Y/ER/MS-3

Post Construction Report for Lower East Fork Poplar Creek Project, Phase I Oak Ridge, Tennessee

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Foster Wheeler Environmental Corporation
Oak Ridge, Tennessee
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Environmental Management Activities at the
Oak Ridge Y - 12 Plant
Oak Ridge, Tennessee 37831-8169
managed by
LOCKHEED MARTIN ENERGY SYSTEMS, INC.
for the
U.S. DEPARTMENT OF ENERGY
under contract DE-AC05-84OR21400

MASTER

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PREFACE

This *Post Construction Report for the Lower East Fork Poplar Creek Project, Oak Ridge, Tennessee* was prepared in accordance with the Incentive Task Order (ITO) Project Plan, Revision 2, submitted February 20, 1996. The purpose of this Post Construction Report (PCR) is to summarize the conduct and results of field construction and monitoring activities and to document that the removal action was performed in compliance with the requirements of CERCLA. This work was performed under Work Breakdown Structure 1.4.12.3.1.04, Activity Data Sheet 9304, "Lower East Fork Poplar Creek." Issuance of this document meets an ITO milestone of November 23, 1996. This document provides the Environmental Restoration Program with notification of completion associated with Phase I of the Lower East Fork Poplar Creek Operable Unit.

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CONTENTS

ACRONYMS

ARARs	applicable or relevant and appropriate requirements
BGS	Below Ground Surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CET	CET Environmental Services, Inc.
CKD	concrete kiln dust
DOE	U.S. Department of Energy
DOT	Department of Transportation
ECU	Excavation Confirmation Units
EPA	Environmental Protection Agency
FPSC	fixed price subcontractor
H&S	Health and Safety
HP	Health Physics
ITO	Incentive Task Order
IVC	Independent Verification Contractor
LEFPC	Lower East Fork Poplar Creek
NOAA	National Oceanographic and Atmospheric Administration
OU	Operable Unit
PCR	Post Construction Report
POTW	Publicly Owned Treatment Works
PPE	personal protective equipment
QA/QC	Quality Assurance/Quality Control
RA	Remedial Action
RAC	Remedial Action Contractor
ROD	Record of Decision
SAP	Sampling and Analysis Plan
TDEC	Tennessee Department of Environment and Conservation
WAC	Waste Acceptance Criteria

EXECUTIVE SUMMARY

This Phase I Remedial Action (RA) effort was conducted in accordance with the *Record of Decision (ROD) for Lower East Fork Poplar Creek (LEFPC) (DOE/OR/02-1370&D2, August 18, 1995)* as a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) action.

The LEFPC, Phase I RA removed approximately 5560 yd^3 of mercury-contaminated soils, $\geq$400 ppm, from selected portions of the National Oceanographic and Atmospheric Administration (NOAA) site LEFPC floodplain from July 8, 1996 - September 14, 1996. This work was performed by CET Environmental Services, Inc. (CET) of Tustin, California under a fixed price subcontract to MK-Ferguson of Oak Ridge. These soils were hauled to the Y-12 Industrial Landfill V for disposal in accordance with the *Special Waste Permit (Approval #01-0096, May 17, 1996).* The excavated soils were either taken directly to the landfill or to the drying bed in the staging area for stabilization with concrete kiln dust (CKD) by mixing with a trackhoe. CKD was added to the soft soils firming them enough to allow for reduced amounts of cover material to be used at the landfill. Confirmatory sampling was performed during the RA in accordance with the *Confirmatory Sampling and Analysis Plan for the LEFPC (Y/ER-258, April 1996)* utilizing the EPA approved field screening method Static Headspace Analysis for Mercury in soils (Kriger & Turner, 1996). This method proved to be very successful and the sampling methodology and analytical results are summarized in Section 3 of this report.

During the RA, erosion control measures were utilized according to the approved *Phase I Remedial Design Report and Remedial Action Work Plan for the LEFPC* (DOE/OR/01-1448&D2). Daily monitoring of the creek surface water conducted in accordance with the *Sampling and Analysis Plan for the Treatment Water and Creek Water for the LEFPC (Y/ER-261, April 1996)*, indicated that there were no impacts from the RA activities on the water quality. These analytical results are summarized in Section 3 of this report. Once the contaminated soils were excavated, the approximately 2 acres of disturbed floodplain were stabilized using erosion control matting and seeded to allow native vegetation to be restored, and the erosion control measures installed for the RA were removed.

Secondary wastes generated during the Phase I RA were handled and disposed of in accordance with the *LEFPC Waste Management Plan (Y/ER-264/R1)* and included trees trunks and limbs from the land clearing operations; personal protective equipment (PPE); contaminated and non-contaminated tree stumps; sand; gravel; decontamination water; excavation water; and water generated from the drying bed. The PPE and contaminated tree stumps were disposed of at the Y-12 Industrial Landfill V as mercury contaminated. The 1310 yd^3 of non-contaminated tree trunks and limbs, from site clearing activities, were hauled to the Burn Area at the Y-12 Plant for burning. The non-contaminated sand and gravel generated were hauled to the Y-12 Spoil Area and the 160 yd^3 of non-contaminated tree stumps were hauled to the Y-12 Construction/Demolition Landfill VI. Approximately 29,000 gal. of waste water, from the dewatering activities at the drying beds and excavation water, was filtered on site to meet the Publicly Owned Treatment Works (POTW) requirements and released into the City of Oak

Ridge's sanitary sewer system for final disposition. Water sampling was performed in accordance with the *Sampling and Analysis Plan for the Treatment Water and Creek Water for the LEFPC (Y/ER-261, April 1996).* The analytical results are summarized in Section 3 of this report. During the filtration and disposal of waste water, a batch of approximately 500 gal. was released into the sewer that exceeded the *POTW Waste Acceptance Criteria (WAC) (Permit Number 6-96).* Appropriate notifications were made and process modifications were implemented to improve control of the filtration system.

The weather during the Phase I RA had some significant impacts on the methods of accomplishment. CET, the fixed price subcontractor (FPSC) selected a method of constructing the haul roads out of clay backfill material to save disposal costs associated with building a gravel haul road that would require removal after completion. This method of road construction proved to be weather dependent and required continuous maintenance. Eventually, CKD was added to the haul roads for stabilization.

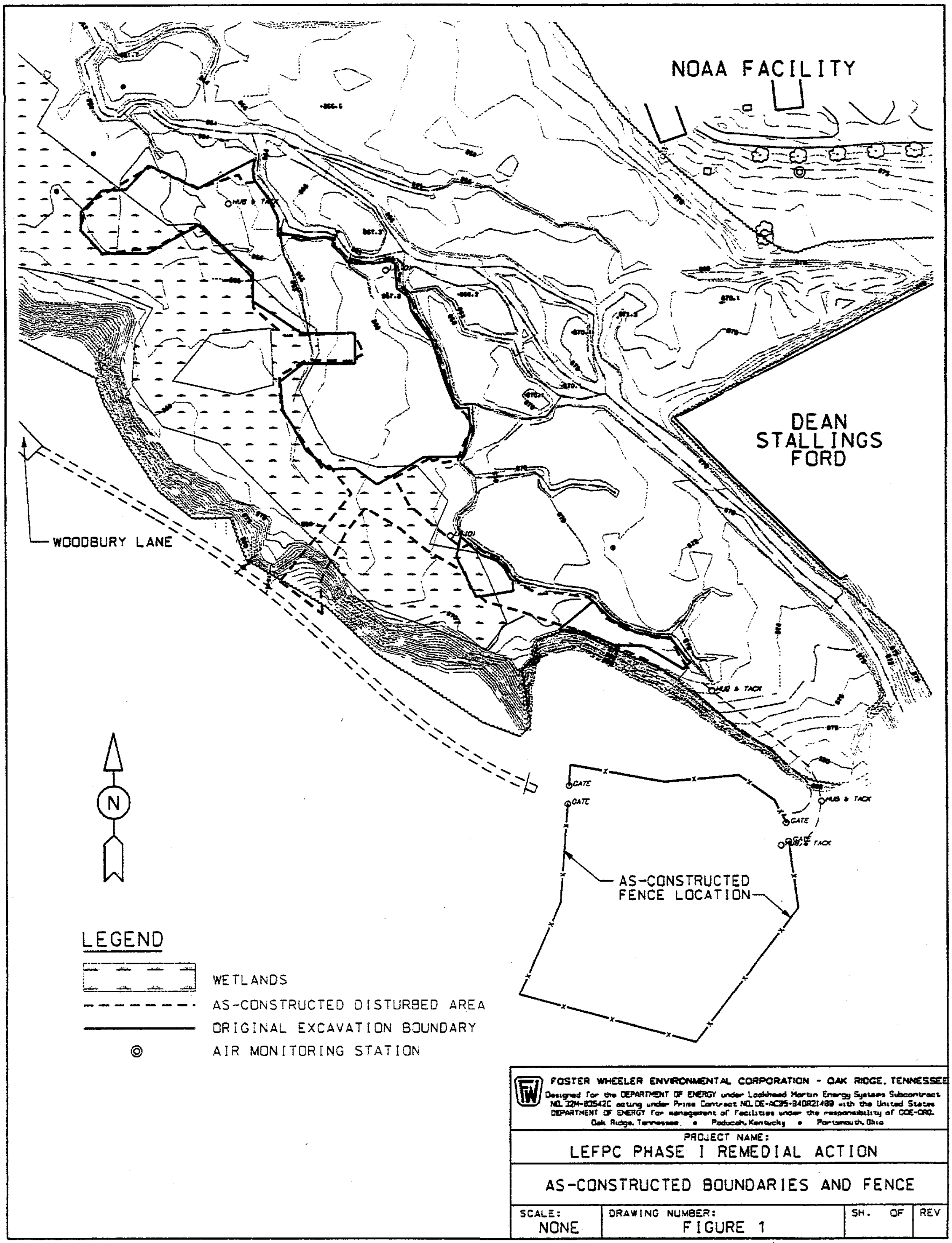
Site access controls were maintained around the clock with an access monitor located at the entrance of the site. During work hours the monitor maintained an access list and monitored shipping papers for waste transportation. The access monitor also provided health and safety controls to ensure that no one entered the site without the proper training or without an escort. After hours, the access monitor was provided by the FPSC through a commercial security firm (Pinkerton) and had health and safety responsibilities for site control. Additionally, the equipment staging area, where the drying beds and equipment were located, was fenced. The removal of the staging area and site restoration will be included in Phase II of this project.

