# *Final Remedial Action Report for Operable Unit 2 – Other Waste Units*

TABLE OF CONTENTS



*20000-RP-0003*

## 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 2 at the U.S. Department of Energy's (DOE's) Fernald Closure Project (FCP) located near Cincinnati, Ohio. It 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 (NPL) 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 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 the Operable Unit 2 Final Remedial Action Report (closeout report).

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 describing the coordination approach across the operable units [DOE 2005], which is described in detail in Section 1.5 of this closeout report. This Operable Unit 2 closeout report has been prepared in accordance with that strategy.

Operable Unit 2 is one of five CERCLA operable units at the FCP and consists of six individual waste disposal sites, termed "the other waste units" in the FCP's regulatory documents: the Active and Inactive Flyash Piles; the South Field waste disposal area; two former Lime Sludge Ponds (north and south); and the FCP's former Solid Waste Landfill. Taken together, the South Field disposal area and the Active and Inactive Flyash Piles are collectively referred to in the FCP's regulatory documents as the "Southern Waste Units" since they all reside in the same geographic area. 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 2

is designed to document the completion of cleanup actions for the wastes contained within the six waste units. Documentation of soil remediation activities within the Operable Unit 2 waste unit boundaries (e.g., beneath and adjacent to the waste materials themselves) will be accomplished as part of a closeout report submitted under Operable Unit 5. In addition, the On-Site Disposal Facility (OSDF), originally a part of the Operable Unit 2 remedy as described in the Operable Unit 2 Record of Decision [DOE 1995b], will be addressed in a closeout report submitted under Operable Unit 5.

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 2 and the remedial actions that were selected in the Operable Unit 2 Record of Decision (ROD). Section 3.0 addresses construction activities associated with the Operable Unit 2 remedial actions, and Section 4.0 provides an annotated chronology of the key events contributing to successful completion and documentation of the Operable Unit 2 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 2 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 Fernald Closure Project (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 feed materials to produce high purity uranium metal. 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, wastes produced from operations 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 EPA to cover environmental impacts associated with the FEMP. 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 Amendment 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. This amended Consent Agreement provided for implementation of the operable unit concept. The FEMP 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, including Operable Unit 2, was included in the amended Consent Agreement.

The Ohio Environmental Protection Agency (Ohio EPA) Office of Federal Facilities Oversight (OFFO) also oversees cleanup activities at the site as a support agency primarily through the December 1988 Consent Decree 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 and Recovery Act (RCRA) enforcement. The June 1996 Director's Final Findings and Orders 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 amended Consent Agreement. 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 "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. The Active and Inactive Flyash Piles, the South Field disposal area, north and south Lime Sludge Ponds, the Solid Waste Landfill, and the berms, liners, and affected soil residing within the operable unit boundary. The Active and Inactive Flyash Piles and South Field area are collectively known as the "Southern Waste Units" because they are collocated in close geographic proximity to one another.
- 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 resides within Operable Unit 5.
- Operable Unit 4: Silos 1 through 4. Contents of Silos 1, 2, and 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 waste unit materials, provided on-site 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. Groundwater restoration for the Great Miami Aquifer is estimated to be complete in 2026, based on modeling projections.

Taken together, the individual RODs for the operable units provide a site-wide 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, the two 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 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 operable 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 (and summarized in Figure 1-1 on the following page):

- Proceed with formal closeout of Operable Unit 1when 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, the two Lime Sludge Ponds, Active and Inactive Flyash Piles, and the South Field 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 soils 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 (estimated completion date in 2026, based on modeling projections). The interim Remedial Action Report under Operable Unit 5 will therefore consist of three independent subsections: soil and sediment remediation, OSDF closeout, and aquifer restoration activities.

**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, Flyash Piles, and South Field area 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 | 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) |

## 2.0 OPERABLE UNIT 2 BACKGROUND

As indicated above, Operable Unit 2 consisted of six waste units:

- The Solid Waste Landfill was reportedly used for the disposal of cafeteria waste, rubbish, and other types of waste from the non-process areas of the site and from on-site construction activities.
- The north and south Lime Sludge Ponds contained waste from the FEMP water treatment plant operations, coal pile storm water runoff, and boiler plant blowdown.
- The Inactive Flyash Pile was used for the disposal of ash from the boiler plant and other non-process wastes and building rubble such as concrete, gravel, asphalt, masonry, and steel rebar.

  The South Field was reportedly used as a burial site for non-process wastes such as flyash, on-site construction/demolition rubble, and soils that may have contained low levels of radioactivity. It was also reportedly used as a historical burial ground for wastes from the site's laboratory. An earthen slope at the southwest border of the South Field was used as a backstop for the security firing range for 35 years. Lead ammunition used during target practice was embedded in this earthen slope. During the remedial excavation of the South Field, uranium product, old drums, and transite were discovered; these findings drove requisite personal protective equipment needs, excavation approaches, and waste handling/disposal practices.
- The Active Flyash Pile was the disposal area for flyash and bottom ash from the boiler plant.

The operational histories of the Lime Sludge Ponds and Active Flyash Piles are well understood, but the operational histories of the Solid Waste Landfill, Inactive Flyash Pile, and South Field are vague and not well documented. The location of each subunit is shown in Figure 2-1.

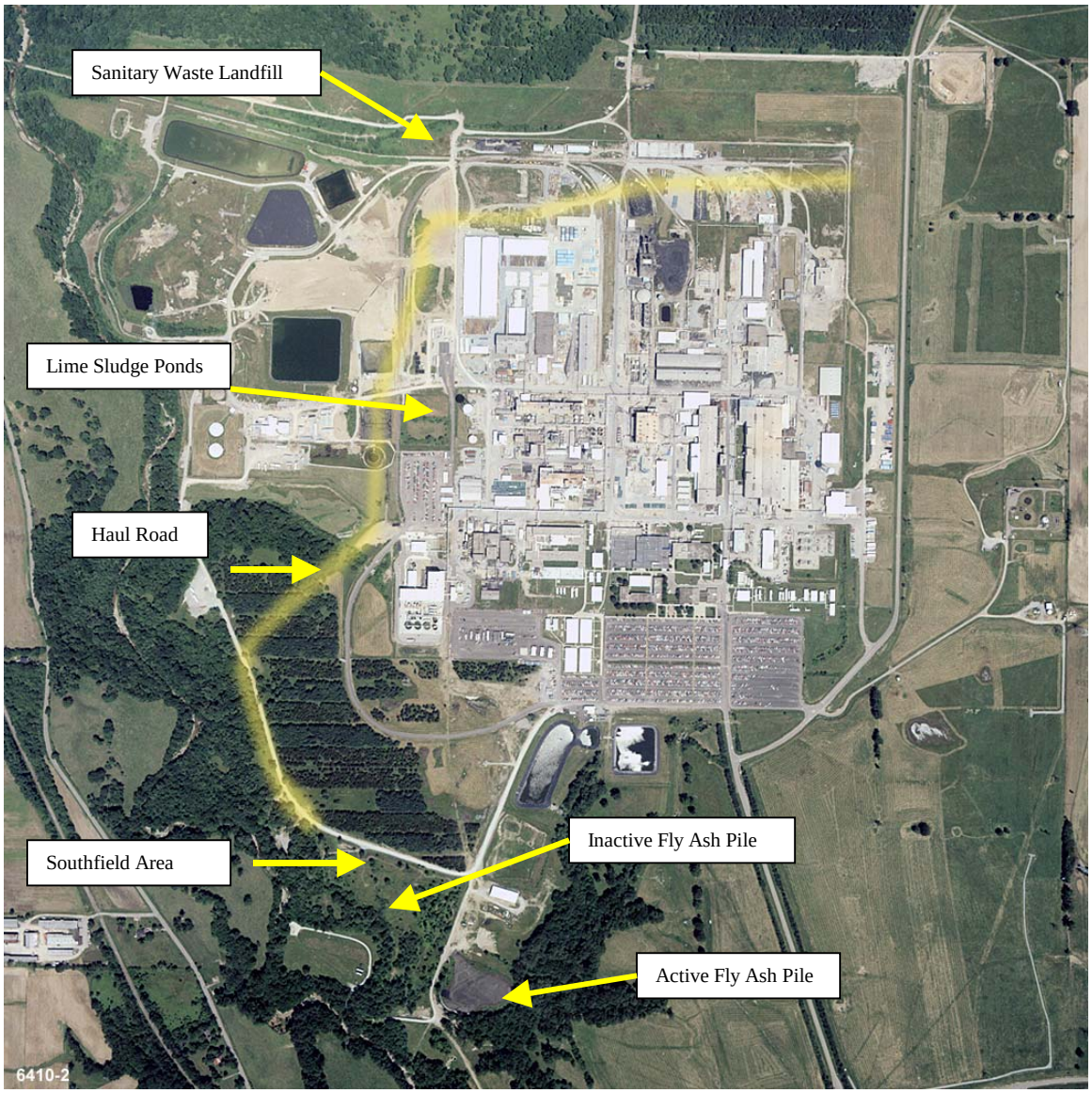
### 2.1 Results of the Operable Unit 2 RI

There were two phases of a CERCLA remedial investigation conducted for Operable Unit 2 [DOE 1995d]. Field investigation activities from 1988 through 1992 are referred to collectively as the Phase I Field Investigation while additional field investigations carried out in 1993 are called the Phase II Field Investigation. Both phases encompassed all affected media (surface water, sediment, surface soil, subsurface soil, and groundwater) and included samples from all six subunits in Operable Unit 2. Findings of these field investigations concluded that the wastes of Operable Unit 2 presented a potentially unacceptable risk to human health and the environment and had to be remediated. The major contaminants of concern for Operable Unit 2 were uranium, thorium, radium, and arsenic.

### 2.2 Removal Actions

In addition to the field investigations conducted under CERCLA, a removal site evaluation (RSE) and several removal actions associated with the Operable Unit 2 subunits were conducted. Under CERCLA, a removal action is defined as a "short term cleanup often completed prior to a more formal ROD process". The RSE was performed to assess lead contamination in the South Field Firing Range and to determine whether the nature and extent of lead contamination warranted a removal action. In January and February of 1992, vertical borings were completed in the western embankment of the South Field. It was determined from the sampling results that a removal action was not necessary for the lead contamination in the South Field Firing Range.

