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PROJECT SPECIFIC PLAN FOR SURFACE AND SUBSURFACE SOIL SAMPLING INVESTIGATION JUNE 1993
DRAFT ADDENDUM TO THE RI/FS WORK PLAN

06/21/93

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ADDENDUM

4492

PROJECT SPECIFIC PLAN

for

SURFACE AND SUBSURFACE SOIL SAMPLING INVESTIGATION

WBS No. 50.03.18

Draft Addendum to the
Remedial Investigation/Feasibility Study
Work Plan

Prepared by

Fernald Environmental Restoration Management Corporation

Prepared for

U.S. Department of Energy
Fernald Field Office

Under Contract DE-AC05-92OR21972

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1.0 INTRODUCTION

CERCLA/RCRA Unit 5 (CRU5) has developed this Project Specific Plan (PSP) as a means to further assess contaminant concentrations in surface and subsurface soils at locations on and off the Fernald Environmental Management Project (FEMP) property during the Spring of 1993. The data acquired from this program will supplement existing data and will be used in the site characterization and risk assessment sections of the Remedial Investigation (RI) report for Operable Unit (OU) 5. This PSP has been developed under the specifications of the Fernald Environmental Management Project (FEMP) Sitewide CERCLA Quality Assurance Project Plan (SCQ), and all field operations and data handling procedures will be consistent with the specifications in the FEMP SCQ.

This PSP is an addendum to the RI/FS Work Plan. The purpose of this PSP is to address the soil data needs of the OU 5 RI report.

2.0 PREVIOUS INVESTIGATIONS

This PSP specifies the locations where additional soils data are needed to support the RI report. In addition, several shallow soil samples and soil borings are proposed in order to fill data needs identified as a result of a thorough review of available soil data.

Initial data was collected during the Characterization Investigation Study (CIS) (Weston 1987). However, the majority of the existing data stemmed from the March 1988 RI/FS Work Plan and its addenda. Work plan addenda that modified the March 1988 Work Plan which included additional soil sampling and/or borings are listed below:

- Production Area and Additional Suspect Area Work Plan, DCR 33, October 13, 1989
- Section 3.5, Add-on to the Production Area and Additional Suspect Areas Work Plan, DCR 63, March 11, 1991
- Operable Unit 5 Addenda, October 1992

In addition to these formal RI/FS sampling programs, several smaller sampling programs have been conducted to support removal actions and construction projects throughout the former production area.

3.0 SOIL BORINGS AND BACKGROUND DATA

Section 3.1 discusses the soil sampling proposed for the former production area and Section 3.2 details the sampling proposed for areas outside the former production area. Target Analyte Lists (TALs), in Appendix A, specify the individual analytical parameters for soil and quality control samples. Table 3-1 distinguishes the proposed sample intervals of the four categories of soil sampling to be conducted. Surface soil samples collected over a depth of 0.0 to 0.5 feet will be collected outside the former production area. Within the former production area, shallow soil samples include samples at a depth of 0.0 to 0.5 feet and 1.0 to 1.5 feet to confirm that contamination due to deposition of airborne contaminants is on the surface only. Shallow borings include samples at depths of 0.0 to 0.5, 1.0 to 1.5, 2.5 to 3.0 and 4.5 to 5.0 feet and are in areas where surface spills are the likely cause of contamination. Deep borings will be used to determine if soil contamination has reached the perched water table or significant depth within the glacial overburden. Deep borings consist of samples at depths of 0.0 to 0.5, 1.0 to 1.5, 2.5 to 3.0 and six-inch samples at three-foot intervals to the water table. Sample intervals below 3.0 feet in deep borings will be at 6.0 to 6.5, 9.0 to 9.5, 12.0 to 12.5, 15.0 to 15.5, 18.0 to 18.5 and 20.0 to 20.5 unless the water table is encountered. Soil samples will not be collected below the water table.