During excavation activities, pockets of elevated radiologically contaminated soils (greater than 35 pCi/g) were located by the continuous monitoring of the excavation areas and contaminated soils with radiological monitoring instruments. Once located, these soils were sampled for additional radiological characterization and secured by covering with plastic and clean backfill material to prevent contaminant migration. These soils, ~130 yd^3, were then excavated by properly trained personnel and are currently staged in a controlled area within the staging area. Through characterization sampling it has been determined that ~90 yd^3 are less than 35 pCi/g uranium contaminated and will be transported to the Y-12 Landfill V for disposal and the remaining ~40 yd^3 do not meet the WAC for radiological constituents included in the Special Waste Permit for Landfill V. The radiologically contaminated soil will be placed in 21st Century containers for storage at the K-25 site.

1. SITE DESCRIPTION

The LEFPC Operable Unit (OU) site includes the soil, sediment, and groundwater within the 100 year floodplain along the LEFPC and the Sewer Line Beltway. The LEFPC OU begins at the outfall of Lake Reality at the Y-12 Plant and ends at the confluence with Poplar Creek, ~23.3 km (14.5 miles) downstream. The site includes portions of the Oak Ridge Reservation (ORR), as well as commercial, residential, agricultural, and other areas within the City of Oak Ridge. Due to mercury and other contaminant releases from the Y-12 Plant since the 1950s, the floodplain downstream of the Y-12 Plant became contaminated. Contaminated soils outside the floodplain consist exclusively of floodplain soils used for backfill along the City of Oak Ridge Sewer Line Beltway.

The Phase I RA was performed in order to accommodate commercial development at the NOAA site. Contaminated soils were removed from three areas, totalling approximately 2 acres of bottomland hardwood forest at the NOAA site, as shown in Figure 1. The three areas were more than 150 ft from LEFPC; but a number of minor tributaries bordered the excavations. Approximately 0.6 acres of wetlands were disturbed during the RA that will be mitigated by the property owner during the commercial development of the property since his development will also impact these wetlands. The approximately 4 acre staging area was sited on a previously cleared area that was utilized as a borrow source by the property owner.


NOAA FACILITY
DEAN STALLINGS FORD
WOODBURY LANE
HUB & TACK
HUB & TACK
HUB & TACK
GATE
GATE
GATE
AS-CONSTRUCTED FENCE LOCATION
N
LEGEND
WETLANDS
AS-CONSTRUCTED DISTURBED AREA
ORIGINAL EXCAVATION BOUNDARY
AIR MONITORING STATION
FOSTER WHEELER ENVIRONMENTAL CORPORATION - OAK RIDGE, TENNESSEE
Designed for the DEPARTMENT OF ENERGY under Lockheed Martin Energy Systems Subcontract NO. 32M-83542C acting under Prime Contract NO. DE-AC05-84OR21400 with the United States DEPARTMENT OF ENERGY for management of Facilities under the responsibility of DOE-ORO.
Oak Ridge, Tennessee • Paducah, Kentucky • Portsmouth, Ohio
PROJECT NAME:
LEFPC PHASE I REMEDIAL ACTION
AS-CONSTRUCTED BOUNDARIES AND FENCE
SCALE: NONE
DRAWING NUMBER: FIGURE 1
SH. OF
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2. PROJECT REQUIREMENTS

LEFPC Phase I RA was performed in accordance with applicable codes, drawings, regulations, standards, and design specifications defined in the *Phase I Remedial Design Report and Remedial Action Work Plan (DOE/OR/01-1448&D2)* and the *Record of Decision (ROD) (DOE/OR/02-1370&D2)*. The applicable or relevant and appropriate requirements (ARARs) from the ROD were incorporated into the design and implemented during the RA. Table 1 identifies how the ARARs were incorporated into the RA.

The ROD requires the removal and disposal of soils ≥400 ppm mercury, which resulted in the estimated removal of ~27,300 yd^3 of contaminated soils, from the floodplain of LEFPC. Phase I removed and disposed of ~ 5560 yd^3 of the contaminated soils at the NOAA site as shown in Figure 1. Phase II of this project will remove and dispose of the remaining contaminated soils.

Table 1: Phase I LEFPC RDR/RAWP ARAR Responses

Actions	Response	Citation
Presence of Contaminants in deep groundwater	The groundwater use will be monitored in accordance with the *Baseline and Postremediation Monitoring Program Plan for the Lower East Fork Poplar Creek Operable Unit, Oak Ridge, Tennessee,* Y/ER 262, August, 1996.	40 CFR 141 TDEC 1200-5-1-.12
Presence of Wetlands as defined in Executive Order 11990§ 7(c)	The wetlands surrounding the remediation areas will be protected by utilizing best management practices and Drawing C2E900000B021 indicate the boundaries of the areas to be excavated and Construction Specification sections 02110, Site Clearing, Part 3; 02270, Slope Protection and Erosion Control, Parts 2 and 3 contain the requirements to be undertaken to minimize impacts to the surrounding wetlands.	Executive Order 11990; 10 CFR 1022
Presence of jurisdictional wetlands as defined in 40 CFR 230.3(t) and 33 CFR 328.3(b)	The wetlands surrounding the remediation areas will be protected by utilizing best management practices and Drawing C2E900000B021 indicate the boundaries of the areas to be excavated and Construction Specification sections 02110, Site Clearing, Part 3; 02270, Slope Protection and Erosion Control, Parts 2 and 3 contain the requirements to be undertaken to minimize impacts to the surrounding wetlands.	Clean Water Act § 404 40 CFR 230 33 CFR 323 33 CFR 330, Appendix A 33 CFR 325.1
Within area encompassing or affecting waters of the state of Tennessee as defined in TCA 69-3-103(32)	Discharge of substances into the waters of the state will be prevented by utilizing best engineering practices and Drawing C2E900000B021 indicate the location of the silt fencing and hay bales to be placed around the excavation areas and in the wet weather conveyances to prevent discharge of silts into the creek. Drawing C2E900000B023 shows the construction details for the installation of the erosion control measures. Construction Specification sections 02270, Slope Protection and Erosion Control, Parts 2 and 3 contain the requirements for the placement and maintenance of the erosion control measures.	TCA 69-3-101 *et seq.* TDEC 1200-4-7
Within area encompassing or affecting waters of the state of Tennessee as defined in TCA 69-3-103(32)	The substantive requirements of the aquatic resource alteration permit will be met with best management practices and utilizing Drawing C2E900000B021 and C2E900000B023 which indicate the approximate locations and construction details of the temporary access roads needed to perform the work. Construction Specification section 02506, Temporary Access Roads and Staging Areas, Parts 1, 2, and 3 contain the requirements for the placement of the temporary roadways.	TDEC 1200-4-7

Table 1: Phase I LEFPC RDR/RAWP ARAR Responses (continued)

Actions	Response	Citation
Within "lowland and relatively flat areas adjoining inland and coastal waters and other floodprone areas..." [Executive Order 11988 §6(c)]	Hydraulic calculations were performed to determine if there would be any adverse effects from the temporary structures associated with the remediation activities would have on the floodplain hydrology. It was determined that there would be no adverse effects. These calculation are contained in the Project Files and can be submitted upon request.	Executive Order 11988 10 CFR 1022
Presence of federally owned, administered, or controlled prehistoric or historic resources -or- the likelihood of undiscovered resources	A complete examination of the prehistoric and historic resources was performed during the preparation of the *Feasibility Study for the East Fork Poplar Creek - Sewer Line Beltway,* DOE/OR/02-1185&D2&V, section 2.1.6.	National Historic Preservation Act (16 USC 470a-w Executive Order 11593 36 CFR 800 16 USC 470f
Presence of archeological resources on public land		Archeological Resources Recovery Act of 1979 (16 USC 470aa-ll) 43 CFR 7
Presence of archeological or historic resources		Archeological and Historical Preservation Act (16 USC 469a-c)
Construction/excavation/ transport of soils	Due to the excavation of floodplain soils, the nature of the soils will be a wet condition. Additionally, the trucks used to haul the soils will be lined and covered to prevent any airborne particulates during transportation. Construction Specification section 01500, Construction Facilities and Temporary Controls, Part 3D contain the requirements for dust suppression.	TDEC 1200-3-8-.01