Figure 2-1 Operable Unit 2 – Waste Units and Haul Road (Circa July 1996)



There were four removal actions associated with Operable Unit 2 that were conducted as an effort to minimize or stabilize the release or threat of release of contaminants to public health and/or the environment. The four actions were initiated to accelerate cleanup activities to address releases or the potential for releases of hazardous substances:

- Removal Action No. 8: Inactive Flyash Pile/South Field Disposal Area Control
- Removal Action No. 10: Active Flyash Pile Control
- Removal Action No. 29: Paddys Run Erosion Control
- Removal Action No. 30: South Field and Inactive Flyash Pile Seepage Control.

These removal actions were initiated and completed in the early 1990s. No additional removal activities took place in the areas associated with the Operable Unit 2 subunits until start-up of remediation efforts. Appendix D of this Remedial Action Report provides a summary of these removal actions.

### 2.3 Operable Unit 2 Selected Remedy

As identified in the Operable Unit 2 ROD, key components of the selected remedy for Operable Unit 2 include:

- Construction of the engineered On-Site Disposal Facility (OSDF).
- Excavation of the Operable Unit 2 subunits to the required depth established by the Operable Unit 2 RI and FS Reports to remove materials with contaminant concentrations above the cleanup levels.
- Verification sampling and testing in the excavated area to confirm that material with contaminant concentrations above the cleanup levels have been removed.
- Segregation of debris (e.g., concrete, steel, pallets, etc.) from Operable Unit 2 subunits and processing for size reduction, as necessary, before disposal in the OSDF.
- Collection and treatment of water from the Operable Unit 2 subunits and OSDF construction areas.
- Transportation and on-site disposal of excavated material with a concentration at or below 346 pCi/g of U-238 or 1,030 ppm of total uranium.
- Transportation and off-site disposal of approximately 3,100 cubic yards of excavated material with concentrations above 346 pCi/g U-238 or 1,030 ppm total uranium.
- Excavation, treatment, and off-site disposal of approximately 300 cubic yards of lead-containing soil from the South Field Firing Range (handled as mixed waste).
- Restoration (including grading, seeding, fencing, and installation of monitoring wells) of Operable Unit 2 subunits after excavation and verification sampling and testing.
- Implementation of institutional controls such as access restrictions (fencing) and groundwater monitoring at the Operable Unit 2 subunits and OSDF.
- Maintenance of Operable Unit 2 subunits after restoration and maintenance and monitoring of the OSDF for at least 30 years following closure of the OSDF.

Readers should note that the Operable Unit 2 ROD preceded the ROD decisions for Operable Units 5 and 3 by nearly a year. As a result, the costs, waste volumes, size, and configuration of the OSDF represented in the Operable Unit 2 ROD are specific to Operable Unit 2 materials only, since the on-site disposal decisions for Operable Units 5 and 3 had not yet been formally made. Ultimately, however, once the Operable Units 5 and 3 on-site disposal decisions were finalized, the OSDF was sized and designed to accommodate all three operable units resulting in a greater economy of scale and a combined sitewide design, siting, and implementation approach.

Ultimately, once the remedial actions across the operable units were poised for implementation in the field, the Operable Unit 2 work scope was combined with the soils remediation work scope from Operable Unit 5 and the at- and below-grade debris removal work scope from Operable Unit 3 and executed accordingly under combined design packages and governing implementation plans. This issue and the combined approach and resultant economies of scale are also highlighted in Section 8.0, where the remedial costs for Operable Unit 2 are evaluated against the original Operable Unit 2 Feasibility Study estimate [DOE 1995a].

### 2.4 Operable Unit 2 Post-ROD Decision Changes

There were two changes to the Operable Unit 2 ROD after approval in May 1995. CERCLA requires that changes to approved RODs be done through a formal amendment for fundamental changes, an Explanation of Significant Differences for other significant changes, or a Fact Sheet for minor modifications. The two post-ROD decision changes were both considered minor and were documented through Fact Sheets.

- Fact Sheet to allow the disposal of the lead contaminated soil from the firing range in the OSDF after successful treatment [DOE 1999b].
- Fact Sheet to address the OSDF under Operable Unit 5 as well as documenting the clean up of soils underlying the Operable Unit 2 waste units through Operable Unit 5 [DOE 2005] (see Section 1.5). These changes did not result in any changes to clean-up levels, design or operational requirements or remedial action schedules. These changes were initiated to simply better align the original Operable Unit 2 remedial actions with those actions approved in the Operable Unit 5 ROD.

### 2.5 Remedial Design Summary

The Operable Unit 2 remedy as identified in the Operable Unit 2 ROD includes excavation of all waste materials for processing of materials for size reduction and moisture control (if required) and on-site disposal of the bulk of the material in the OSDF, and off-site disposal of a small fraction of the excavated material that exceeds the maximum WAC of the OSDF. Three distinct remedial design phases were identified to implement these Operable Unit 2 remedial actions.

- Design of the Waste Haul Road. This haul road was designed and used to transport excavated materials from the Operable Unit 2 waste units to the OSDF (see Figure 2-1). This design also involved the relocation of the existing North Access Road.
- Design of the OSDF. While the OSDF has now been administratively moved to Operable Unit 5, the design of this facility was a significant activity under Operable Unit 2. In addition, two documents were developed and approved by EPA and Ohio EPA to control the placement of waste materials into the OSDF: The Waste Acceptance Criteria Attainment Plan for the On-Site Disposal Facility [DOE 1998d] and the Impacted Materials Placement Plan for the On-Site Disposal Facility [DOE 1998b]. These two documents had a direct bearing on the excavation of the Operable Unit 2 waste units.
- Design of the excavation of the waste units in accordance with the Site-wide Excavation Plan [DOE 1998c]. The waste units would need to be excavated to required depths established by RI/FS and necessary sampling and size reduction of any debris to meet established OSDF WAC. The general approach implemented to accomplish the excavation of waste materials and necessary contaminated soils was described in the Site-wide Excavation Plan. (The Site-wide Excavation Plan is an Operable Unit 5 remedial design document). Individual designs for the excavations were submitted to and approved by EPA and Ohio EPA in the form of Integrated Remedial Design Packages.

## 3.0 CONSTRUCTION ACTIVITIES

Construction activities relative to the scope of the Operable Unit 2 waste units involved several distinct efforts. The initial effort involved the construction of the waste haul road, the purpose of which was to provide a safe method of transporting waste materials from the southern waste unit area to the OSDF. (The haul road would also serve other remedial activities at the site as part of the integrated remediation approach. The haul road project included the construction of the re-routed north access road that provided access to the site from the north around the footprint of the OSDF. This re-routed north access road portion of the project is not further discussed.)

In order to proceed with the excavation of the individual waste units several foundational documents had to be prepared that would define how the excavations would be conducted, how the excavations would be sequenced, and where and how the excavated waste material would be dispositioned.

It was recognized that a site-wide sequencing plan and technical guidance document was needed to guide the excavation of soils and waste units through out the site to ensure remediation area specific conditions were addressed as well as integrating the numerous excavations into comprehensive site-wide approach. The Site-wide Excavation Plan was developed to serve this purpose. The Site-wide Excavation Plan was an Operable Unit 5 Remedial Design Deliverable. It outlined the general steps of each remediation project and provided a remediation document hierarchy. The Site-wide Excavation Plan included remediation drivers, restoration goals, health and safety requirements, environmental controls and monitoring requirements, impacted material management programs and manifesting, and record keeping and data management requirements. The Site-wide Excavation Plan also described representative area specific conditions expected to be encountered based on depth and extent of contamination and types of contamination and included methods and protocols for these conditions.

While it was assumed in the Operable Unit 2 remedy that much of the waste material excavated would be eligible for disposition in the OSDF, specific waste acceptance criteria and waste placement methods had to be developed to ensure the OSDF was constructed to meet the required design criteria and be protective of human health and the environment.

The Impacted Materials Placement Plan was written primarily to address the physical acceptance criteria of waste received and define the placement, compaction, and Quality Assurance/Quality Control activities undertaken throughout the construction, filling, and closure of the OSDF.

The Waste Acceptance Criteria Attainment Plan (WAC Plan) was prepared to compliment the Impacted Material Placement Plan by describing the material management approaches for demonstrating attainment of radiological, chemical, and physical acceptance criteria for all materials destined for placement in the OSDF. The radiological and chemical attainment criteria for soil and soil-like material were established in the Operable Unit 5 ROD.

With these documents in place, it was then possible to develop the individual designs based on the characteristics of the waste material in each of the Operable Unit 2 waste units. These designs, Integrated Remedial Design Packages, were developed based on area specific contaminants of concern, potential technetium-99 contamination (a specific OSDF WAC concern), RCRA, and above WAC considerations determined through pre-excavation surveys and sampling as well as a data review of the remedial investigation or other data sources.

In general, in the vernacular of the WAC plan, the waste in the Operable Unit 2 waste units was classified as debris, soil, and soil like material. The Waste Unit excavations follow a logic flow presented as Approach B in the Site-wide Excavation Plan. This flow diagram is presented in Figure 3-1. Major construction activities for each of the major projects are described below, along with an identification of the volumes of materials excavated

