1992 and were completed in December 1992.

Removal Action 22 – Waste Pit Area Containment Improvement Removal Action

Removal Action No. 22 involved improvements to the vegetation cover on Waste Pits 1, 2, and 3; and regrading the ditches along the southside of Pit 4. The south berm was stabilized as part of this removal action also. Each of the areas addressed by this removal action reduced the spread of contamination by wind borne and water borne transport. Field activities for the removal action commence on October 19, 1992 and were completed on July 30, 1993.

APPENDIX E – LEGAL AGREEMENTS

The DOE has conducted operations at the Fernald Site under several legal agreements beginning with the 1986 FFCA. This includes the Consent Agreement and ACA under CERCLA 121, and other agreements such as the Ohio EPA DF&O and Consent Decrees. This appendix, however, describes the legal agreements specific to Operable Unit 1.

Consent Decree – December 1988
The Consent Decree entered in U.S. District Court (Civil Action C-1-86-0217) included two specific prohibitions relative to the control of wastewater and runoff from the waste pit area. Unless specifically approved by Ohio EPA, no sewage or industrial waste was to be placed into Waste Pit No. 5 or the Clearwell (normal storm water runoff was allowed) nor was any water from Waste Pits 4, 5, or 6 (and the Bio-Surge Lagoon system) allowed to be discharged into Paddys Run.

Stipulation and Settlement Agreement Pertaining to the Interim Closure Plan for Waste Pit 4 – December 19, 1988
A closure plan for Waste Pit 4 was submitted by DOE and subsequently approved by Ohio EPA, with conditions. These conditions were appealed by DOE to the State of Ohio Environmental Board of Review (Case No. EBR 311831). The DOE and Ohio EPA entered into settlement discussions relative to this appeal resulting in this settlement agreement. A specific order in the *1996 Ohio Directors Findings and Orders for RCRA/CERCLA Integrated Closure* (Section V.8) stipulated that compliance with the 1996 DF&O would satisfy aforementioned settlement agreement.

Federal Facility Agreement Relative to 40 CFR Subpart Q – November 26, 1991
The overriding purpose of the Federal Facility Compliance Agreement was the control and abatement Radon-222 emissions. The FFCA required that DOE directly measure the Radon-222 flux rate from Waste Pits 1, 2, 3, 4, and 5 as well as the Clearwell and include these measurements in the RI/FS (see Section 2.8 of the RI/FS). The termination of the FFCA is based on the completion of remedial actions for the waste pits and either a mutual agreement between EPA and DOE that the FFA could be terminated or a specific demonstration that the Radon-222 flux was in compliance with NESHAP Subpart Q.

Stipulated Amendment to Consent Decree (SACD) Entered December 2, 1988 and Settlement of Charges in Contempt – January 22, 1993
The SACD established specific amendments to the December 1988 Consent Decree entered into U.S. District Court between DOE and Ohio EPA. The SACD included specific provision relative to Waste Pit 5. It had been acknowledged that Waste Pit 5 had received and stored hazardous waste, and as such, fell under the jurisdiction of Ohio EPA relative to management and closure requirements. While DOE and submitted closure plan information and data for Waste Pit 5, DOE's position that the actions taken relative to Waste Pit 5 would be conducted under their CERCLA obligations under the Amended Consent Agreement. The parties agreed to reserve their rights relative to these positions.

Ohio EPA Director's Findings and Orders for RCRA/CERCLA Integrated Closure – June 6, 1996
These DF&Os were focused on integrating the closure requirements for those waste units that had received and stored hazardous wastes with those remedial activities conducted under CERCLA. As Waste Pit 4 and 5 had been declared Hazardous Waste Management Units based on their receipt and storage of hazardous wastes during past FCP operations, they were subject to closure requirements under the authority of Ohio EPA administering their RCRA program. These DF&Os identified Waste Pits 4 and 5 as inactive units that would be closed under the RCRA/CERCLA integrated process.

APPENDIX F – REFERENCES

Ohio EPA, 2003, Letter, Phillip C. Harris to Glenn Griffiths, "Subject: Closeout of NEC Solvent Investigation – Concurrence, July 14, 2003.

U.S. Department of Energy, 1990, "Waste Pit Six Removal Action Work Plan," DOE, Fernald Field Office, Cincinnati, Ohio.

U.S. Department of Energy, 1991, "Pit 5 Experimental Treatment Facility Removal Action Work Plan," DOE, Fernald Area Office, Cincinnati, Ohio.

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U.S. Department of Energy, 1992b, "Waste Pit 5 Exposed Material Removal Action Work Plan," DOE, Fernald Area Office, Cincinnati, Ohio.

U.S. Department of Energy, 1992c, "Waste Pit Area Containment Improvement Removal Action 22 Work Plan," DOE, Fernald Area Office, Cincinnati, Ohio.