Actions	Response	Citation
Surface Water Control	The substantive requirements of the stormwater permitting process will be met by the implementation of the *Draft Best Management Practices Plan for the Lower East Fork Poplar Creek,* Y/ER-260, June 1996. Additionally, these BMPs are included in the Construction Specifications in sections 02110, Site Clearing, Part 3 contains the requirements for clearing and grubbing the work areas; section 02200, Earthwork, Part 3 contain the requirements for excavation and backfill sequencing and time constraints; section 02270, Slope Protection and Erosion Control, Part 3 contains the requirements for the installation of the surface water runoff-on and soil stabilization measures; section 02700, Temporary Storm Drains, Part 3 contain the requirements for the installation of temporary storm drains and; section 02225, Trenching, Part 3 contain the requirements for the installation of trenches and grading to control surface water runoff-on. Drawing C2E900000B022 also indicates the location of a drainage ditch surrounding the staging area.	TDEC 1200-4-10-.05 40 CFR 125.104
Waste Pile	Construction Specification Section 02200, Earthwork, Part 3 prohibits the stockpiling of contaminated soils.	40 CFR 264.250(c) TDEC 1200-1-11-.06 (12)(b)
Treatment and disposal of decontamination/dewatering fluids. Disposal of solid waste	The soils were fully characterized during the Remedial Investigation as reported in the *East Fork Poplar Creek - Sewer Line Beltway Remedial Investigation Report* DOE/OR/02-1119&D2. Further TCLP sampling results are reported in the *Characterization Report for Lower East Fork Poplar Creek) Floodplain Soils* DOE/OR/02-1387&D1.	40CFR262.11 TDEC 1200-1-11-.03 (1)(b)
Direct discharge to surface water body	Runoff from the site to the creek will be managed utilizing best engineering practices and Drawing C2E900000b021 indicates the location of the silt fencing and hay bales to be placed around the excavation areas and in the wet weather conveyances to prevent discharge of silts into the creek. Drawing C2E900000b023 shows the construction details for the installation of the erosion control measures. Construction Specification Section 02270, Slope Protection and Erosion Control, Parts 2 and 3 contain the requirements for the placement and maintenance of the erosion control measures. All other water generated from the site will be treated prior to disposal at the POTW.	TDEC 1200-4-3 TDEC 1200-4-4 TDEC 1200-4-5
Discharge to publicly owned treatment works (POTW)	All contamination water generated as well as any water from groundwater intrusion or rainwater that is pumped from the excavation area will be collected and treated with the water treatment unit as required by Construction Specification Section 01550, Waste Disposal, Part 3G. The treated water will be discharged in the City of Oak Ridge Publicly Owned Treatment Works (POTW) in accordance with the Industrial and Commercial User Water Discharge Permit, Permit Number 6-96.	40 CFR 403.5 40 CFR 403.5(d)

3. REMEDIATION ACTIVITIES

The Lower East Fork Poplar Creek project consists of two phases, Phase I, portions of the NOAA site (5560 yd^3) and Phase II, the remainder of the floodplain soils $\geq$ 400 ppm mercury located at the NOAA and Bruner sites (~ 23,000 yd^3). Phase I was initiated July 8, 1996 and was substantially completed September 14, 1996.

The remediation activities began with the mobilization of the subcontractor, CET and surveying the staging area and excavation areas boundaries. Erosion control measures were installed in accordance with the approved *Remedial Action Work Plan and Remedial Design Report* (DOE/OR/D1-1448&D2) plans and drawings. Upon completion of the erosion control measures, the site clearing and access road installation began. The effectiveness of the erosion control measures and precautions taken during excavation of the creek banks to prevent contamination from entering the creek were tested by several significant rain events. During the RA, 30 days of rain occurred with over 16.3 inches recorded. This is 6.8 inches above normal. During the RA, the creek surface water was sampled daily in accordance with the *Sampling and Analysis Plan for the Treatment Water and Creek Water for the LEFPC (Y/ER-261, April 1996)*, and the Tennessee Department of Environment and Conservation (TDEC) inspected the site after several significant rain events. The analytical results of the surface water sampling indicated that there were no impacts to the surface water during the RA. These results are summarized in Table 2, and TDEC indicated that they were satisfied with the rain water runoff controls incorporated into the construction. Once the contaminated soils were excavated, the approximately 2 acres of disturbed floodplain were stabilized using erosion control matting and seeded to allow native vegetation to be restored and the erosion control measures installed for the RA were removed.

The weather during the Phase I RA had some significant impacts on the methods of accomplishment. In addition to the routine suspension of work activities during the rain events, schedule delays occurred due to site access problems. The FPSC, CET, selected a method of constructing the haul roads out of clay backfill material to save disposal costs associated with building a gravel haul road that would require removal after completion. This method of road construction proved to be weather dependent, required continuous maintenance, and caused delay. CKD was eventually added to the haul roads for stabilization.

During the site clearing activities, trees and other vegetation were cut to manageable sizes and hauled to a Burn Area at the Y-12 Plant for burning in accordance with the *LEFPC Waste Management Plan (Y/ER-264/R1)*. The site clearing activities generated 131 loads of tree trunks and limbs for burning.

Prior to the RA activities, the Excavation Confirmation Units (ECU) were established and the sampling locations selected. The locations of the ECUs are shown in Figure 2. Therefore, once the sites were cleared and the access roads installed, the excavation of the contaminated soils by ECU began. The confirmatory sampling was performed by the Remedial Action Contractor (RAC) (the Lockheed Martin Energy Systems team) in accordance with the *Confirmatory Sampling and Analysis Plan for the LEFPC (Y/ER-258, April 1996)* by taking 4 samples plus a field replicate per ECU after the area had

Table 2
Surface Water Summary

Inorganics	Units	Sampling Station*	Background	Lab Qual#	Total No. Collected	Minimum	Maximum	Average
Aluminum	UG/L	U	69.7	=	33	66.2	2370	246.9
		D	74.2	=		63.6	2130	257.1
Antimony	UG/L	U	3	U	33	3	3	3.0
		D	3	U		3	3	3.0
Arsenic	UG/L	U	4.4	=	33	4.1	9.5	4.3
		D	4.1	U		4.1	4.2	4.1
Barium	UG/L	U	56.7		33	38.5	59.5	45.6
		D	60.7			36.4	60.9	46.5
Beryllium	UG/L	U	0.65	U	33	0.2	1.6	0.3
		D	0.25	U		0.2	1.6	0.3
Boron	UG/L	U	136	=	33	24.2	127	68.3
		D	139	=		30.7	122	71.7
Cadmium	UG/L	U	0.7	U	33	0.7	0.7	0.7
		D	0.7	U		0.7	0.7	0.7
Calcium	UG/L	U	51000		33	31200	46100	41724.2
		D	51900			33900	47500	41597.0
Chromium	UG/L	U	1.6	=	33	1.5	74.4	5.1
		D	1.5	U		1.5	6	2.1
Cobalt	UG/L	U	1.2	U	33	1.2	2.4	1.3
		D	1.2	U		1.2	2.1	1.2
Copper	UG/L	U	6.1	U	33	2.2	20.2	8.9
		D	6.7	U		1.6	19.2	8.2
Iron	UG/L	U	95.6		33	98.3	3410	359.2
		D	138			105	2920	306.2
Lead	UG/L	U	5	=	33	1.8	15.7	5.5
		D	6.1	=		1.8	49	6.4
Magnesium	UG/L	U	13000		33	5800	12500	10561.8
		D	13900			7180	12500	10662.1
Manganese	UG/L	U	32.1		33	39	189	60.1
		D	25.3			26.7	151	44.3
Mercury	**UG/L**	**U**	**0.23**		**33**	**0.1**	**1.2**	**0.4**
		D	**0.29**			**0.1**	**2.6**	**0.5**
Molybdenum	UG/L	U	1.8	U	33	1.8	6.6	2.5
		D	1.8	U		1.8	6	2.7
Nickel	UG/L	U	2.6	U	33	2.6	35	4.3
		D	2.6	U		2.6	5.6	2.8
Potassium	UG/L	U	1850		33	1510	2810	1755.5
		D	2120			1380	2570	1806.1
Selenium	UG/L	U	4.2	U	33	4.2	4.2	4.2
		D	4.2	U		4.2	4.3	4.2
Silica	UG/L	U	6970	=	33	2750	9650	6143.0
		D	7950	U		3160	10700	6565.7
Silver	UG/L	U	0.9	U	33	0.9	1.9	0.9
		D	1.2	U		0.9	3.1	1.0
Sodium	UG/L	U	10900		33	3320	10200	8036.1
		D	10800			4770	9640	7771.8
Thallium	UG/L	U	5.7	=	33	4	5.2	4.2
		D	4	U		4	18.9	5.4
Vanadium	UG/L	U	0.9	U	33	0.9	4.7	1.1
		D	0.9	U		0.9	4.4	1.1
Zinc	UG/L	U	17.9		33	25.5	83.4	42.9
		D	21.8			16.8	76.1	30.5