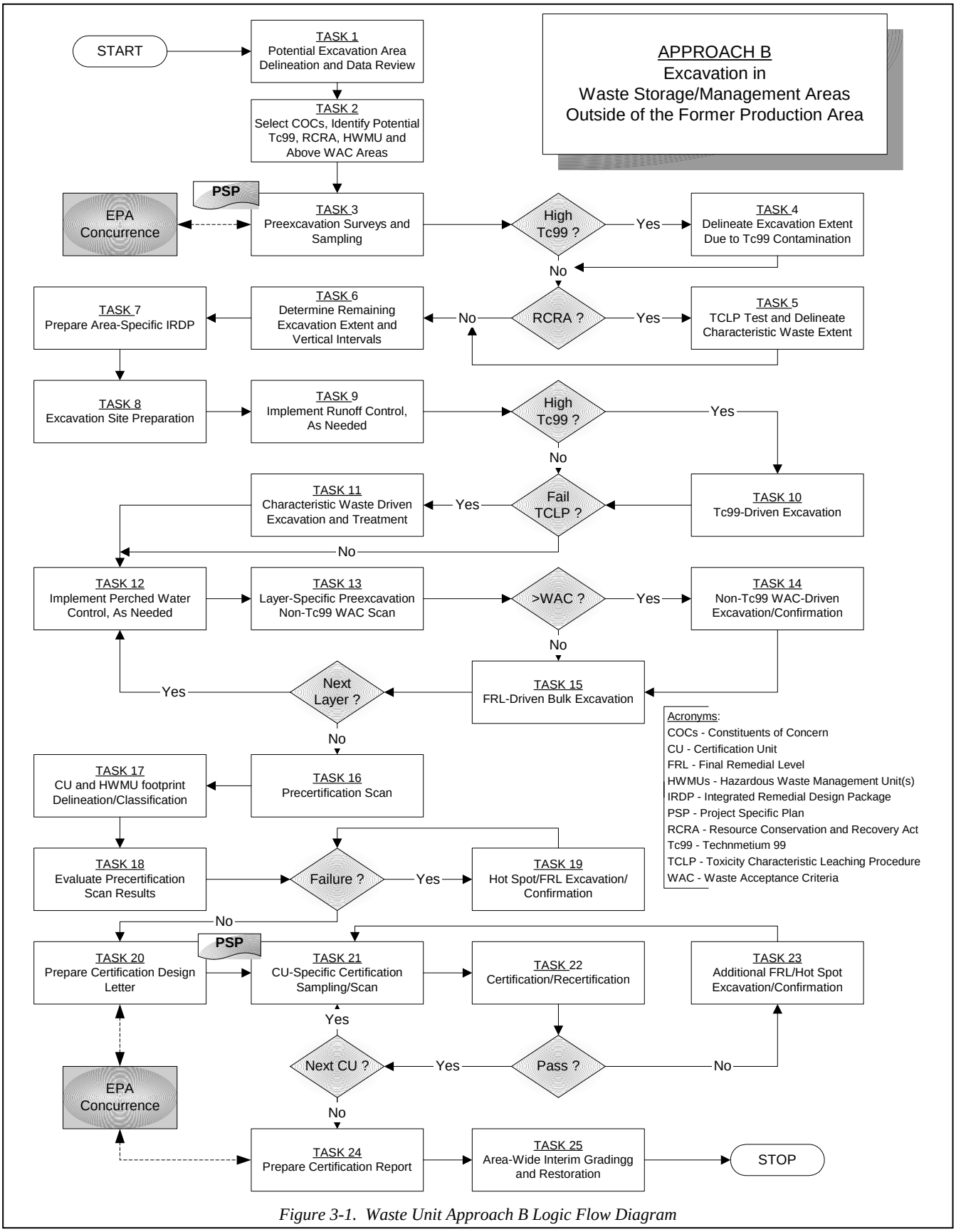



*Figure 3-1. Waste Unit Approach B Logic Flow Diagram*

and disposed during the remediation activities. For reference, at the time of the RI/FS efforts Operable Unit 2 was estimated to have about 348,600 in-place (i.e., banked) cubic yards of waste material requiring remediation, in the following categories (ash –108,600 cubic yards; solid waste – 15,220 cubic yards; lime sludge – 16,500 cubic yards; buried wastes, residues, debris, and soils – 208,280 cubic yards). The estimated numbers track reasonably well to the actual numbers described below.

### 3.1 Waste Haul Road Construction

The design of the waste haul road was Phase 1 of the remedial design strategy for Operable Unit 2 as described in the Remedial Design Work Plan for Remedial Actions at Operable Unit 2 [DOE 1995c]. The Remedial Action Work Plan for the Haul Road and Rerouted North Entrance Road [DOE 1996b] was prepared to define the implementation strategy for constructing these roads. The design package for the Haul Road and Rerouted North Entrance Road was approved by the EPA's in 1996 and contained the specific construction activities that would be undertaken. The following activities were implemented:

- Establish erosion and sediment controls
- Removing/relocating vegetation
- Removing/relocating utilities (telephone, fiber-optic, water/sewer lines, electric)
- Installing traffic controls
- Preparing the subgrade
- Paving the roadways with asphalt.

The site preparation of the haul road was integral with the overall site preparation of the Area 2 Phase 1 excavation project. Kelchner Environmental performed site preparation activities while Barret Paving performed the actual road construction. Spoil materials were primarily stockpiled within the Area 2 Phase 1 boundaries and were dispositioned to the OSDF during the excavation activities conducted within Area 2 Phase 1.

Environmental controls during construction included strategically located silt fencing and the application of water for fugitive dust control. Storm water runoff from the haul road areas was not monitored specifically. However, the path of the haul road went through uncontrolled drainage basins monitored under the site National Pollutant Discharge Elimination System (NPDES) Permit at locations 4003 and 4004. Location 4004A was added as an NPDES monitored point because of the haul road construction and operation.

Two wheel wash facilities were constructed near the southern end of the haul road as well as near its termination at the OSDF. These facilities were used to mitigate the migration of contaminated material on the haul road and were a critical part in ensuring fugitive dust did not become a concern. Wash water from these facilities was treated at the Advanced Wastewater Treatment (AWWT) facility (see Appendix B; Figure B-2).

### 3.2 Southern Waste Unit Excavations

The excavation of the Active Flyash Pile, Inactive Flyash Pile, and South Field area was accomplished under the Area 2 Phase 1 (A2P1) Southern Waste Units Implementation Plan for Operable Unit 2 [DOE 1998a]. These waste units are summarized below:

- Active Flyash Pile: The Active Flyash Pile was a steep-sided pile of flyash and bottom ash from the coal-fired boiler plant that had been built-up since the mid-1960's. This pile covered an area of approximately 2.2 acres.

- Inactive Flyash Pile: Beginning in 1951, the Inactive Flyash Pile received flyash and bottom ash from the coal-fired boiler plant. It also was used to dispose of building rubble. Up until 1990, certain drill cuttings from soil borings were placed in the pile. While there was not a clear boundary between this pile and the South Field area, it was estimated that the Inactive Flyash Pile covered an area of approximately 3.4 acres.
- South Field Area. The South Field area was used on an as-needed basis for disposing of construction rubble and soil excavated from the former production area. Field investigations indicated that process waste may have also been disposed in the South Field area. A firing range used by the site security force was located in the South Field area, resulting in a portion of this area being contaminated with lead at concentrations above RCRA characteristic toxicity levels. The South Field area covered an area of approximately 10 acres.

The actual remediation of the area was divided into two separate construction activities. The A2P1 Site Preparation [DOE 1997] project prepared the area for the eventual waste excavation. This involved establishing site boundaries and support areas, providing the necessary utility hook-ups, necessary clearing and grubbing of vegetation and the installation of the surface water management system including diversion and collection ditches and three storm water collection basins used to collect contaminated runoff from the excavations and transfer this contaminated runoff to the AWWT for treatment. Spoils from these site preparation activities were stockpiled within the A2P1 project boundaries for eventual disposition. Site preparation activities began in August 1997 and ended in May 1998. Kelchner Environmental performed the site preparation activities.

Actual excavation activities began in July 1998 and ended in December 2001. Petro Environmental performed the excavation activities in 1998, 1999, and 2000. IT Corporation performed the remaining excavations in 2001. The excavation phase involved the removal and disposition to the OSDF of all material that was placed in these waste units. Material that did not meet the chemical or radiological WAC for the OSDF was segregated and shipped off-site to a permitted commercial disposal facility. Material that did not meet the physical WAC for placement in the OSDF was processed (e.g., size reduced) to meet the necessary WAC. The Waste Unit excavations followed the logic flow presented as Approach B in the Site-wide Excavation Plan (Figure 3-1 of this report).

The firing range had significant lead contamination due to the deposition of lead fragments into the side of a hill adjacent to the Southern Waste Units. Approximately 45 cubic yards of lead contaminated soils were found to exceed the RCRA toxicity level, prohibiting disposition into the OSDF. However, a treatment process was proposed that would bind the lead and meet the Toxicity Characteristic Leaching Procedure for lead. Sevenson Environmental Services was contracted to provide stabilization of these soils using their MAECTITE process to stabilize these soils *insitu*. Samples collected after stabilization demonstrated the soils met the TCLP standard of 5 mg/L for lead and, in so doing, the soils could be disposed to the OSDF [Letter DOE-1071-99, August 1999].

Environmental controls in place during excavation included the aforementioned storm water collection basins (a diagram of this system is included in Appendix B, Figure B-1), fugitive dust control activities (including the control of dust during excavation, during the loading of material into the dump trucks used to transfer material to the OSDF, during the actual transfer by using dust screens over the loaded material, speed restriction of the trucks, and the installed wheel wash facilities) and the continual monitoring and cleaning of the haul road, as well as dust control during placement in the OSDF. Environmental monitoring during excavation activities included fugitive emission, airborne radiological, radon, and direct radiation.

The following table indicates the quantities of material excavated from the Southern Waste Units and disposed of in the OSDF and the amount of material not meeting OSDF chemical/radiological WAC and the respective disposition pathway(s).

**Table 3-1**

| Material Source | Quantity of Material Disposed at OSDF (banked cubic yards) | Quantity of Material Disposed at Permitted Commercial Disposal Facility (above WAC material) (banked cubic yards)* |
|---|---|---|
| Active Flyash Pile | 87,224 | 53 |
| Inactive Flyash Pile | 123,880 | 6,531 |
| South Field Area | 185,335 | 123 |

*Above WAC material was shipped to Envirocare via the Operable Unit 1 Waste Pits Remedial Action Project with the exception of approximately 210 banked cubic yards that was sent to the Nevada Test Site (NTS). The waste shipped to NTS is from the Southern Waste Units as a whole and no attempt to differentiate the amount from the individual waste units is made.

### 3.2 Lime Sludge Ponds Excavation

The Lime Sludge Ponds excavation to address the north and south ponds was performed under the Area 3 Lime Sludge Ponds Implementation Plan [DOE 1999a]. This plan was approved as a draft by the regulatory agencies. Excavation of the ponds began in October 2001 and ended in October 2002. Excavation was performed by IT Corporation in 2001 and was self-performed by Fluor Fernald, Inc. in 2002. The underlying soils certification will be performed under Operable Unit 5.

The excavation approach was based on the expectation that above WAC material and debris such as pipe and concrete would not be encountered. However, visual inspection and radiological surveys were conducted continuously to ensure special materials and above WAC material was not encountered. Excavated lime sludge was mixed with other excavated soils, as necessary and practical, to reduce the moisture content and improve the placement aspects of the material.

Excavation was performed to include low points within the excavation that would serve as collection points for storm water runoff. Collected storm water and groundwater was pumped to the storm sewer system within the former production area for treatment at AWWT. Fugitive dust control was implemented at the excavation and during the hauling of the waste material to the OSDF.

The following table indicates the quantities, by category, of material excavated from the Lime Sludge Ponds and disposed of in the OSDF and the amount of material not meeting OSDF chemical/radiological WAC and the respective disposition pathway(s).