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APPENDIX G – WASTE PIT REMEDIATION PHOTOS

Figure G - 1 Waste Pits Just After the Start of Excavation (circa Fall 1999)

Figure G - 2 Waste Pits Remediation Facility (circa Fall 1999)

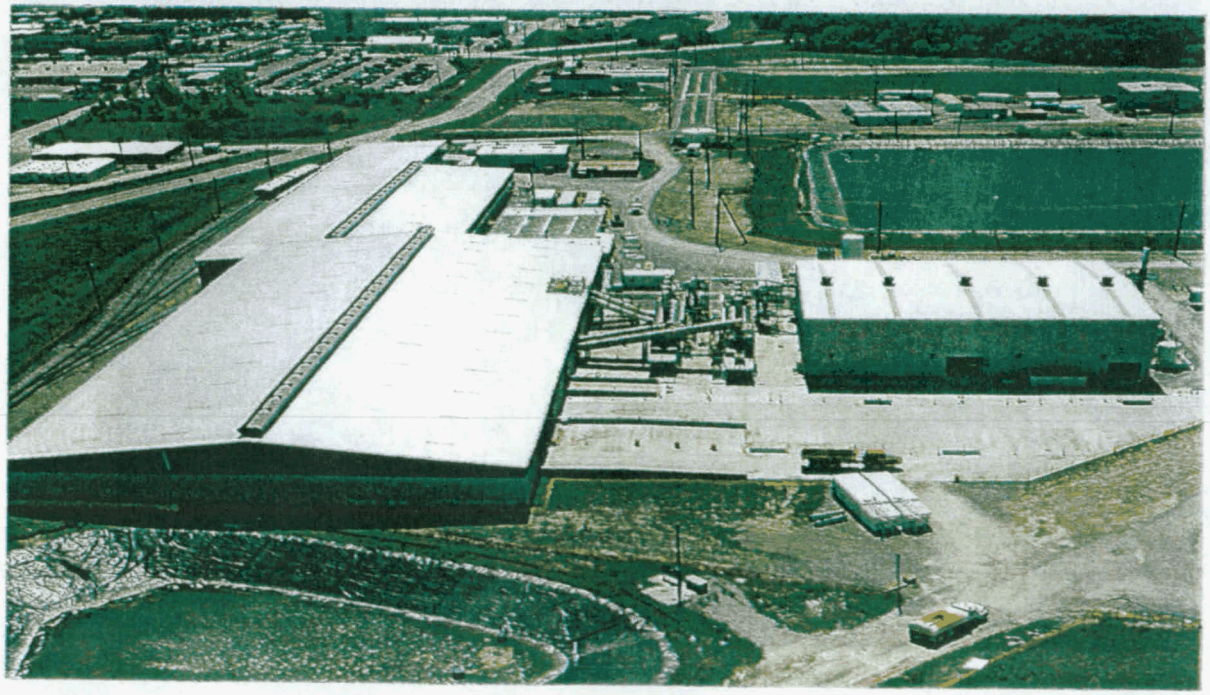

Figure G - 3 Waste Pits Excavation Activities (circa Fall 1999)

Figure G - 4 Waste Pits Excavation Activities (circa Spring 2000)

Figure G - 5 Pit 3 Excavation (circa Spring 2000)

Figure G - 6 Receipt of Waste Material at Material Handling Building (circa Fall 1999)

Figure G - 7 Loadout of Waste Material into Railcars (circa Summer 1999)

Figure G - 8 North Railyard at the FCP (circa Spring 1999)

Figure G - 9 First Unit Trail Leaving the FCP (April 1999)

Figure G - 10 Pit 6 Following Completion of all Waste Pits Excavation Activities (August 2004)

Figure G - 11 Excavated Waste Pits Relative to the Future Legacy Management Multi-Use Educational Facility (MUEF - circa June 2006)

APPENDIX H – LIST OF ACRONYMS

ACA	Amended Consent Agreement
ACM	asbestos containing material
AEC	Atomic Energy Commission
ARAR	applicable or relevant and appropriate requirements
BSL	bio surge lagoon
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CIS	Characterization Investigation Study
D&D	decontamination & dismantlement
DF&O	Director's Findings & Orders
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
EPA	U.S. Environmental Protection Agency
ERDA	U.S. Energy Research & Development Administration
ESD	explanation of significant differences
ETF	engineered treatment facility
FCP	Fernald Closure Project
FEMP	Fernald Environmental Management Project
FERMCO	Fernald Environmental Restoration Management Company
FFCA	Federal Facilities Compliance Agreement
FMPC	Feed Materials Production Center
FRL	final remediation levels
GCS	gas cleaning system
HWMU	Hazardous Waste Management Unit
IEMP	Integrated Environmental Management Plan
LMICP	Legacy Management and Institutional Controls Plan
LSA	low specific activity
MHB	material handling building
mg/l	milligrams/liter

MUEF	Multi-Use Educational Facility
NEC	National Electric Coil
NPL	National Priorities List
Ohio EPA	Ohio Environmental Protection Agency
OSDF	On-site Disposal Facility
OSWER	Office of Solid Waste and Emergency Response (U.S. EPA)
OU1	Operable Unit 1
pCi/g	picocuries/gram
RCRA	Resource Conservation and Recovery Act
RI/FS	Remedial Investigation/Feasibility Study
RLB	railcar loadout building
ROD	Record of Decision
SACD	Stipulated Amendment to Consent Decree
SAP	sampling and analysis plan
SARA	Superfund Amendments and Reauthorization Act
SWM	stormwater management
TCLP	toxicity characteristic leaching procedure
VOC	volatile organic compound
WAC	waste acceptance criteria
WAO	Waste Acceptance Organization
WEMCO	Westinghouse Environmental Management Company of Ohio
WMCO	Westinghouse Materials Company of Ohio
WPRAP	Waste Pits Remedial Action Project
WTS	wastewater treatment system

APPENDIX I – SIGNATURE PAGE

The undersigned agree that the remedial actions as described within this report have been completed.

Johnny W. Reising 8/9/06

Johnny W. Reising, Director
United States Department of Energy
Fernald Closure Project