* U - Upstream
D - Downstream

Table 2
Surface Water Summary

Pesticides/PCBs	Units	Sampling Station*	Background	Lab Qual#	Total No. Collected	Minimum	Maximum	Average
4,4'-DDD	UG/L	U	0.11 U		6		0.11	0.1
		D	0.11 U			0.1	0.12	0.1
4,4'-DDE	UG/L	U	0.11 U		6		0.11	0.1
		D	0.11 U			0.1	0.12	0.1
4,4'-DDT	UG/L	U	0.11 U		6		0.11	0.1
		D	0.11 U			0.1	0.12	0.1
Aldrin	UG/L	U	0.056 U		6		0.06	0.0
		D	0.056 U			0.05	0.06	0.1
Dieldrin	UG/L	U	0.11 U		6		0.11	0.1
		D	0.11 U			0.1	0.12	0.1
Endosulfan I	UG/L	U	0.056 U		6		0.06	0.0
		D	0.056 U			0.05	0.06	0.1
Endosulfan II	UG/L	U	0.11 U		6		0.11	0.1
		D	0.11 U			0.1	0.12	0.1
Endosulfan sulfate	UG/L	U	0.11 U		6		0.11	0.1
		D	0.11 U			0.1	0.12	0.1
Endrin	UG/L	U	0.11 U		6		0.11	0.1
		D	0.11 U			0.1	0.12	0.1
Endrin aldehyde	UG/L	U	0.11 U		6		0.11	0.1
		D	0.11 U			0.1	0.12	0.1
Endrin ketone	UG/L	U	0.11 U		6		0.11	0.1
		D	0.11 U			0.1	0.12	0.1
Heptachlor	UG/L	U	0.056 U		6		0.06	0.0
		D	0.056 U			0.05	0.06	0.1
Heptachlor epoxide	UG/L	U	0.056 U		6		0.06	0.0
		D	0.056 U			0.05	0.06	0.1
Lindane	UG/L	U	0.056 U		6		0.06	0.0
		D	0.056 U			0.05	0.06	0.1
Methoxychlor	UG/L	U	0.56 U		6		0.55	0.4
		D	0.56 U			0.51	0.62	0.6
PCB-1016	UG/L	U	1.1 U		6		1.1	0.9
		D	1.1 U			1	1.2	1.1
PCB-1221	UG/L	U	2.2 U		6		2.2	1.7
		D	2.2 U			2	2.5	2.2
PCB-1232	UG/L	U	1.1 U		6		1.1	0.9
		D	1.1 U			1	1.2	1.1
PCB-1242	UG/L	U	1.1 U		6		1.1	0.9
		D	1.1 U			1	1.2	1.1
PCB-1248	UG/L	U	1.1 U		6		1.1	0.9
		D	1.1 U			1	1.2	1.1
PCB-1254	UG/L	U	1.1 U		6		1.1	0.9
		D	1.1 U			1	1.2	1.1
PCB-1260	UG/L	U	1.1 U		6		1.1	0.9
		D	1.1 U			1	1.2	1.1
Toxaphene	UG/L	U	5.6 U		6		5.5	4.3
		D	5.6 U			5.1	6.2	5.5
alpha-BHC	UG/L	U	0.056 U		6		0.06	0.0
		D	0.056 U			0.05	0.06	0.1
alpha-Chlordane	UG/L	U	0.056 U		6		0.06	0.0
		D	0.056 U			0.05	0.06	0.1
beta-BHC	UG/L	U	0.056 U		6		0.06	0.0
		D	0.056 U			0.05	0.06	0.1
delta-BHC	UG/L	U	0.056 U		6		0.06	0.0
		D	0.056 U			0.05	0.06	0.1
gamma-Chlordane	UG/L	U	0.056 U		6		0.06	0.0
		D	0.056 U			0.05	0.06	0.1

* U - Upstream
D - Downstream

Table 2
Surface Water Summary

Radiologicals	Units	Sampling Station*	Background	Lab Qual#	Total No. Collected	Minimum	Maximum	Average
Alpha activity	PCI/L	U	11.12		5	3.7	85.31	22.1
		D	14.85			3.92	10.1	7.0
Americium-241	PCI/L	U	1.4		5	0.26	0.93	0.6
		D	0.37			0.4	0.78	0.6
Beta activity	PCI/L	U	12.54		5	4.61	7.57	5.9
		D	12.29			4.51	7.84	6.2
Cesium-137	PCI/L	U	0.25		5	-0.94	0.63	-0.1
		D	-0.4			-1.46	0.47	-0.1
Cobalt-60	PCI/L	U	0.1		5	-2.21	0.68	-0.5
		D	3.07			-1.33	0.53	-0.4
Neptunium-237	PCI/L	U	0.2		4	0.14	0.21	0.2
		D	0.09			0.13	0.19	0.2
Plutonium-238	PCI/L	U	4.32		4	-0.68	1.25	0.2
		D	3.93			-0.69	0.32	-0.1
Plutonium-239	PCI/L	U	0.1		4		0.18	0.1
		D	0.18			0.04	0.26	0.1
Thorium-228	PCI/L	U	0.6		5	0.15	0.2	0.2
		D	0.66			0.06	0.56	0.3
Thorium-230	PCI/L	U	1.3		5	0.08	0.3	0.2
		D	1.87			0.17	0.5	0.3
Thorium-232	PCI/L	U	0.8		5		0.1	0.0
		D	0.56				0.21	0.1
Uranium-234	PCI/L	U	2.4		5	0.56	3.57	1.8
		D	2.63			1.48	3.16	2.1
Uranium-235	PCI/L	U	0		5		0.25	0.1
		D	0			0.05	0.18	0.1
Uranium-238	PCI/L	U	7.47		5	2.07	6.85	3.6
		D	6.78			2.53	8.59	4.3
Anions/Miscellaneous								
Alkalinity	MG/L	U	115		6	107	114	110.7
		D	115			108	119	112.7
Ammonia	MG/L	U	0.1	U	6	0.1	0.1	0.1
		D	0.1	U		0.1	0.1	0.1
Biochemical Oxygen Demand (BOD	MG/L	U	1	U	6	1	2	1.5
		D	1	U		1	7	2.7
Bromide	MG/L	U	0.25	U	6	0.25	0.25	0.3
		D	0.25	U		0.25	0.25	0.3
Chloride	MG/L	U	19.3		6	9.1	13.4	11.5
		D	19			7.8	14.3	11.3
Fluoride	MG/L	U	0.62		6	0.33	0.5	0.5
		D	0.62			0.31	0.5	0.5
Kjeldahl Nitrogen	MG/L	U	0.13		6	0.1	0.1	0.1
		D	0.1	U		0.1	0.11	0.1
Nitrate/Nitrite	MG-N/L	U	3.7		6	1.9	2.5	2.2
		D	3.6			1.8	2.4	2.1
Orthophosphate	MG/L	U	0.66		6	0.25	0.56	0.4
		D	0.62			0.25	0.6	0.4
Phenol	UG/L	U	11	U	6	10	11	10.2
		D	11	U		10	12	10.7
Sulfate	MG/L	U	39.5		6	30.3	34.7	32.8
		D	39.4			31.9	35.3	33.5
Suspended Solids	MG/L	U	9		6	5	6	5.3
		D	5.4			5	5.6	5.1

* U - Upstream
D - Downstream

Table 2
Surface Water Summary

Anions/Miscellaneous Cont.	Units	Sampling Station*	Background	Lab Qual#	Total No. Collected	Minimum	Maximum	Average
Total Phosphate as Phosphorus	MG/L	U	0.3		6	0.18	0.28	0.2
		D	0.25			0.17	0.25	0.2
Semivolatiles								
1,2,4-Trichlorobenzene	UG/L	U	11	U	6	10	11	10.2
		D	11	U		10	12	10.7
1,2-Dichlorobenzene	UG/L	U	11	U	6	10	11	10.2
		D	11	U		10	12	10.7
1,3-Dichlorobenzene	UG/L	U	11	U	6	10	11	10.2
		D	11	U		10	12	10.7
1,4-Dichlorobenzene	UG/L	U	11	U	6	10	11	10.2
		D	11	U		10	12	10.7
2,4,5-Trichlorophenol	UG/L	U	55	U	6	50	55	50.8
		D	55	U		50	60	53.3
2,4,6-Trichlorophenol	UG/L	U	11	U	6	10	11	10.2
		D	11	U		10	12	10.7
2,4-Dichlorophenol	UG/L	U	11	U	6	10	11	10.2
		D	11	U		10	12	10.7
2,4-Dimethylphenol	UG/L	U	11	U	6	10	11	10.2
		D	11	U		10	12	10.7
2,4-Dinitrophenol	UG/L	U	55	U	6	50	55	50.8
		D	55	U		50	60	53.3
2,4-Dinitrotoluene	UG/L	U	11	U	6	10	11	10.2
		D	11	U		10	12	10.7
2,6-Dinitrotoluene	UG/L	U	11	U	6	10	11	10.2
		D	11	U		10	12	10.7
2-Chloronaphthalene	UG/L	U	11	U	6	10	11	10.2
		D	11	U		10	12	10.7
2-Chlorophenol	UG/L	U	11	U	6	10	11	10.2
		D	11	U		10	12	10.7
2-Methyl-4,6-dinitrophenol	UG/L	U	55	U	6	50	55	50.8
		D	55	U		50	60	53.3
2-Methylnaphthalene	UG/L	U	11	U	6	10	11	10.2
		D	11	U		10	12	10.7
2-Methylphenol	UG/L	U	11	U	6	10	11	10.2
		D	11	U		10	12	10.7
2-Nitrobenzenamine	UG/L	U	55	U	6	50	55	50.8
		D	55	U		50	60	53.3
2-Nitrophenol	UG/L	U	11	U	6	10	11	10.2
		D	11	U		10	12	10.7
3,3'-Dichlorobenzidine	UG/L	U	22	U	6	20	22	20.3
		D	22	U		20	24	21.3
3-Nitrobenzenamine	UG/L	U	55	U	6	50	55	50.8
		D	55	U		50	60	53.3
4-Bromophenyl phenyl ether	UG/L	U	11	U	6	10	11	10.2
		D	11	U		10	12	10.7
4-Chloro-3-methylphenol	UG/L	U	11	U	6	10	11	10.2
		D	11	U		10	12	10.7
4-Chlorobenzenamine	UG/L	U	11	U	6	10	11	10.2
		D	11	U		10	12	10.7
4-Chlorophenyl phenyl ether	UG/L	U	11	U	6	10	11	10.2
		D	11	U		10	12	10.7
4-Methylphenol	UG/L	U	11	U	6	10	11	10.2
		D	11	U		10	12	10.7
4-Nitrobenzenamine	UG/L	U	55	U	6	50	55	50.8
		D	55	U		50	60	53.3