**Table 3-2**

| Material Source | Quantity of Material Disposed at OSDF (banked cubic yards) | Quantity of Material Disposed at Permitted Commercial Disposal Facility (above WAC material) (banked cubic yards) |
|---|---|---|
| Lime Sludge Ponds | 32,094 | 0 |

### 3.3 Solid Waste Landfill Excavation

The Solid Waste Landfill was excavated under the Implementation Plan for Area 6 Solid Waste Landfill and Fire Training Facility [DOE 2003a]. The Solid Waste Landfill was located in the northeast corner of the waste storage area and covered an area of approximately one acre. From 1974 until 1986 the Solid Waste Landfill was used for the disposition of non-burnable trash, cafeteria waste, medical waste, construction-related rubble, and double bagged and bulk quantities of non-radioactive asbestos.

The excavation of the Solid Waste Landfill was self performed by Fluor Fernald, Inc. and began in October 2003. Excavation of the waste material ended in November 2003. The underlying soils certification will be performed under Operable Unit 5. Prior to excavation of the Solid Waste Landfill, site preparation activities were conducted to establish site boundaries, installation of support facilities, establishing haul routes to the OSDF, and installation of necessary erosion and sediment controls.

It was anticipated that a high percentage of the material excavated from the Solid Waste Landfill would be debris consisting of refuse, rather than concrete and metal (based on a 1992 trenching investigation which uncovered a wide variety of waste materials). The general excavation approach used involved performing the excavations in three-foot lifts to allow the necessary visual observations and real-time monitoring to explore potential above-WAC materials or prohibited items.

Surface water collected during excavation was managed through the site AWWT. Because of the potential VOC contamination in the Solid Waste Landfill area, the collected water was sampled and analyzed for VOCs. If any specific VOC was above a threshold of 50 µg/L, the water was discharged to the AWWT Phase 2, where activated carbon adsorption was performed. Otherwise, collected storm water was discharged to the existing storm sewer (via portable pump) located within the former production area. Fugitive dust controls implemented included the application of dust control water at the excavation and along the haul routes and speed restrictions of the dump trucks used to convey waste material to the OSDF. Other environmental monitoring included airborne particulate, radon, and direct radiation.

The following table indicates the quantities of material excavated from the Solid Waste Landfill and disposed of in the OSDF and the amount of material not meeting OSDF chemical/radiological WAC and the respective disposition pathway(s).

**Table 3-3**

| Material Source | Quantity of Material Disposed at OSDF (banked cubic yards) | Quantity of Material Disposed at Permitted Commercial Disposal Facility (above WAC material) (banked cubic yards) |
|---|---|---|
| Solid Waste Landfill | 41,325 | 1,729* |

*All above WAC material was shipped to Envirocare via the Operable Unit 1 Waste Pits Remedial Action Project

## 4.0 CHRONOLOGY OF EVENTS

The following table provides a summary of the events for Operable Unit 2 remediation, and associated dates of those events, starting with planning and execution of the associated removal actions.

**Table 4-1 Summary of Events for Operable Unit 2 Remediation**

| Event | Date |
|---|---|
| **Operable Unit 2 Decision Related Documents** | |
| Approval of Operable Unit 2 Record of Decision | June 1995 |
| Approval of Operable Unit 5 Record of Decision | January 1996 |
| Fact Sheet related to Firing Range | July 1999 |
| Fact Sheet Related to Minor Record of Decision Changes | October 2004 |
| **Operable Unit 2 Related Umbrella Documents** | |
| Impacted Materials Placement Plan for the On-Site Disposal Facility | January 1998 |
| Waste Acceptance Criteria Attainment Plan for the On-Site Disposal Facility | June 1998 |
| Sitewide Excavation Plan | July 1998 |
| **Operable Unit 2 Remedial Design Documents** | |
| Remedial Design Work Plan for Remedial Actions at Operable Unit 2 | December 1995 |
| Haul Road Remedial Design Work Plan | August 1996 |
| Area 2 Phase 1 Southern Waste Units Implementation Plan for Operable Unit 2 | July 1998 |
| Implementation Plan for Area 3 Lime Sludge Ponds (Draft) | April 1999 |
| Implementation Plan for Area 6 Solid Waste Landfill and Fire Training Facility | September 2003 |
| **Operable Unit 2 Remedial Action Documents** | |
| Remedial Action Work Plan for the Haul Road and Rerouted North Entrance Road | August 1996 |
| Remedial Action Work Plan for Remedial Actions at Operable Unit 2 | March 1997 |
| **Remedial Action Field Activities** | |
| Haul Road Construction Start | August 1997 |
| Haul Road Construction End | May 1998 |
| Area 2 Phase 1 Site Preparation Construction Start | June 1997 |
| Area 2 Phase 1 Site Preparation Construction End | May 1998 |
| Southern Waste Units Excavation (South Field, Inactive/Active Flyash Piles) Start | July 1998 |
| Southern Waste Units Excavation (South Field, Inactive/Active Flyash Piles) End | September 2002 |
| Lime Sludge Ponds Excavation Start | October 2001 |
| Lime Sludge Ponds Excavation End | October 2002 |
| Solid Waste Landfill Excavation Start | October 2003 |
| Solid Waste Landfill Excavation End | November 2003 |

## 5.0 PERFORMANCE STANDARDS AND CONSTRUCTION QUALITY CONTROL

The quality assurance and quality control programs necessary to ensure construction and excavation activities were conducted in a manner to meet project goals and associated environmental monitoring data were of the necessary quality to be used for the intended objectives are defined in Appendix E "SEP Quality Assurance Job Specific Plan (QAJSP)" of the Site-wide Excavation Plan. The QA/QC program described in Appendix E is derived from FCP Quality Assurance Program Description (RM-0012) and the Site-wide CERCLA Quality Assurance Project Plan (SCQ; FD-1000) [DOE 2003b]. Additional considerations in the derivation of this QA/QC program included requirements relative to 10 CFR 830.120 "Quality Assurance Requirements;" DOE Order 5700.6C "Quality Assurance;" ANSI/ASQC E4 "Specifications and Guidelines for Quality Systems for Environmental Data Collection and Environmental Technology Programs;" and ASME NQA-1, "Quality Assurance requirements for Nuclear Facilities." With the necessary programs in place, the QAJSP describes the necessary QA assessments to verify quality performance.

The QAJSP covers all remediation excavation activities carried out by Fluor Fernald employees and subcontractors. Key activities covered under the QAJSP include radiological surveys, field measurements, sampling and analysis during pre-excavation activities, preparation of data quality objectives and project specific plans, engineering controls of the remedial design, preparation of the Integrated Remedial Design Packages, soil excavations and segregation, and WAC attainment at the OSDF.

The QAJSP defines work processes for all sampling and analysis, document preparation, computer hardware, software, and database management (e.g., Site-wide Environmental Data Base and Integrated Information Management System). It defines objectives for design document preparation, design change control, and procurement requirements. It also defines requirements for construction quality control and inspection and acceptance testing for installed systems and earthwork as well as QC performance specifications for the *insitu* gamma technology (Sodium-Iodide and High Purity Germanium detector systems).

In 1997, the FCP formed an independent oversight organization known as the Waste Acceptance Organization (WAO) that was responsible for observing all excavations and all placements of waste in the OSDF, including the excavations associated with the removal of the Operable Unit 2 materials. During the Operable Unit 2 field activity, WAO was charged with implementing the manifesting system used to track material from excavation to disposal, making field calls on material engineering categories and size restrictions for OSDF placement, and for providing oversight and support in identifying and removing OSDF-prohibited items from the excavated wastes at the excavation sites and, as a second independent check, at the point of placement in the OSDF. WAO also identified the off-site disposition pathway and handling requirements for shipping OSDF prohibited items and above-WAC materials to the respective off-site disposal facilities. WAO also produced daily records of material quantities removed and placed, and oversaw the administrative management of the FCP's interim soil and debris stockpiles and material transfer locations. Finally, since the completion of the removal of the Operable Unit 2 wastes was verified both by engineering survey data as well as visual observation of the materials remaining at the excavation sites, WAO served as the primary observing entity to ensure that visual completion obligations were satisfied. WAO continues to perform such functions for the remaining soil excavation activities for Operable Unit 2 that will be completed and reported in a closeout report submitted under Operable Unit 5.

## 6.0 FINAL INSPECTIONS AND CERTIFICATIONS

The scope of this Operable Unit 2 Final Remedial Action Report involves the demonstration that the waste material in each of the six waste units described in the Operable Unit 2 ROD have been removed and dispositioned.

The Southern Waste Units, comprised of the Active Flyash Pile, Inactive Flyash Pile and South Field area have been completely excavated. Moreover, the underlying soils have been certified to meet the required Final Remediation Levels (FRLs) established in the Operable Unit 2 and Operable Unit 5 RODs providing the assurance that the waste units have been completely removed. Soil certification activities are generally an Operable Unit 5 activity but due to the progress of remediation the Certification Report for the Active Flyash Pile [DOE 2001] and the Certification Report for the Area 2, Phase 1 Former Inactive Flyash Pile, South Field, Carolina Area, East-West Construction Road and Equipment Wheel Wash Perimeter [DOE 2002] provides the requisite documentation that the Southern Waste Units have been removed. As EPA has approved this certification report, no additional remedial actions are required for the Southern Waste Units and the entire area has undergone its final restoration.

The underlying soils for the Lime Sludge Ponds and Solid Waste Landfill have not yet been certified to meet FRLs to date; they will be certified as a part of the Area 3 and Area 6 Operable Unit 5 soil certification activities and reported in the Operable Unit 5 closeout report (soil section).

The implementation plan for the Lime Sludge Ponds established the excavation boundaries based on the 1952 design drawings. The depth of the lime sludge was confirmed through the Characterization Investigation Study and Remedial Investigation/Feasibility Study borings. The excavation proceeded based on these limits until the design contours were reached. Confirmation that all waste material was removed was accomplished through radiological surveys and visual inspections.

The implementation plan for the Solid Waste Landfill established the boundaries of the excavation through physical sampling that identified above-WAC and above-FRL locations. Constructability and safe slope configurations were established to effectively excavate the area. The excavation contours were established by comparing the depth of the sample results from soil boring with the design depth of the Solid Waste Landfill. Excavation contours were extended downward if the above FRL sample result depth was deeper than the design depth the contours were extended downward. The excavation proceeded based on these limits until the design contours were reached. Confirmation that all waste material was removed was accomplished through radiological surveys and visual inspections.