TABLE 3-1
SOIL SAMPLE DEPTHS BY BORING TYPE

Surface	Shallow Sample	Shallow Boring	Deep Boring
0.0 to 0.5	0.0 to 0.5	0.0 to 0.5	0.0 to 0.5
	1.0 to 1.5	1.0 to 1.5	1.0 to 1.5
		2.5 to 3.0	2.5 to 3.0
		4.5 to 5.0	6.0 to 6.5
			9.0 to 9.5
			12.0 to 12.5
			15.0 to 15.5
			18.0 to 18.0
			20.0 to 20.5

3.1 FORMER PRODUCTION AREA SOIL SAMPLING

Sample analyses for hazardous substance list (HSL) organic and inorganic parameters and radiological data available from the former production area were reviewed to identify potential data needs for the OU 5 Remedial Investigation. The horizontal and vertical extent of radiological contamination at the FEMP is well defined. However, most of the existing radiological data was analyzed at the on-site laboratory. This data will be confirmed by additional radiological sampling proposed in this PSP which will be analyzed at Analytical Support Level (ASL) C as defined in the SCQ. The proposed radiological sampling will supplement existing data collected under the March 1988 RI/FS Work Plan and its addenda.

The available HSL data are summarized in Appendix B. Sampling for HSL constituents has not been extensive and was biased toward suspected source areas. Soil sample locations and depths for HSL analyses were otherwise selected on the basis of field screening results using an HNu photoionization detector (PID). Thus, the horizontal and vertical extent of HSL contamination across the former production area is not well defined.

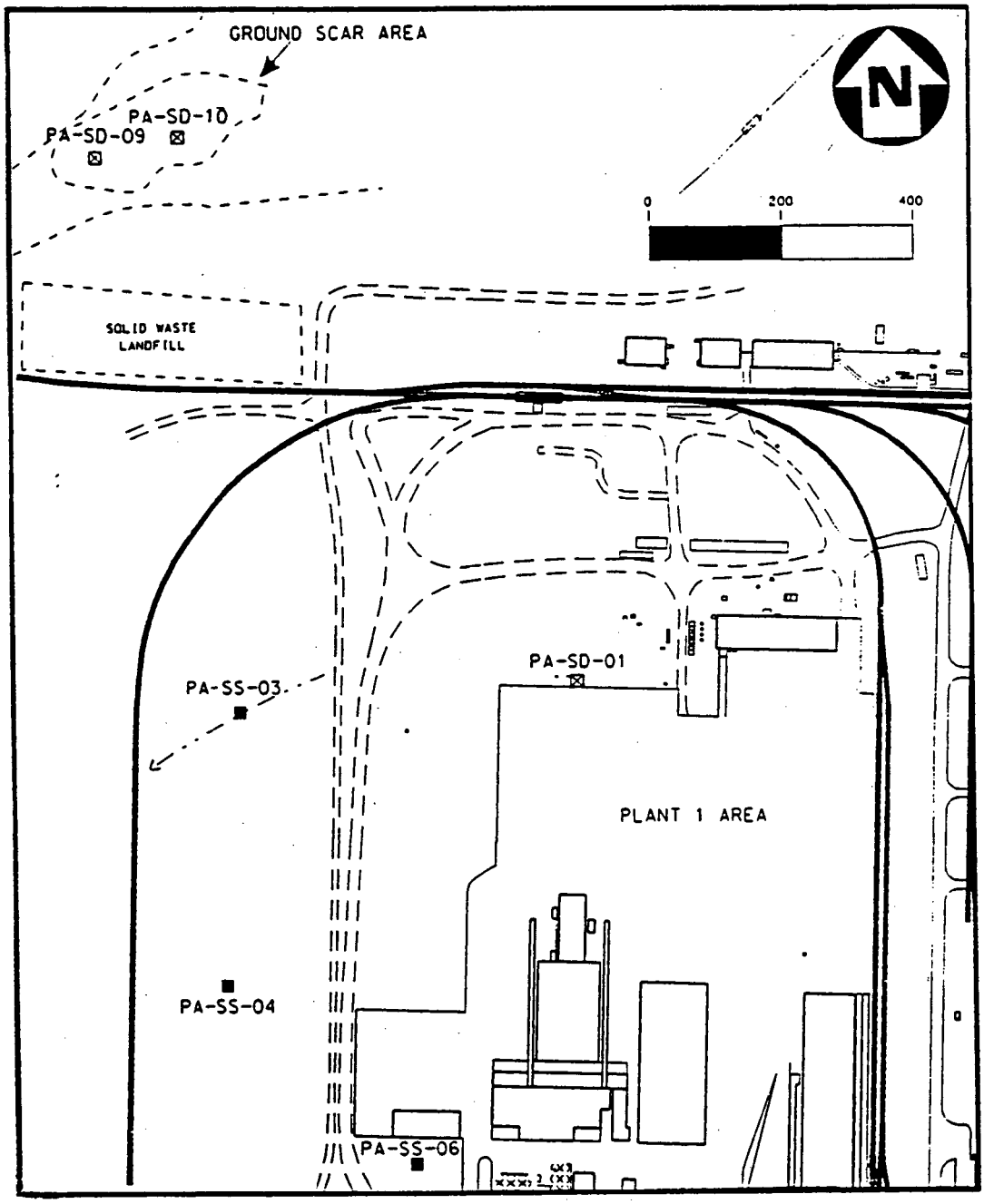
The following discussion presents the sampling to be conducted in the former production area, which has been divided into quadrants to facilitate the presentation of this plan. All soil samples collected in the former production area will be analyzed for HSL inorganic, volatile and semivolatile organic, pesticide/PCB analyses and limited radiological analysis as listed in TAL 50.03.18A, Appendix A.