* U - Upstream
D - Downstream

Table 2
Surface Water Summary

Semivolatiles Cont.	Units	Sampling Station*	Background	Lab Qual#	Total No. Collected	Minimum	Maximum	Average
4-Nitrophenol	UG/L	U	55	U	6	50	55	50.8
		D	55	U		50	60	53.3
Acenaphthene	UG/L	U	11	U	6	10	11	10.2
		D	11	U		10	12	10.7
Acenaphthylene	UG/L	U	11	U	6	10	11	10.2
		D	11	U		10	12	10.7
Anthracene	UG/L	U	11	U	6	10	11	10.2
		D	11	U		10	12	10.7
Benz(a)anthracene	UG/L	U	11	U	6	10	11	10.2
		D	11	U		10	12	10.7
Benzenemethanol	UG/L	U	11	U	6	10	11	10.2
		D	11	U		10	12	10.7
Benzo(a)pyrene	UG/L	U	11	U	6	10	11	10.2
		D	11	U		10	12	10.7
Benzo(b)fluoranthene	UG/L	U	11	U	6	10	11	10.2
		D	11	U		10	12	10.7
Benzo(ghi)perylene	UG/L	U	11	U	6	10	11	10.2
		D	11	U		10	12	10.7
Benzo(k)fluoranthene	UG/L	U	11	U	6	10	11	10.2
		D	11	U		10	12	10.7
Benzoic acid	UG/L	U	55	U	6	50	55	50.8
		D	55	U		50	60	53.3
Bis(2-chloroethoxy)methane	UG/L	U	11	U	6	10	11	10.2
		D	11	U		10	12	10.7
Bis(2-chloroethyl) ether	UG/L	U	11	U	6	10	11	10.2
		D	11	U		10	12	10.7
Bis(2-chloroisopropyl) ether	UG/L	U	11	U	6	10	11	10.2
		D	11	U		10	12	10.7
Bis(2-ethylhexyl)phthalate	UG/L	U	11	U	6	3	47	15.2
		D	11	U		2	11	9.0
Butyl benzyl phthalate	UG/L	U	11	U	6	10	11	10.2
		D	11	U		10	12	10.7
Carbazole	UG/L	U	11	U	6	10	11	10.2
		D	11	U		10	12	10.7
Chrysene	UG/L	U	11	U	6	10	11	10.2
		D	11	U		10	12	10.7
Di-n-butyl phthalate	UG/L	U	11	U	6	10	11	10.2
		D	11	U		1	12	9.0
Di-n-octylphthalate	UG/L	U	11	U	6	10	11	10.2
		D	11	U		10	12	10.7
Dibenz(a,h)anthracene	UG/L	U	11	U	6	10	11	10.2
		D	11	U		10	12	10.7
Dibenzofuran	UG/L	U	11	U	6	10	11	10.2
		D	11	U		10	12	10.7
Diethyl phthalate	UG/L	U	11	U	6	10	11	10.2
		D	11	U		10	12	10.7
Dimethyl phthalate	UG/L	U	11	U	6	10	11	10.2
		D	11	U		10	12	10.7
Fluoranthene	UG/L	U	11	U	6	10	11	10.2
		D	11	U		10	12	10.7
Fluorene	UG/L	U	11	U	6	10	11	10.2
		D	11	U		10	12	10.7
Hexachlorobenzene	UG/L	U	11	U	6	10	11	10.2
		D	11	U		10	12	10.7
Hexachlorobutadiene	UG/L	U	11	U	6	10	11	10.2
		D	11	U		10	12	10.7

* U - Upstream
D - Downstream

Table 2
Surface Water Summary

Semivolatiles Cont.	Units	Sampling Station*	Background	Lab Qual#	Total No. Collected	Minimum	Maximum	Average
Hexachlorocyclopentadiene	UG/L	U	11	U	6	10	11	10.2
		D	11	U		10	12	10.7
Hexachloroethane	UG/L	U	11	U	6	10	11	10.2
		D	11	U		10	12	10.7
Indeno(1,2,3-cd)pyrene	UG/L	U	11	U	6	10	11	10.2
		D	11	U		10	12	10.7
Isophorone	UG/L	U	11	U	6	10	11	10.2
		D	11	U		10	12	10.7
N-Nitroso-di-n-propylamine	UG/L	U	11	U	6	10	11	10.2
		D	11	U		10	12	10.7
N-Nitrosodiphenylamine	UG/L	U	11	U	6	10	11	10.2
		D	11	U		10	12	10.7
Naphthalene	UG/L	U	11	U	6	10	11	10.2
		D	11	U		10	12	10.7
Nitrobenzene	UG/L	U	11	U	6	10	11	10.2
		D	11	U		10	12	10.7
Pentachlorophenol	UG/L	U	55	U	6	50	55	50.8
		D	55	U		50	60	53.3
Phenanthrene	UG/L	U	11	U	6	10	11	10.2
		D	11	U		10	12	10.7
Pyrene	UG/L	D	11	U	6	10	11	10.2
		U	11	U		10	12	10.7
Field Measurements								
Conductivity	MS/CM	U	0.332		30	0.125	0.375	
		D	0.326			0.132	0.383	
pH	PH	U	8.01		30	7.34	8.12	
		D	8.19			6.52	7.99	
Temperature	DEGC	U	27		30	19.5	25	
		D	27.8			19.5	25.5	
Turbidity	NTU	U	-10		30	-10	40	
		D	-10			-10	74	

- Laboratory Qualifier
U - Not detected at the concentration indicated.
= - Validated and detected at the concentration indicated.

* U - Upstream
D - Downstream

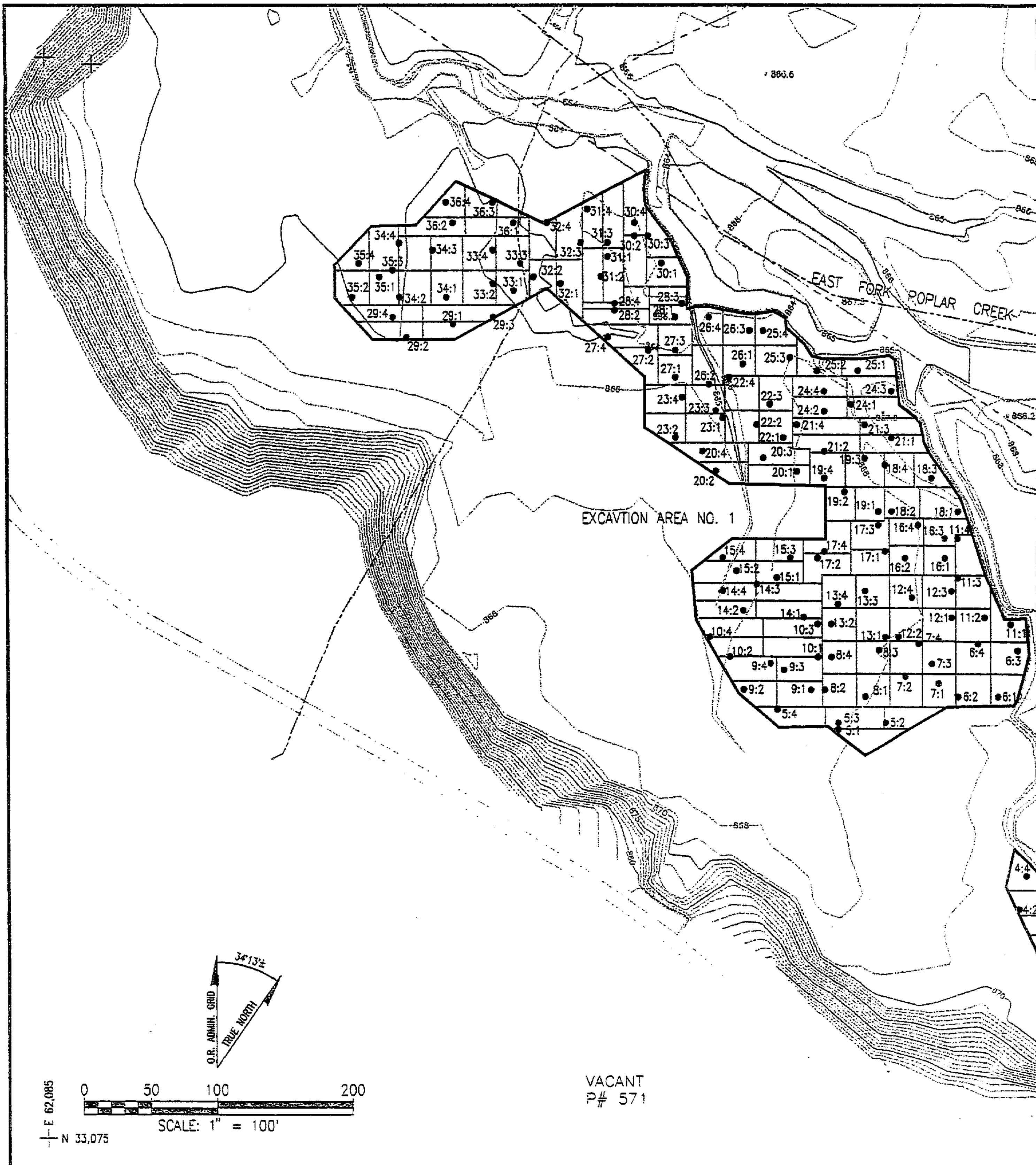
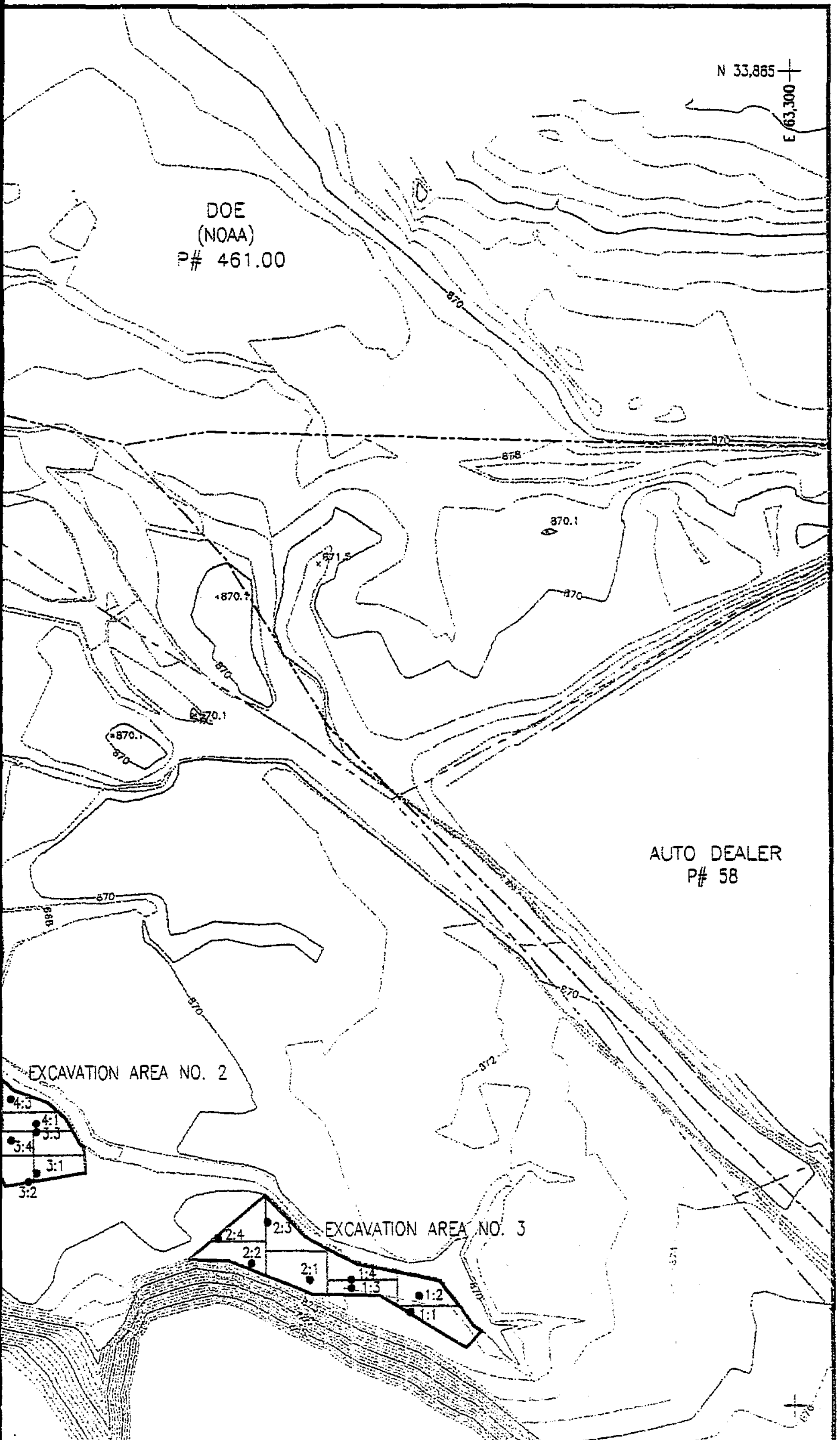