## 7.0 OPERATION AND MAINTENANCE ACTIVITIES

As an excavation and disposal remedy, there are no post-remedy operational issues or requirements for the six waste units remediated under the scope of Operable Unit 2. Maintenance activities for these waste units are generally related to controlling access to prevent re-contamination and ensuring these areas are restored in accordance with the Natural Resource Restoration Plan.

Restoration activities in the southern waste unit area have been completed. Routine evaluations of the area are conducted to ensure the planted vegetation survives at an acceptable rate.

Because certification activities for the underlying soils of the Lime Sludge Ponds and Solid Waste Landfill have yet to be initiated, maintenance activities of these excavation footprints are related to establishing the necessary boundary control. Once certification activities commence, these areas will be protected to ensure recontamination does not occur. Restoration of the Lime Sludge Ponds will eventually involve establishing a pond within the excavation footprint. Restoration of the Solid Waste Landfill excavation footprint will involve the grading of the surrounding area. Depending on the grading necessary, the Solid Waste Landfill area may be an open-water body or wetland.

Clean rubblized concrete from portions of the Operable Unit 4 remediation facilities and clean railroad ballast from the Operable Unit 1 Rail Yard has been used to provide erosion control and the enhancement of aquatic habitats within Operable Unit 2. The rubblized concrete has been placed in the eroded areas of the Southern Waste Units to both stabilize the areas and create habitat for the endangered Cave Salamander and other amphibians and reptiles. A small portion of the railroad ballast has been placed in the excavation foot-print of the Solid Waste Landfill to facilitate the conversion of this relatively deep excavation to a wetland.

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. The Operable Unit 2 ROD did envision fencing of the Operable Unit 2 waste units as a possible institutional control. However, as the Legacy Management and Institutional Controls Plan (LMICP) [DOE 2006] was developed it was decided that fencing the remediated waste units would not be necessary as the waste units were considered within the context of the entire site and the institutional controls being applied throughout. The institutional controls outlined in the LMICP are intended to replace the need for waste unit fencing as suggested in the Operable Unit 2 ROD. All the legacy management and institutional control requirements and initiatives for the FCP are defined in the LMICP. Since the LMICP is applicable to the FCP as a whole, there are no specific institutional controls related to Operable Unit 2.

## 8.0 SUMMARY OF PROJECT COSTS

The May 1995 Operable Unit 2 ROD identifies the remedial actions selected for Operable Unit 2. The final remedial alternative selected in the ROD was *Alternative 6 – Excavation and On-Site Disposal with Off-Site Disposal of the Fraction Exceeding Waste Acceptance Criteria.* 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 2 FS report.

This section of the remedial action closeout report compares the original estimated costs for the Operable Unit 2 remedy from the May 1995 ROD with the actual costs experienced on the project. Consistent with EPA's closeout guidance a detailed 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.

Readers should note that for all of the cost evaluations presented in the FCP's individual operable unit closeout reports (including this Operable Unit 2 report), the evaluations focus on those direct and indirect remedial costs specifically associated with the individual remedies conducted for the operable unit of interest. The cost evaluations do not include FCP administrative or overhead costs for managing the site as a whole, such as for oversight, site administration and management, communications and reporting, site-wide utilities, office space, and the like. The comparisons are therefore aimed at the specific direct and indirect costs (like engineering) required to complete the individual remedies required by the FCP's CERCLA process across the five operable units. In this way, users of this report will be able to more readily compare costs from other sites within the Superfund program for like remedies with those experienced at Fernald. This also permits the cost comparisons presented in the closeout reports to remain consistent with how the ROD cost estimates were originally developed back in the 1990s, when the cleanup remedies for Fernald were first envisioned.

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

The present-worth cost estimate provided in the May 1995 ROD for the selected Operable Unit 2 remedial action was $105.9 million (Operable Unit 2 ROD, p. 9-2). This assumed about 50 months for the remedy implementation duration and a 30-year operation and maintenance (O&M) period for the on-site disposal facility. This net present worth estimate included $85.9 million for construction costs (including waste material and contaminated soil excavation) and $20.0 million for O&M. It also included the estimated costs for the shipping and disposal of the Operable Unit 2 wastes and soils that exceed the on-site WAC at an off-site permitted commercial disposal facility. Finally, the estimate included the final contouring and natural resource restoration of the excavation areas consistent with the return of the areas to a natural state. Because the decision presented in the Operable Unit 2 ROD was specific to the Operable Unit 2 waste materials and volumes, the on-site disposal facility in the cost estimate was sized for estimating purposes to accommodate the Operable Unit 2 materials only, independent of the other FCP operable units.

Several adjustments are necessary to permit a fair comparison of the present-worth cost estimate in the 1995 ROD with the actual costs experienced in conducting the Operable Unit 2 remedy. As background, readers need to be aware that a "present worth" cost estimate is typically used for relative cost comparison and ranking purposes only, to evaluate remedial alternatives with differing durations or completion timeframes as a means to identify and select a preferred alternative from a common starting point. By definition, a present-worth cost estimate represents the sum of money which must be fully placed up-front in an interest bearing account (such as a bank) at the onset of remedial activities at a prescribed inflation-adjusted interest rate set by the government (called the

discount rate) to progressively pay for the entire scope and duration of remedial actions. Present-worth cost evaluation techniques are required under CERCLA guidance to compare remedial alternatives, and are used during the feasibility study to help identify and evaluate the preferred alternative for inclusion in the ROD. The present-worth technique does not actually represent how money will be allocated to pay for the remedy over its duration (e.g., such as annualized funding appropriations, without the ability to draw interest on an initial up-front total project sum). Rather, its primary purpose is to facilitate fair comparison of feasible alternatives from a "common point in time" approach to identify the least cost alternative. Therefore, in order to compare a CERCLA ROD's initial present-worth cost estimate with the actual costs experienced in implementing the remedy, the present-worth cost estimate must first be converted to total constant-year dollars for a given base year (in this case, 1994 as the base year, since this was the year the estimate was prepared). This initial constant-year adjustment is a precursor step that assumes the selected remedy is implemented on an annualized funding basis -- but with no escalation or inflation effects over the life of the remedy, thus the term "constant dollars". This base year constant-dollar estimate is then escalated in a second step to future dollars, to match the actual years the work was performed, and thereby accounting for the effects of inflation using government specified escalation factors for each year of passage from the base year. Such adjustments then bring the estimates from the ROD and FS into a form that can be directly compared to the actual dollars expended over the life of the remedy.

Lastly, several adjustments are needed to bring the 1994 estimate in line with the closeout decisions accompanying the spring 2005 Fact Sheet -- so that the costs associated with the completion of the individual work scopes match the particular closeout reports where the work completion is being documented. These final adjustments also account for how the work was executed and tracked in the field, during actual implementation (for example, much of the Operable Unit 2 excavation work was conducted concurrently with Operable Unit 5 excavation work using the same equipment, staff, and techniques). For Operable Unit 2, the adjustments under this last step include three cost-related "deductions" from the adjusted 1994 estimate to account for the fact that 1) all costs associated with design and construction of the OSDF were tracked as part of Operable Unit 5 and will be reported in the Operable Unit 5 closeout report (OSDF subsection); 2) costs associated with soil remediation, characterization, and natural resource restoration for the Lime Sludge Ponds and Solid Waste Landfill subunits were tracked concurrently with Operable Unit 5 and will be reported in the Operable Unit 5 closeout report (soil and sediment subsection); and 3) costs associated with the shipping of above-WAC materials from Operable Unit 2 via the SP-7 above-WAC material stockpile were also tracked concurrently with Operable Unit 5 and will therefore be reported in the Operable Unit 5 closeout report (soil and sediment subsection). These "deducts" from the Operable Unit 2 cost estimates will be accounted for with parallel "add ins" in the Operable Unit 5 closeout report, to ensure representative cost comparisons are conducted as required in Section 8 of that report. Overall, these key adjustments allow the various operable-unit closeout reports to remain integrated and consistent in their tracking, documentation, and reporting of both work-scope and cost completion information.

### 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, the ROD-adjusted cost estimate for use in the comparison is $42.3 million. Actual costs for the adjusted ROD work scope total to $33.6 million. The EPA guidance requirements specify if the actual cost of the remedy is within –30% to +50% range of the ROD estimate, no further explanation of costs are necessary. If the costs fall out of the specified range, further discussion of cost differences are needed. The difference between the Operable Unit 2 ROD escalated estimate and the actual costs is a savings of about $9.0 million -- or about 27% below the adjusted

remedy scope value as described above. This falls within the EPA guideline, indicating the actual and ROD adjusted costs compare reasonably favorably. As discussed above the remaining costs associated with Operable Unit 2 remediation and material disposal will appear as “add ins” in the Operable Unit 5 closeout report under the OSDF and soil remediation sections, respectively.

## 9.0 OBSERVATIONS AND LESSONS LEARNED

Lessons learned from previous Operable Unit 2 and Operable Unit 5 remedial activities were continuously incorporated into the design for subsequent excavations to ensure that remedial activities met all applicable requirements and achieve the highest quality level possible. Some of the most important lessons include:

- Excavate prohibited items in such a manner that they are transported to the appropriate stockpile location at the time of their removal from the excavation location (i.e., avoid double handling).
- Perform continuous visual observation of the excavation to identify and segregate special material.
- Obtain EPA consensus for field decisions during construction.

### Pre-Design Investigation – Project Specific Plans

- Point sampling, such as Geoprobe sampling of subsurface soil contamination can provide very useful information but can't be expected to identify all the hot spots of contamination.
- Real-time scan approach can fill the data gaps regarding the extent of unexpected above WAC materials during excavation.
- Real-time scan approach also can help to identify needs to upgrade personal protective equipment requirements due to potential thorium and/or radium contaminations in an uranium-driven excavation area.

### Remedial Design – Integrated Remedial Design Packages

- The storm water management system, including three basins, pump stations, and pipeline in the Southern Waste Units, performed well.
- It is better to use performance specifications instead of specific detailed drawing for temporary erosion controls.
- The structure/foundation portion of the South Field wheel wash facility was over designed and the mechanical portion could be better designed.
- The South Field haul road served its purposes well.
- Requirements for necessary personal protective equipment, container, and transportation requirements of thorium and asbestos containing material should have been identified earlier in the process.

### Remedial Action – Excavation, Treatment, Disposal, Restoration

- Selection of the type of equipment necessary to conduct lift excavation, in order to maximize the opportunity for visual inspection of the cut face and maintain production rate, changed with area conditions.
- Larger articulated trucks were more efficient than smaller articulated or road trucks.
- Lead treatment by *insitu* chemical stabilization in the Firing Range was successful and allowed disposal of the treated soil in the OSDF.
- Intensive excavation control requirements were accomplished efficiently with a combination of visual inspection, real-time scanning, physical sampling, and on site analytical resources.
- Dust and erosion control efforts in an excavation area were significant and continuous and should be planned properly.
- Timing of seeding needs to be right to avoid reseeding.