3.1.1 Northwest Quadrant

Figure 3-1 shows the locations that will be sampled in the northwest quadrant. As a part of the CIS (Weston, 1987), a systematic radiological survey of surface soils in the waste pit area was conducted (Figure 3-2). A field instrument for detecting low energy radiation (FIDLER) was used to survey at a 50-foot by 50-foot grid over the entire waste pit area.

An initial set of soil samples (0 to 2 inches) was analyzed for Uranium-238 activity and was used for site-specific calibration of the FIDLER counts per minute readings. The FIDLER was used to locate spots where Uranium-238 activity concentrations in surface soils exceeded 35 pCi/g. When these spots were located, soil samples were collected and submitted to the on-site laboratory for Uranium-238 activity analysis. The results of the survey are indicated in Figure 3-3 for surface soils (0 - 0.5 feet). A ground

FIGURE 3-1
SOIL SAMPLE LOCATIONS IN THE NORTHWEST QUADRANT
OF THE PRODUCTION AREA



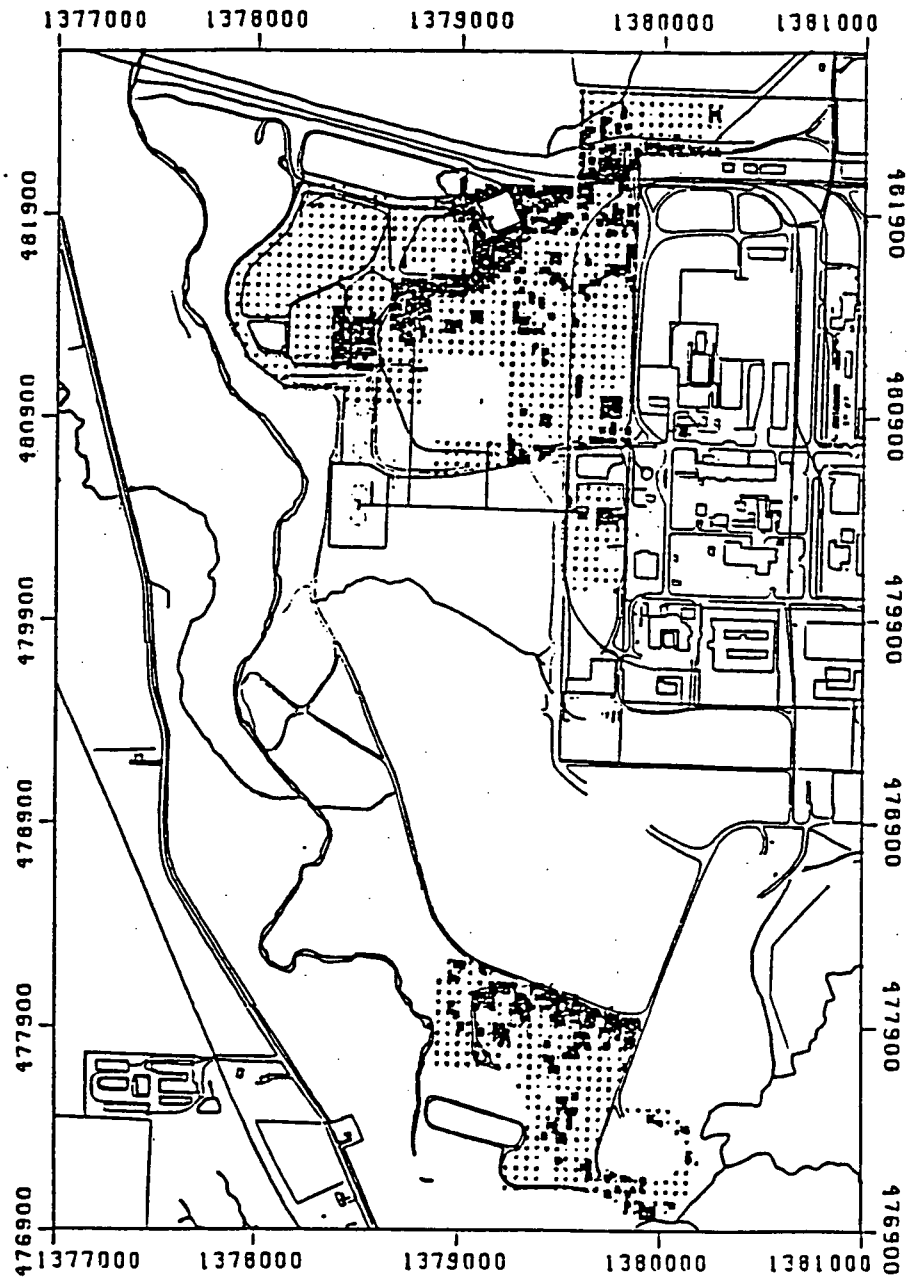
LEGEND

■ SHALLOW SAMPLE LOCATION (0.0 to 0.5 ft., 1.0 to 1.5 ft.)

⊠ SHALLOW BORING LOCATION (0.0 to 0.5 ft., 1.0 to 1.5 ft., 2.5 to 3.0 ft., 4.5 to 5.0 ft.)

● DEEP BORING LOCATION (0.0 to 0.5 ft., 1.0 to 1.5 ft., 2.5 to 3.0 ft., and three foot increments thereafter to 20 feet or the water table)

FIGURE 3-2
CHARACTERIZATION INVESTIGATION STUDY (CIS) RADIOLOGICAL GRID SURVEY AREA



X - FIDLER GRID MEASUREMENTS

STATE PLANE COORDINATE SYSTEM
OHIO SOUTH ZONE
1 INCH = 950 FEET

scar north of the SWL was identified as a possible area of uranium contamination of soils during this study. Additional soil sampling is needed for the ground scar area to confirm existing CIS radiological data.