Fig. 2 Phase I Remediation Action Confirmatory
at the NOAA Facility.



LEGEND:

- ...... PARCEL BOUNDARY
- .... CREEK & TRIBUTARIES
- 870 . . .5 FOOT CONTOUR INTERVAL
- . . .1 FOOT CONTOUR INTERVAL
- .... EXCAVATION AREA
- .EXCAVATION CONFIRMATION UNIT
- ● . . . . SAMPLE LOCATION
- + ... OAK RIDGE ADMINISTRATIVE GRID

NOTES:

1. EXISTING TOPOGRAPHIC SITE FEATURES AND COORDINATES SHOWN TAKEN FROM FIELD RUN TOPOGRAPHIC SURVEY PERFORMED BY ETE CONSULTING ENGINEERING, DATED 12/95. COORDINATE SYSTEM IS BASED UPON THE OAK RIDGE ADMIN. GRID.
2. EXCAVATION LIMITS SHOWN ARE TAKEN FROM INFORMATION PROVIDED BY JACOBS ENGINEERING GROUP, DATED 2/28/96.
3. THE ACTUAL CONFIRMATORY SAMPLING POINT IS LOCATED WITHIN THE BOUNDARY LINES OF THE ECU.

SAIC®
Science Applications International Corporation

LOWER EAST FORK POPLAR CREEK
PHASE I – NOAA AREA
OAK RIDGE, TENNESSEE

REVISION	DRAWN BY:	CHKD. BY:	DATE:
0	J. HOY	A. BAILEY	10-29-96

XREFERENCES	PLOT FILES
96022\XREF\96RDADM.DWG 96024\XREF\PAR-93.DWG	96024\PLOT\558ECU2.HP

SHT 1 OF 1 — DRAWING #

96024\DWGS\558ECU2 — CAD FILE #

Sampling Point Locations

been excavated and analyzed by utilizing the EPA approved field screening method, the Static Headspace Analysis for Mercury in soils. After several days of excavation and sampling, it was determined that the excavation process could be expedited by performing the confirmatory sampling prior to excavation of the ECUs. This was accomplished by removing a 16-in. layer of contaminated soil from each of the 4 confirmatory sampling locations within an ECU with a hand auger, then obtaining a 16-in. core sample from the 16-in. to 32-in. interval for analysis. This approach established the depth to be excavated, and allowed the contractor to rapidly excavate the ECUs. A total of 146 confirmatory soil samples were taken in the 36 ECUs. As shown on Table 3, all confirmatory sample results collected from the 16-in. to 32-in. interval are <400 ppm except for samples collected from locations ECU 11:1 and 21:1. At these locations, the confirmatory samples collected from a depth of 16-in. to 32-in. below ground surface (BGS) had high mercury concentrations; ECU 111:1, 1105 ppm and ECU 21:1, 651 ppm. At these two ECUs, the area surrounding the sampling stations of ECU 11:1 and ECU 21:1 were excavated to a depth of 32-in. BGS. According to the SAP, excavation below a depth of 16-in., or over excavation, will only be required if the mean of the ECU is ≥400 ppm. Although the mean of ECU 11 and ECU 21 were not ≥400 ppm, the mercury levels were considered to be excessive and; therefore, the areas were overexcavated. Afterwards, additional confirmatory samples were collected at both locations from a depth of 32-in. to 48-in. BGS to ensure that the effected areas had been excavated sufficiently. The results for both samples were well below the criteria. The mean value was calculated for each of the 36 ECUs and in all cases was well below the cleanup criteria, even for ECUs 11 and 21. The Static Headspace Analysis method worked very successfully. Additionally, 25% of the RAC samples or a total of thirty seven 16-in core soil samples were taken by the Independent Verification Contractor (IVC) for off-site laboratory analysis. Only 1 IVC sample was found with higher than acceptable contaminant levels. The area, ECU 21, identified as contaminated by the IVC sampling was over excavated and resampled as discussed above. Table 4 summarizes the IVC sample results, which compares the IVC off-site laboratory analysis with the RAC static headspace analysis results. The IVC also assisted the excavation effort by visually locating the black layer, which is likely to contain elevated levels of mercury contamination, to identify additional areas requiring over excavation.

The FPSC initially assumed that a large drying bed would not be necessary but constructed a small area to be used if needed; however, due to the above average rainfall during the RA, the drying bed was enlarged to handle the wet soils. After removal from the floodplain, the excavated soils were taken either directly to the landfill or to the drying bed. Initially, the wet soils were allowed to air dry, but due to the numerous rain events, this methodology proved unsuccessful. Additionally, the landfill experienced problems handling soils from the floodplain that were too soft to allow equipment to spread without using a excessive amount of cover (~ 500%). In addition, the soft soil was creating difficulty in complying with a condition specified in the TDEC special waste approval letter. This required the wet contaminated soils to be moved into the drying bed where they were mixed with CKD with a trackhoe and allowed to dry before being loaded into lined dump trucks for transportation to the landfill. The CKD/soil mix allowed for reduced amounts of cover material (~25%) to be used at the landfill.

The subcontractor filled out shipping papers for each load of contaminated soil. Health Physics provided additional documentation for each truck stating that the contaminated soils were not removed from a posted radiological area. The access monitor verified both documents before the trucks were permitted to exit the site. A total of 556 loads or approximately 5560 yd^3 of contaminated soils were shipped to the landfill during Phase I.