## 10.0 CONTACT INFORMATION

### Remedial Action Contacts

| U.S. Department of Energy Contact | Fluor Fernald Contact |
|---|---|
| Public Information<br>Fernald Closure Project<br>U.S. Department of Energy<br>P.0. Box 538705<br>Cincinnati, OH 45253-8705<br><br>513-648-3153 | Fernald Closure Project<br>Fluor Fernald<br>P.O. Box 538704<br>Cincinnati, OH 45253-8704<br><br><br>513-648-4898 |
| **U.S. Environmental Protection Agency Contact** | **Ohio Environmental Protection Agency Contact** |
| Remedial Project Manager<br>U.S. EPA SRF-6J<br>77 W. Jackson Blvd.<br>Chicago, IL 60604-3590<br><br>312-886-0992 | Fernald Project Manager<br>Ohio Environmental Protection Agency<br>401 E. Fifth St.<br>Dayton, OH 45402-2911<br><br>937-285-6357 |

## APPENDIX A – COST AND PERFORMANCE SUMMARY

The Operable Unit 2 project cost can be broken into two distinct types of costs: 1) remedial construction costs (including direct remedial costs and indirect engineering costs) and 2) long-term operation and maintenance costs for the On-Site Disposal Facility, as summarized below:

| Cost Description | ROD Present Worth Cost Estimate (ROD pg.9-2) ($ Millions) | Present Worth Costs converted to 1994 constant dollars ($ Millions) | Adjusted ROD Cost Estimate ($Millions) See Footnote (1) | Actual Costs ($ Millions) |
|---|---|---|---|---|
| Construction Costs (Direct/Indirect) | $85.9 | $96.8 | $42.3 | $33.6 |
| Long-Term O&M | $20.0 | $32.8 | $0 | $0 |
| Grand Total | $105.9 | $129.6 | $42.3 | $33.6 |

Footnote (1): The adjusted ROD Cost Estimate *includes*:

- Escalation factors, to adjust the 1994 constant dollars to the years the remedial activities were performed.
- Engineering costs for waste excavation.
- Site prep/haul road construction.
- Excavation/hauling costs to OSDF/SP-7.
- Characterization costs:
  - Southern Waste Units: both waste and soil
  - Solid Waste Landfill: waste only; soil in OU-5 report.
  - Lime Sludge Ponds: waste only; soil in OU-5 report.
- Site restoration costs:
  - For Southern Waste Units only; other units (Solid Waste Landfill and Lime Sludge Ponds) included in OU-5 report.
- In process monitoring costs.
- Construction overhead.
- Indirect costs.
- Sales tax.

Footnote (1): The adjusted ROD Cost Estimate *excludes*:

- Shipping of above-WAC materials from SP-7, which is included in the OU-5 report.
- Soil excavation, characterization, and natural restoration in the Lime Sludge Ponds and Solid Waste Landfill units, which are included in the OU-5 report.
- OSDF design, construction, waste placement, and O&M costs, which are included in the OU-5 report.
- Risk and contingency costs.

***Note to readers***: See Section 8.0 for a discussion of the cost adjustments -- and how the adjustments align the Operable Unit 2 and 5 closeout reports. The adjustments integrate how the work was conducted and tracked from a cost standpoint, and how completion of the work is being reported.

As discussed in Section 8.0, the adjusted ROD cost estimate of $42.3 million shown in column 4 above is about $9.0 million higher than the actual costs of $33.6 million shown in column 5, resulting in a cost savings. The EPA CERCLA guidance requirements specify if the actual cost of the remedy is within –30% to +50% range of the ROD estimate, no further explanation of costs are necessary. The difference between the Operable Unit 2 ROD adjusted estimate and the actual costs is a savings of about $9.0 million -- or about 27% below the adjusted estimate. This falls within the EPA guideline, indicating the actual and ROD adjusted costs compare reasonably favorably. As discussed above the remaining costs associated with Operable Unit 2 remediation and material disposal will appear as cost “add ins” in the Operable Unit 5 closeout report so that the various closeout reports remain integrated and consistent.

## APPENDIX B – SCHEMATIC OF TREATMENT SYSTEMS

Treatment needs during the excavation of the Operable Unit 2 Waste Units included three distinct operations:

- In-situ treatment of lead contaminated soils from the firing range located in the South Field Area. A solution of the proprietary substance MACETITE was applied to the area, which served to bind the lead to an extent, that the material would pass the RCRA Toxicity Characteristic Leaching Procedure (TCLP). Once demonstrated, the area was excavated with conventional excavating equipment.
- Surface water collection and treatment from the southern waste unit excavations. Three retention basins were installed which would collect surface water runoff and pump the collected runoff to the site Storm Water Retention Basin (SWRB). Water from the SWRB was pumped to Phase 1 of the Advanced Wastewater Treatment Facility. The Schematic of this Surface Water Management System for Southern Waste Units is included as Figure B-1.
- All water collected during the excavation of each of the six waste units was directed to the AWWT. Phase 1 of the AWWT is used for the treatment of contaminated storm water. Phase 2 of the AWWT provides treatment for select areas of site storm water runoff and other remediation related wastewater. Phase 2 is used for treating storm water or perched groundwater that may have volatile organic chemical (VOC) contamination. Phase 2 of the AWWT contains activated carbon absorption, which effectively removes VOCs commonly found throughout the site. Relative to excavation of waste units, if an area was suspected of containing VOC contamination, water collected in excavations was sampled for the suspect VOCs and was delivered to Phase 2 of the AWWT if any VOC was above 50 ppb. The Advanced Wastewater Treatment Plant Simplified Process Diagram is included as Figure B-2.

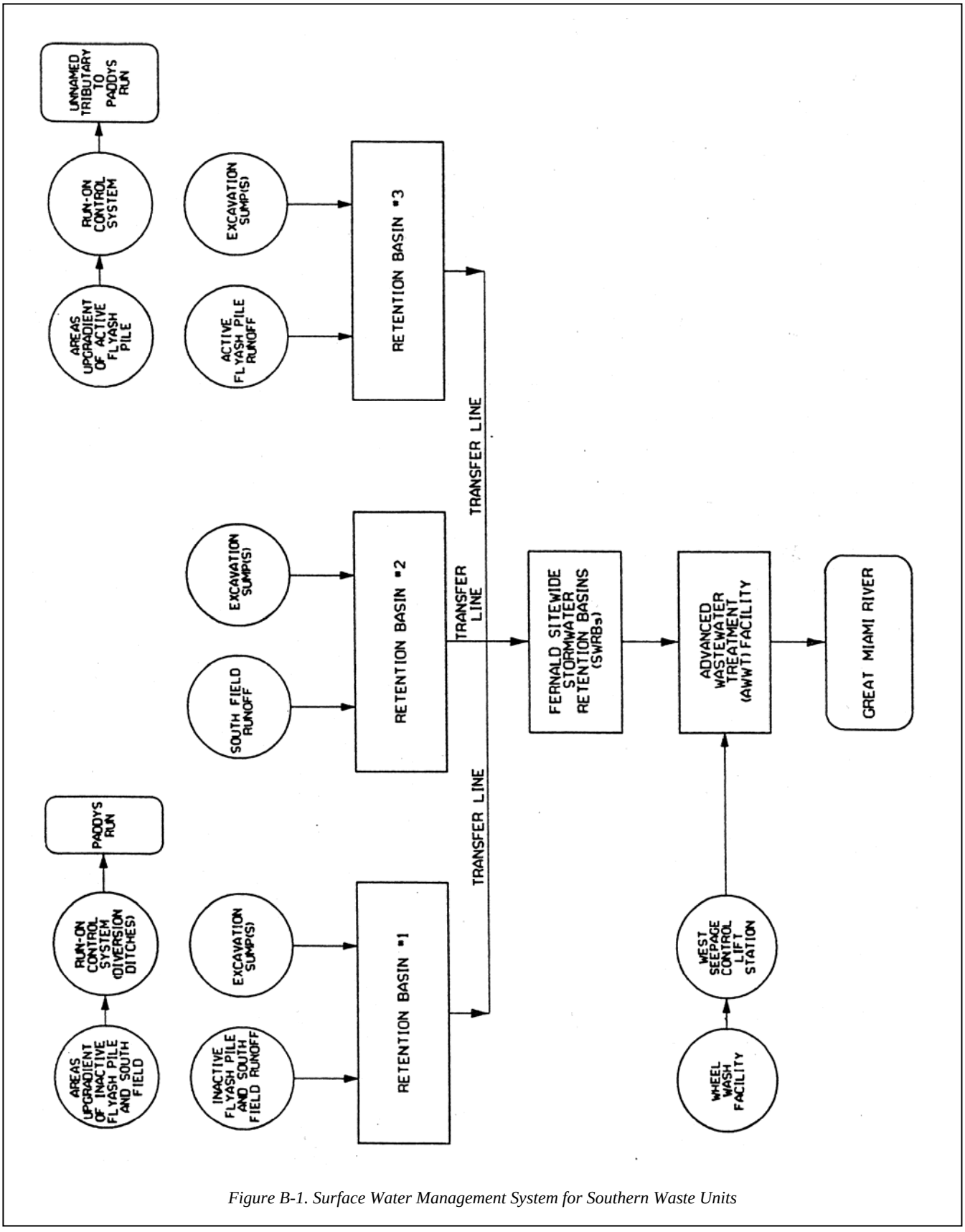



*Figure B-1. Surface Water Management System for Southern Waste Units*

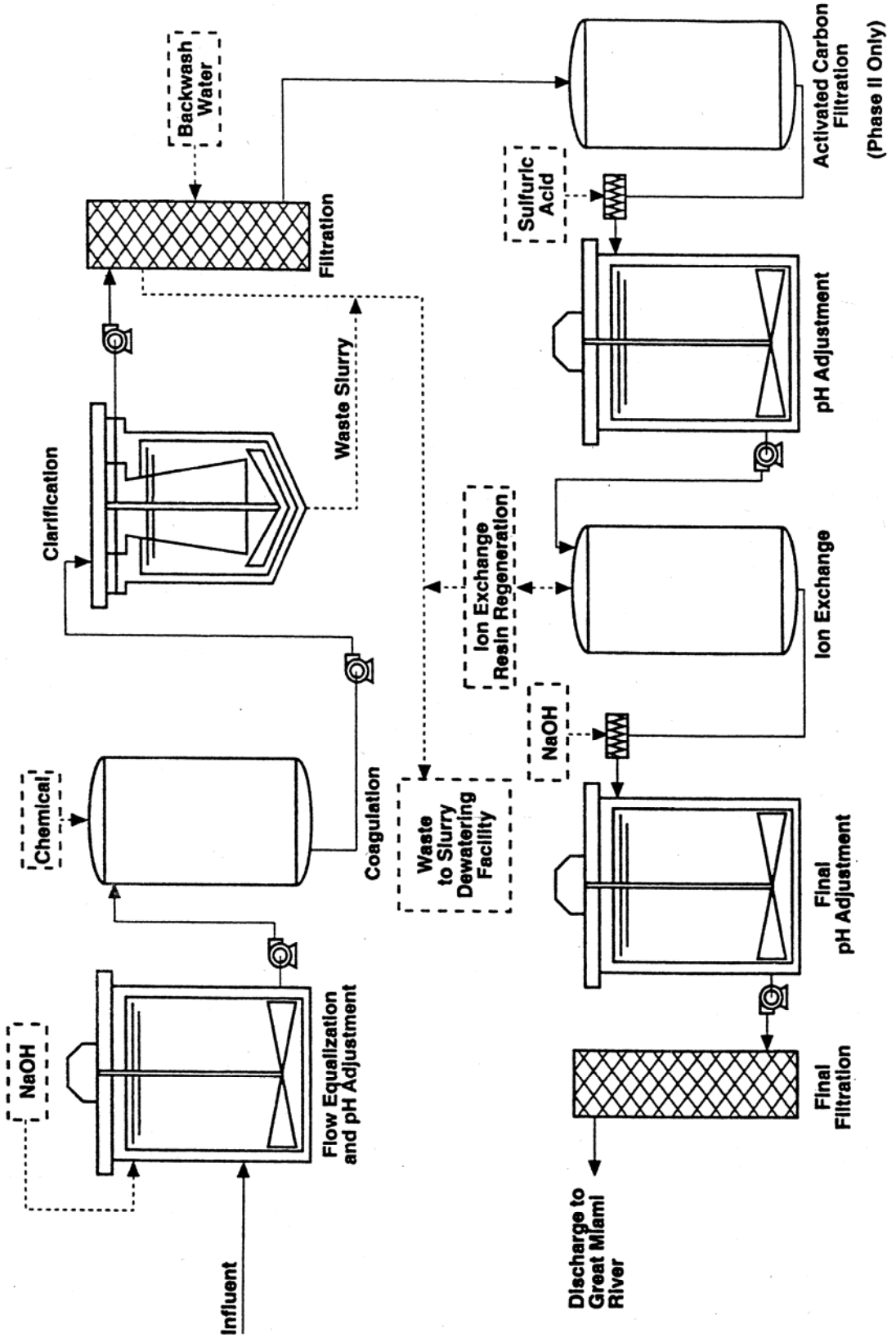



*Figure B-2. Advanced Wastewater Treatment Plant (AWWT) Simplified Process Diagram*

## APPENDIX C – HWMU CLOSURES

There were no RCRA Hazardous Waste Management Units associated with any of the six Operable Unit 2 Waste Units.

## APPENDIX D – REMOVAL ACTIONS

As discussed in Section 2.2, there were four removal actions associated with Operable Unit 2 that were conducted as an effort to minimize the release or threat of release of contaminants and to accelerate cleanup activities. These four removal actions are summarized below.

### The Inactive Flyash Pile/South Field Disposal Area Control Removal Action (Removal Action No. 8)

This removal action [DOE 1991] consisted of the installation of ropes, fences, and warning signs around the perimeter of these waste areas to control access. Phase I of the activities, which included fencing and roping the areas to be controlled, was completed in December 1991. Phase II, which included a radiological survey of the area, was completed in June 1992.

### The Active Flyash Pile Control Removal Action (Removal Action No. 10)

This removal action [DOE 1992] was completed as a time-critical removal action to mitigate the wind and water erosion of the Active Flyash Pile. This was accomplished by regrading the pile, installing a silt trap and wind barrier, and applying a crusting agent to the surface of the pile. Implementation of this removal action was completed in June 1992. Periodic routine inspections of the Active Flyash Pile and necessary maintenance of the erosion control measures continued until the pile was excavated and disposed.

### The Paddys Run Erosion Control Removal Action (Removal Action No. 29)

This removal action [DOE 1993] was implemented in Paddys Run to provide bank stabilization adjacent to the Inactive Flyash Pile. Continued erosion of the bank could have undermined the western slope of the Inactive Flyash Pile, which would have resulted in a discharge of contamination into Paddys Run. The bank was protected by installing riprap stone to cover the exposed soil face adjacent to Paddys Run. This time-critical removal action was completed in September 1993. Periodic routine inspections of the riprap stone and necessary maintenance of the erosion control measures continued until the Inactive Flyash Pile was excavated and disposed.

### The South Field and Inactive Flyash Pile Seepage Control Removal Action (Removal Action No. 30)

This removal action [DOE 1995e] was performed in 1995 as a time-critical removal action to collect contaminated surface water that seeped into drainage ditches and migrated directly to Paddy's Run or to the Great Miami Aquifer. Collected seepage was directed to the AWWT for treatment.

## APPENDIX E – LEGAL AGREEMENTS

The DOE has conducted operations at the Fernald Site under several legal agreements beginning with the 1986 Federal Facility Compliance Agreement. This includes the Consent Agreement and Amended Consent Agreement under CERCLA 121 and other agreements such as Ohio EPA Directors Findings and Orders, and Consent Decrees. This appendix, however, describes the legal agreements specific to Operable Unit 2, which consisted of only one dispute resolution under the Amended Consent Agreement.

### Agreement Resolving Dispute Concerning Denial of Request for Extension of Time to Submit Operable Unit 2 Documents – April 1993

On October 17, 1992, DOE submitted the Operable Unit 2 Remedial Investigation to EPA, which was subsequently disapproved by EPA on December 17, 1992. Having a direct bearing on the other documents and respective schedules, DOE requested an extension of time under Section XVIII of the Amended Consent Agreement (ACA). EPA did not concur with the request for an extension and on February 16, 1993 DOE invoked the dispute resolution process under Section XIV of the ACA. Later, DOE invoked the dispute resolution process when, on March 16, 1993, EPA notified DOE that it intended to assess stipulated penalties relative to missing Operable Unit 2 document milestones.

The negotiations conducted throughout this process resulted in several initiatives, which were identified in the Terms of Resolution. These initiatives included:

- The agreement by DOE to spend not less than $2.0 million dollars on a supplemental environmental project. This project consisted of:
- Procurement and installation of one additional Interim Advanced Wastewater Treatment trailer unit
- Extend the life of the existing Interim Advanced Wastewater Treatment trailer unit
- Utilize off-peak capacity in Advanced Wastewater Treatment Facility, Phase I, for treatment of South Plume Groundwater
- Eliminate low uranium streams from Advanced Wastewater Treatment Facility, Phase II, and use the resulting additional capacity for treatment of South Plume Groundwater
- The agreement by DOE to a monetary penalty in the amount of $50,000.
- New submission dates for Operable Unit 2 documents, including the submission of the draft ROD by January 5, 1995
- The agreement by DOE to accelerate, by 30 days, the scheduled submission of the draft ROD's for Operable Unit s 1, 3, and 5 in the ACA
- The agreement by DOE to perform, in consultation with EPA, a comprehensive review of data collected for each of the operable units in advance of the respective remedial investigation report in an attempt to identify and resolve any potential problems in the area of data adequacy.

All of these initiatives were successfully completed.

## APPENDIX F – REFERENCES

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U.S. Department of Energy, 1992,"Active Flyash Pile Controls Removal Action Work Plan," Revision 3, Fernald Environmental Management Project, DOE, Fernald Area Office, Cincinnati, Ohio.

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Letter, 1999, DOE-1071-99, To Mr. James Saric, Remedial Project Manager, EPA and Mr. Thomas Schneider, Project Manager, Ohio EPA, From Johnny Reising Fernald Remedial Action Project Manager, "Transmittal of the Area 2 Phase 1 Firing Range Addendum to the Verification of Treatment Report for the Area 1, Phase II Trap Range Stabilization Project," dated August 24, 1999.

U.S. Department of Energy, 1995a ,"Feasibility Study Report/Environmental Assessment for Operable Unit 2," Final, (Vol.1-6) Fernald Environmental Management Project, DOE, Fernald Area Office, Cincinnati, Ohio.

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

U.S. Department of Energy, 1995d, "Remedial Investigation Report for Operable Unit 2," Final, (Vol. 1-6) Fernald Environmental Management Project, DOE, Fernald Area Office, Cincinnati, Ohio.

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

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U.S. Department of Energy, 2003a, "Implementation Plan for Area 6 Solid Waste Landfill and Fire Training Facility," Revision 0 PCN 1, Fernald Closure Project, DOE, Fernald Area Office, Cincinnati, Ohio.