Table 3: Confirmation sampling summary

ECU	Units	Sampling Station 1	2	3	4	*Mean	Std. Deviation	*$\mu_{U\alpha}$	*Clean/Dirty
ECU001	UG/G	3	1	1	12	4	5	10	Clean
ECU002	UG/G	371	1	16	8	99	181	312	Clean
ECU003	UG/G	1	1	64	81	37	42	86	Clean
ECU004	UG/G	363	8	36	5	103	174	308	Clean
ECU005	UG/G	1	46	1	1	12	22	38	Clean
ECU006	UG/G	14	1	35	4	14	15	32	Clean
ECU007	UG/G	106	13	145	1	66	70	149	Clean
ECU008	UG/G	1	5	1	62	17	30	52	Clean
ECU009	UG/G	4	3	7	29	11	12	25	Clean
ECU010	UG/G	9	19	23	9	15	7	23	Clean
ECU011	UG/G	1	5	31	22	15	14	32	Clean
ECU012	UG/G	2	1	4	2	2	1	3	Clean
ECU013	UG/G	1	18	6	19	11	9	22	Clean
ECU014	UG/G	7	6	17	27	14	10	26	Clean
ECU015	UG/G	13	15	12	3	11	5	17	Clean
ECU016	UG/G	3	4	3	9	5	3	8	Clean
ECU017	UG/G	19	1	44	1	16	20	40	Clean
ECU018	UG/G	304	19	24	353	175	178	385	Clean
ECU019	UG/G	9	29	4	4	11	12	26	Clean
ECU020	UG/G	28	1	33	14	19	14	36	Clean
ECU021	UG/G	1	25	73	33	33	30	68	Clean
ECU022	UG/G	12	9	21	5	11	7	20	Clean
ECU023	UG/G	87	31	21	1	35	37	78	Clean
ECU024	UG/G	74	35	4	3	29	34	69	Clean
ECU025	UG/G	11	1	1	181	49	88	153	Clean
ECU026	UG/G	16	3	81	10	28	36	70	Clean
ECU027	UG/G	1	30	1	3	9	14	26	Clean
ECU028	UG/G	1	33	14	1	12	15	30	Clean
ECU029	UG/G	5	3	20	5	8	8	17	Clean
ECU030	UG/G	3	1	1	1	2	1	3	Clean
ECU031	UG/G	1	1	1	1	1	0	1	Clean
ECU032	UG/G	13	34	1	1	12	16	31	Clean
ECU033	UG/G	1	24	1	5	8	11	21	Clean
ECU034	UG/G	14	3	6	21	11	8	20	Clean
ECU035	UG/G	4	27	11	5	12	11	24	Clean
ECU036	UG/G	3	7	3	1	4	3	7	Clean

ECU = Excavation Confirmation Unit

Station = Sampling location within the ECU

*Mean = The mean was calculated using the 4 primary samples. It does not include replicate samples.

*$\mu_u\alpha$ = This value expresses the upper one-sided 100 (1-α) percent confidence limit around the mean and is used to determine the success of the remedial clean-up effort by applying a confidence estimate (95%) to the null and alternative hypothesis.

*Clean/Dirty = If $\mu_u\alpha < 400$, then the ECU is clean
If $\mu_u\alpha > 400$ or = 400, then the ECU is dirty

Table 4: IVC Split Sampling Analytic Results

Collection	Independent Verification Contractor			Remedial Action Contractor	
Station	Sample ID	Blind ID	Result[a]	Sample ID	Result[a]
ECU005:3	EFPCSS1361	EF-C017801	0.07	SAICE00051	0
ECU008:4	EFPCSS1362	EF-C017803	60	SAICE00064	61.9
ECU007:3	EFPCSS1363	EF-C017805	136	SAICE00059	144.5
ECU012:2	EFPCSS1364	EF-C017807	1	SAICE00078	0
ECU009:3	EFPCSS1365	EF-C017901	3.1	SAICE00067	22.5
ECU032:4	EFPCSS1366	EF-C018503	0.25	SAICE00060	1
ECU010:3	EFPCSS1369	EF-CO18001	20.3	SAICE00071	22.6
ECU015:4	EFPCSS1370	EF-C018003	2.1	SAICE00092	3.2
ECU014:1	EFPCSS1371	EF-C018005	3.7	SAICE00085	7
ECU017:1	EFPCSS1372	EF-C018007	7.8	SAICE00097	19.1
ECU006:2	EFPCSS1373	EF-C018101	0.81	SAICE00054	1
ECU011:4	EFPCSS1374	EF-C018103	20.4	SAICE00076	22
ECU016:2	EFPCSS1375	EF-C018105	2.7	SAICE00094	4.2
ECU013:3	EFPCSS1377	EF-C018201	1.4	SAICE00083	5.5
ECU018:1	EFPCSS1378	EF-C018203	255	SAICE00101	304
ECU019:4	EFPCSS1379	EF-C018205	1.5	SAICE00108	3.6
ECU020:1	EFPCSS1380	EF-C018207	14.9	SAICE00109	27.8
ECU021:1	EFPCSS1381	EF-C018301	533	SAICE00113	651
ECU022:1	EFPCSS1382	EF-C018303	8.6	SAICE00117	11.5
ECU024:1	EFPCSS1383	EF-C018305	70.1	SAICE00125	74.2
ECU023:2	EFPCSS1385	EF-C018401	26.9	SAICE00122	30.6
ECU025:2	EFPCSS1386	EF-C018403	1.6	SAICE00130	1
ECU026:1	EFPCSS1387	EF-C018405	12.6	SAICE00133	16.3
ECU030:1	EFPCSS1388	EF-C018407	4.2	SAICE00149	3.4
ECU031:1	EFPCSS1389	EF-C018501	0.49	SAICE00153	1
ECU033:4	EFPCSS1390	EF-C018505	0.27	SAICE00164	4.8
ECU034:4	EFPCSS1391	EF-C018507	21.5	SAICE00179	20.8
ECU035:1	EFPCSS1392	EF-C018601	11.1	SAICE00180	4.2
ECU036:2	EFPCSS1393	EF-C018603	5.1	SAICE00185	7.1
ECU021:1R	EFPCSS1396	EF-C018701	0.08	SAICE00900	1
ECU027:3	EFPCSS1397	EF-C018703	0.17	SAICE00139	1
ECU028:2	EFPCSS1398	EF-C018705	27.9	SAICE00142	33.4
ECU029:1	EFPCSS1399	EF-C018707	5.7	SAICE00145	5.3
ECU003:4	EFPCSS1400	EF-C018801	53.9	SAICE00012	81.4
ECU004:4	EFPCSS1404	EF-C018901	5.3	SAICE00016	4.97
ECU002:2	EFPCSS1405	EF-C018903	0.41	SAICE00006	1
ECU001:1	EFPCSS1406	EF-C018905	1.4	SAICE00001	3.1

[a] Results are mercury concentrations in mg/kg

Approximately 29,000-gal of wastewater from the drying bed and excavation areas were collected during the remedial activities due to unseasonably large amounts of rainfall during the month of July 1996. A 22,000-gal FRAC tank was mobilized to the site to allow for storage of large amounts of water awaiting filtration. A total of 20,000-gal of wastewater were collected from the July 1996 rain events. The water was filtered on-site and analyzed in accordance with the *Sampling and Analysis Plan for the Treatment Water and Creek Water for the LEFPC (Y/ER-261, April 1996).* Once it was determined that the filtered water met the POTW requirements, it was released into City of Oak Ridge manhole number MH L 12-1 between August 3, 1996 and August 5, 1996 without incident. A summary of the treated water analytical results is included in Table 5.

On August 9, 1996, approximately 500-gal of wastewater collected from the drying bed was filtered and discharged into the sewer prior to receipt of the sample results. Results from the sampling event received August 14, 1996 on the drying bed wastewater indicated that mercury and iron values were above the POTW permit limits. Notifications were made to appropriate parties, and a follow-up letter was sent to DOE *(Ltr. ER-JTB/96-67)*. After consultation with the design engineer and manufacturer of the wastewater filtration unit, the filter setup was modified to be more effective. The additional 8,000-gal of wastewater collected during the remainder of the Phase I RA were held for review of the analytical results before release into the sewer system as a preventive measure.

Health Physics personnel continuously monitored the excavation areas, contaminated soils, and trucks prior to leaving the site for levels of radiological contamination with a variety of instrumentation. During excavation activities, several pockets of elevated radiologically contaminated soil were located. Once located, these soils were sampled for additional characterization and secured by covering with plastic and clean backfill material to prevent migration. After the sample results were reviewed with DOE, TDEC, and the project team, these soils (~120 yd^3), were excavated by properly trained personnel and placed in a controlled storage area at the staging area for additional characterization prior to final disposal. Through characterization sampling it has been determined that ~80 yd^3 meet the WAC and will be transported to the Y-12 Industrial Landfill V for disposal. The additional ~40 yd^3 which do not meet the WAC for radiological constituents included in the Special Waste Permit for Landfill V, will be placed in 21st Century containers for storage at the K-25 site. The analytical results are summarized in Table 6.

During the Phase I RA, continuous air monitoring for mercury was performed at a site behind the NOAA facility (Figure 1) from March 10 to October 14, 1996. The purpose of the air monitoring was to ascertain whether or not the excavation resulted in the release of airborne mercury to the surrounding area. A Techran Model 2537A Mercury Vapor Analyzer was used to monitor airborne mercury above the floodplain. The Techran analyzer was selected because it can provide continuous monitoring and is many times more sensitive than typical hand-held mercury vapor analyzers, such as the Jerome meter, and is capable of measuring mercury concentrations at ambient (i.e., background) levels. The results of the mercury vapor monitoring indicate that the concentrations of mercury in air above the floodplain may be slightly above background concentrations, but are much too low to be a human health threat. This increase was attributed to the coincidental increase in temperature and sunlight during the majority of the excavation. The mean concentrations ranged from 3.2 - 8.5 ng/m^3 and the median concentrations ranged from 2.4 - 6.4 ng/m^3. Background levels vary from 1 - 2 ng/m^3 over the open ocean, approximately 2 ng/m^3 at Walker Branch Watershed and to 4 - 6 ng/m^3 at a background site in Indiana. The values above the floodplain are at or slightly above these background values and

Table 5: Treatment Water Summary Table

Analyte		POTW Permit Requirements UG/L	Initial Sampling Event 1-Aug-96 Tank 1* UG/L	Tank 2* UG/L	Tank 3* UG/L	Weekly Sampling Event 9-Aug-96 UG/L	Resampling** Event 14-Aug-96 UG/L	Final Sampling Event 27-Aug-96 UG/L
Arsenic								
	Influent	1500	4.1	4.1	4.1	7.1		
	Effluent		4.1	4.1	4.1	6.3		
Cadmium								
	Influent	110	0.7	0.7	0.7	2		
	Effluent		0.7	0.7	0.7	1		
Chromium								
	Influent	1500	6.7	6.7	8.5	13.6		
	Effluent		5.8	5.5	5.4	9.1		
Copper								
	Influent	1500	22.3	17.8	22.4	49.1		
	Effluent		19	14.9	22.5	40.6		
Cyanide (Total)								
	Influent	1200	5	5	5		5	5
	Effluent		5	10	5		5	5
Iron								
	Influent	4000	3330	3080	3580	9650	10400	26200
	Effluent		2760	2900	2720	6250	29500	795
Lead								
	Influent	690	21.2	28.6	20.4	24.3		
	Effluent		8.1	9.1	7.2	20.4		
Mercury								
	Influent	35	20.8	20.1	18	91.8	64	51.6
	Effluent		6.5	6.6	5.9	46.9	51	2.5
Nickel								
	Influent	1500	7.1	6.5	9.2	20.4		
	Effluent		4.1	5.8	4.5	13.5		
Selenium								
	Influent	1000	4.2	4.2	4.2	4.2		
	Effluent		4.2	4.2	4.2	4.2		
Silver								
	Influent	500	0.9	0.9	0.9	1.2		
	Effluent		0.9	1.1	0.9	0.9		
Zinc								
	Influent	2500	82.8	74.3	105	79		
	Effluent		39.1	35.2	59.5	59.7		

* The samples were collected from individual 500 gallon tanks that represented a batch of treated water.