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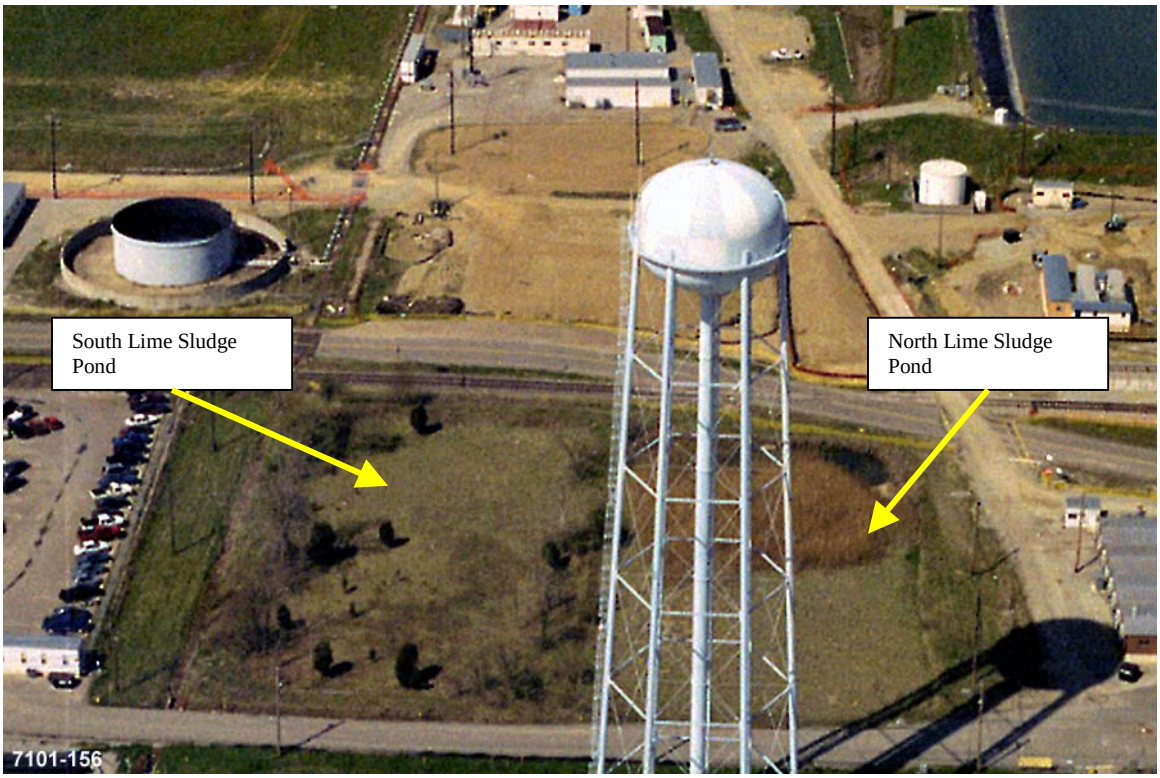
## APPENDIX G – WASTE UNIT PHOTOS

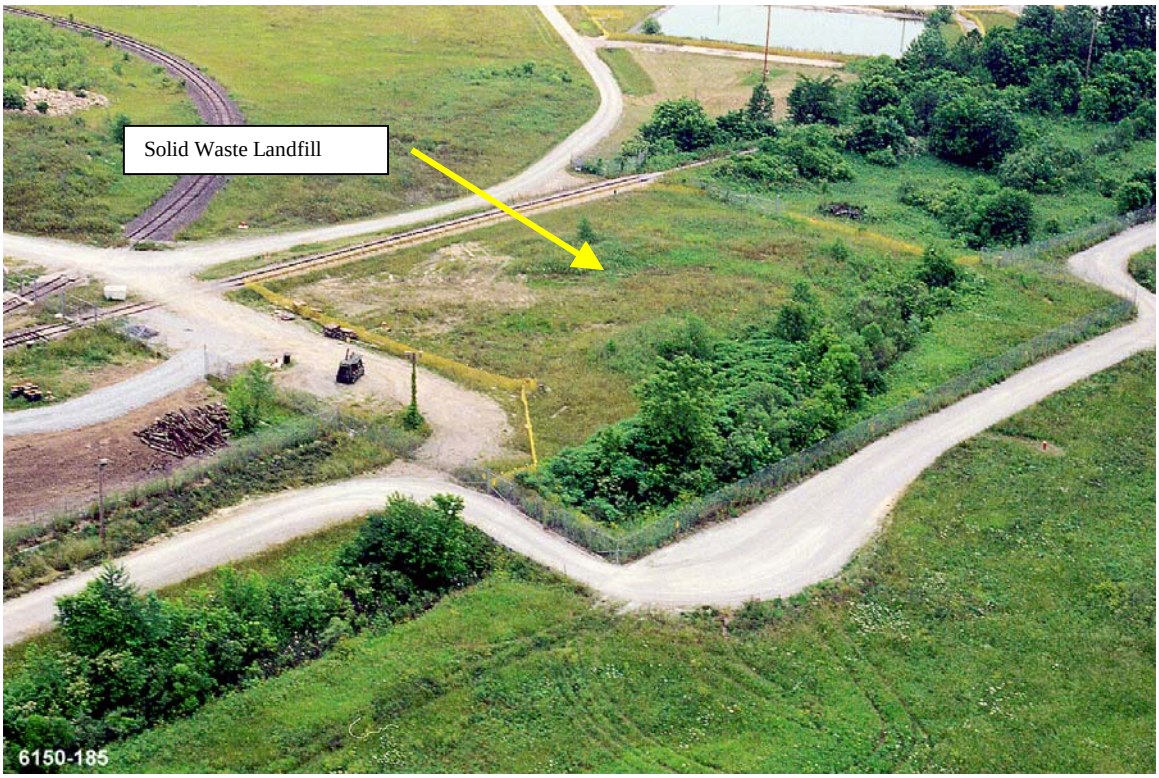

*Operable Unit 2 Active Flyash Pile* *Before Excavation – Circa June 1996*


*Operable Unit 2 Active Flyash Pile* *After Excavation – Circa May 2003*



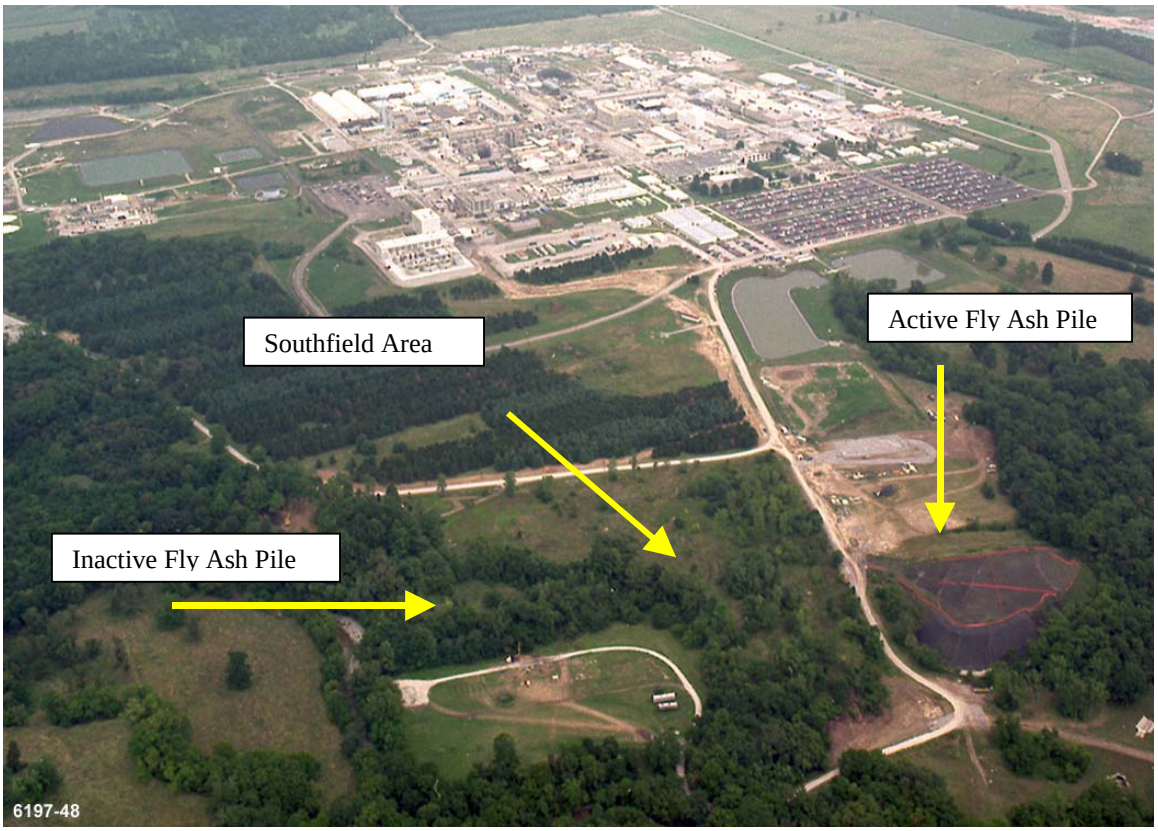

*Operable Unit 2 Lime Sludge Ponds* *Before Excavation – Circa April 1999*


*Operable Unit 2 Lime Sludge Ponds* *After Excavation – Circa May 2004*




*Operable Unit 2 Solid Waste Landfill* *Before Excavation – Circa June 2002*


*Operable Unit 2 Solid Waste Landfill* *After Excavation – Circa May 2004*




*Operable Unit 2 Southern Waste Units* *Before Excavation – Circa August 1995*


*Operable Unit 2 Southern Waste Units* *Excavation Complete with Restoration – Circa May 2004*

## APPENDIX H – LIST OF ACRONYMS

| | |
|---|---|
| ACA | Amended Consent Agreement |
| ACM | asbestos containing material |
| AEC | Atomic Energy Commission |
| ANSI | American National Standards Institute |
| ARAR | applicable or relevant and appropriate requirements |
| ASQC | American Society of Quality Control |
| ASME | American Society of Mechanical Engineers |
| AWWT | Advanced Wastewater Treatment |
| BSL | bio surge lagoon |
| CERCLA | Comprehensive Environmental Response, Compensation, and Liability Act |
| 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 |
| 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 |
| HWMU | Hazardous Waste Management Unit |
| IEMP | Integrated Environmental Management Plan |
| LMICP | Legacy Management and Institutional Controls Plan |
| mg/l | milligrams/liter |
| NLO | National Lead of Ohio |

| | |
|---|---|
| NPDES | National Pollutant Discharge Elimination System |
| NPL | National Priorities List |
| NQA | National Quality Assurance |
| NTS | Nevada Test Site |
| O&M | operations and maintenance |
| OFFO | Office Federal Facilities Oversight (Ohio EPA) |
| Ohio EPA | Ohio Environmental Protection Agency |
| OSDF | On-site Disposal Facility |
| OSWER | Office of Solid Waste and Emergency Response (U.S. EPA) |
| OU | Operable Unit |
| QA/QC | quality assurance/quality control |
| QAJSP | Quality Assurance Job Specific Plan |
| RCRA | Resource Conservation and Recovery Act |
| RI/FS | Remedial Investigation/Feasibility Study |
| ROD | Record of Decision |
| RM | Requirements Manual |
| RSE | Removal Site Evaluation |
| SARA | Superfund Amendments and Reauthorization Act |
| SCQ | Site-wide CERCLA Quality Assurance Plan |
| SEP | Site-wide Excavation Plan |
| SP | stockpile (soil stockpile) |
| SWRB | storm water retention basin |
| TCLP | toxicity characteristic leaching procedure |
| µg/L | micrograms per liter |
| 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 |

## APPENDIX I – SIGNATURE PAGE

I certify that the remedial actions as described within this report have been completed.

_____

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