** This batch of water was treated and sampled again. It was not released to the City sewer system because of the high iron and mercury content.

Table 6: Rad Contaminated Soil Sampling Results

Sample ID[a]	234U (pCi/g)	235U (pCi/g)	238U (pCi/g)	Total Rad (pCi/g)[b]
12123	22	0.9	23	45.9
10123	43	1.9	46	99.9
08123	20	0.85	19	39.85
05123	38	1.7	36	84.7
09123	1.5	0.06	1.3	2.86
07123	12	0.6	16	28.6
06123	8	0.3	7	15.3
04123	14	0.6	15	29.6
03123	13	0.5	14	27.5
02123	9	0.4	10	19.4
01123	5	0.2	5	10.2
11123	2.6	0.1	2.4	5.1

[a] Sample represents a composite of 3 grab samples taken from each of 12 soil piles located in the controlled storage area at the NOAA staging area.

[b] Acceptance criteria at the Y-12 landfill is less than 35 pCi/g total uranium.

indicate that there was no discernable impact on ambient air quality due to construction activities.

During Phase I, site access controls were maintained around the clock with an access monitor located at the entrance of the site. During hours of operation, the monitor was responsible for maintaining an access list and monitoring shipping papers for waste transportation. The access monitor also provided health and safety controls to ensure that no one without the proper training was allowed to enter the site without an escort. After hours, the access monitor was provided by CET through a commercial security firm (Pinkerton) and had health and safety responsibilities for site control. Additionally, the equipment staging area, where the drying beds and equipment were located, was fenced. The removal of the staging area and site restoration is included in Phase II of this project.

All secondary contaminated wastes; tree stumps, plastic, filters, PPE, etc., were shipped with the contaminated soils to Landfill V, non-contaminated tree stumps were transported to the Construction/Demolition Landfill VI, and all other secondary wastes; non-contaminated, sand, and gravel, etc., were transported to the Y-12 Spoil Area in accordance with the *LEFPC Waste Management Plan (Y/ER-264/R1)*.

During the RA, Health and Safety (H&S) was a priority and the H&S measures implemented were successful in achieving no lost time due to injuries, no radiological exposures to personnel, and H&S audits found no reportable incidents.

4. DEVIATIONS FROM THE ROD

LEFPC Phase I was performed in accordance with the requirements listed in the *Record of Decision (ROD) (DOE/OR/02-1370&D2, August 18, 1995)* and the *Explanation of Significant Differences for the Lower East Fork Poplar Creek Record of Decision Oak Ridge Tennessee (DOE/OR/02-1443&D2).* There were no deviations from the ROD.

5. WASTE MANAGEMENT/TRANSPORTATION ACTIVITIES

Wastes generated during LEFPC Phase I were stored, transported, and disposed of in accordance with applicable waste regulations and U.S. Department of Transportation regulations, primarily DOT federal motor carrier safety regulations, hazardous materials regulations, and EPA regulations. All materials were transported in standard 12 yd^3 dump trucks, filled to 10 yd^3. The trucks used to haul contaminated soils were lined with 6 mil plastic prior to filling with soil and the liners disposed of with the soil. The trucks were also covered with canvas covers prior to leaving the site or borrow area. Treated water was transported in a poly tank by truck to the POTW manhole for disposal. The *Waste Management Plan (Y/ER-264)* provided a disposition table for primary and secondary waste. Despite a total of 703 loads of contaminated and non-contaminated waste hauled from the site for disposal, and approximately an additional 560 loads of fill and backfill hauled to the site during Phase I, there were no traffic incidents; however minor repairs to city roads are required. The city roads were kept clean, during the RA, by routine washing and brooming by CET. The material hauled during the Phase I RA is summarized in Table 7 and compared to the waste management plans estimates.

A special waste permit granted by TDEC in 1995 allowed for the disposal of excavated soils and contaminated secondary waste at the Y-12 Industrial Landfill V. The soils were classified as non-RCRA characteristic waste. U.S. DOT regulations required shipping papers and placards to be used with each truck load of contaminated soils. Landfill V waste acceptance criteria (WAC) also required a letter to accompany each truck load of contaminated soil stating that it had not been excavated from a posted radiological area. Additionally a 2109, Request for Disposal Form, was required by the RAC for each type of waste generated. A single 2109 Form could cover a maximum of 200 truck loads of waste.

Table 7: Waste and Material Hauling Summary

Material	Estimated Quantity	Actual Quantity	Disposition
Mercury contaminated soil, tree stumps, and PPE	5156 yd^3	5560 yd^3	Y-12 Landfill V
Non-contaminated tree trunks, limbs and brush	2126 yd^3	1310 yd^3	Y-12 Burn Area for burning
Non-contaminated tree stumps	0 yd^3	50 yd^3	Construction/Demolition Landfill VI
Non-contaminated sand and gravel	660 yd^3	110 yd^3	Y-12 Spoil Area
Suspected Rad contaminated Soils[a]	0	~90 yd^3	Y-12 Landfill V
Rad contaminated soil	0	~40 yd^3	Placed in 21st Century containers for storage at K-25
Fill and backfill	5160 yd^3	~5600 yd^3	Used for access road construction and as site backfill
Treated Wastewater	205,200 gal	~29,000 gal	POTW

[a] Additional characterization performed indicated that these soils were not radiologically contaminated above 35 pCi/g.

6. OPERATIONAL AND MAINTENANCE PLANS

LEFPC Phase I was conducted in accordance with the *Phase I Remedial Design Report and Remedial Action Work Plan (DOE/OR/0-1448&D2)*. Additional documentation generated to support operations included *Best Management Practices Plan for the Lower East Fork Poplar Creek Remedial Action Project, Oak Ridge, Tennessee (Y/ER-260/R1)* and the *Environmental Compliance Plan for the Lower East Fork Poplar Creek Remedial Action Project at Oak Ridge, Tennessee (Y/ER-275)*.

As previously discussed in Section 3, the confirmatory sampling methodology was modified several days into the RA. Additionally, the number of QA/QC samples taken for confirmatory sampling were taken at a rate of 25%; however, since off-site laboratory results and the on-site laboratory results correlated well, *The Confirmatory Sampling and Analysis Plan for the LEFPC* on (Y/ER-25B) will be revised to recommend a 10% QA/QC rate for Phase II. The plan revision will also include the modification to the sampling methodology. The revised plan will be sent to the EPA for approval.

Additionally, *The Sampling and Analysis Plan for Treatment Water and Creek Water for the LEFPC OU* (Y/ER-261) will be modified to request that the full suite of creek water sampling be decreased to once a month and after storm events since there was no fluctuation in the weekly sampling results during Phase I.

A lessons learned for Phase I was performed and incorporated into the Phase II Remedial Design Package. The three primary lessons learned were the poor workability of the floodplain soils for the landfill operators, the HP monitoring to locate the elevated radiologically contaminated soils, and the necessity of receiving analytical results prior to discharge of wastewater to the POTW. It was determined that soils that passed the paint filter test were not necessarily workable for the landfill. Soft soils needed to be stabilized and CKD was cost-effective for this purpose. The identification of elevated radiologically contaminated soils emphasized the need for continual HP monitoring during RA activities and established procedures to handle the soils. Additionally for Phase II, it will be required to receive wastewater sampling results prior to discharge to the POTW.

7. MONITORING SCHEDULE AND/OR EXPECTATIONS

The monitoring for LEFPC is outlined in the *Baseline and Postremediation Monitoring Program Plan for the Lower East Fork Poplar Creek Remedial Action Project Oak Ridge, Tennessee (Y/ER-262/R1).* This document provides the Environmental Restoration Program with information about the requirements to monitor for soil and terrestrial biota in the East Fork Poplar Creek (EFPC) floodplain; sediment, surface water, and aquatic biota in EFPC; wetland restoration in the EFPC floodplain; and human use of shallow groundwater wells in the EFPC floodplain for drinking water. The document describes the monitoring program that will ensure that actions taken under Phases I and II of the Lower East Fork Poplar Creek Remedial Action are protective of human health and the environment.

Prior to the Phase I RA, baseline monitoring was performed that included the placement of starling boxes to collect specimens for bio-accumulation studies, as well as samples collected for sediment toxicity, surface water toxicity, fish bio-accumulation and earthworm bio-accumulation studies. The results of these analyses will establish the baseline for comparison with the 5-yr monitoring results designed to monitor the long-term effect of the remediation of the LEFPC Ecosystem.

REFERENCES

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