A total of six soil sample locations are planned for the northwest quadrant of the former production area as shown in Figure 3-1. Two shallow boring sites are within the ground scar area identified in the CIS and one is located on the north side of the Plant 1 Pad where samples will be collected at depths of 0.0 to 0.5, 1.0 to 1.5, 2.5 to 3.0 and 4.5 to 5.0-foot intervals. Three shallow soil sampling locations are west and south of the Plant 1 Pad where samples will be collected at depths of 0.0 to 0.5 and 1.0 to 1.5-foot intervals.

3.1.2 Southwest Quadrant

In the southwest portion of the former production area, numerous borings and piezometers have been sampled for radiological contamination of soils and groundwater. However, there is minimal or no HSL data for several areas in the southwest quadrant. Borings 1183, 1412, 1193 and 1213 were drilled in the immediate vicinity of Plant 2/3 (Figure 3-4) to investigate possible inorganic and organic soil contamination. The results (Table 3-2) show inorganic and organic contamination in this area at various depths. However, the boundaries of the contaminated area have not been well defined; therefore, additional sampling is necessary.

Similarly, existing data from the Production and Additional Suspect Area investigation indicate inorganic and organic contamination within perched groundwater just north of Plant 2/3. An underground storm sewer drainpipe in this area appears to be affecting the perched groundwater elevation just north of Plant 2/3 (Figure 3-5) and, therefore, is thought to be affecting movement of perched groundwater contamination in the immediate area.

Borings 11101, 11102 and 11103, located on the north side of Plant 2/3 (Figure 3-4), will refine the northern boundary of the soil contamination. These deep soil borings will be sampled at 0.0 to 0.5, 1.0 to 1.5, 2.5 to 3.0 and at 3.0-foot intervals until perched groundwater is encountered. All soil samples will be analyzed for HSL inorganics, volatile and semivolatile organic compounds, pesticides and PCBs,

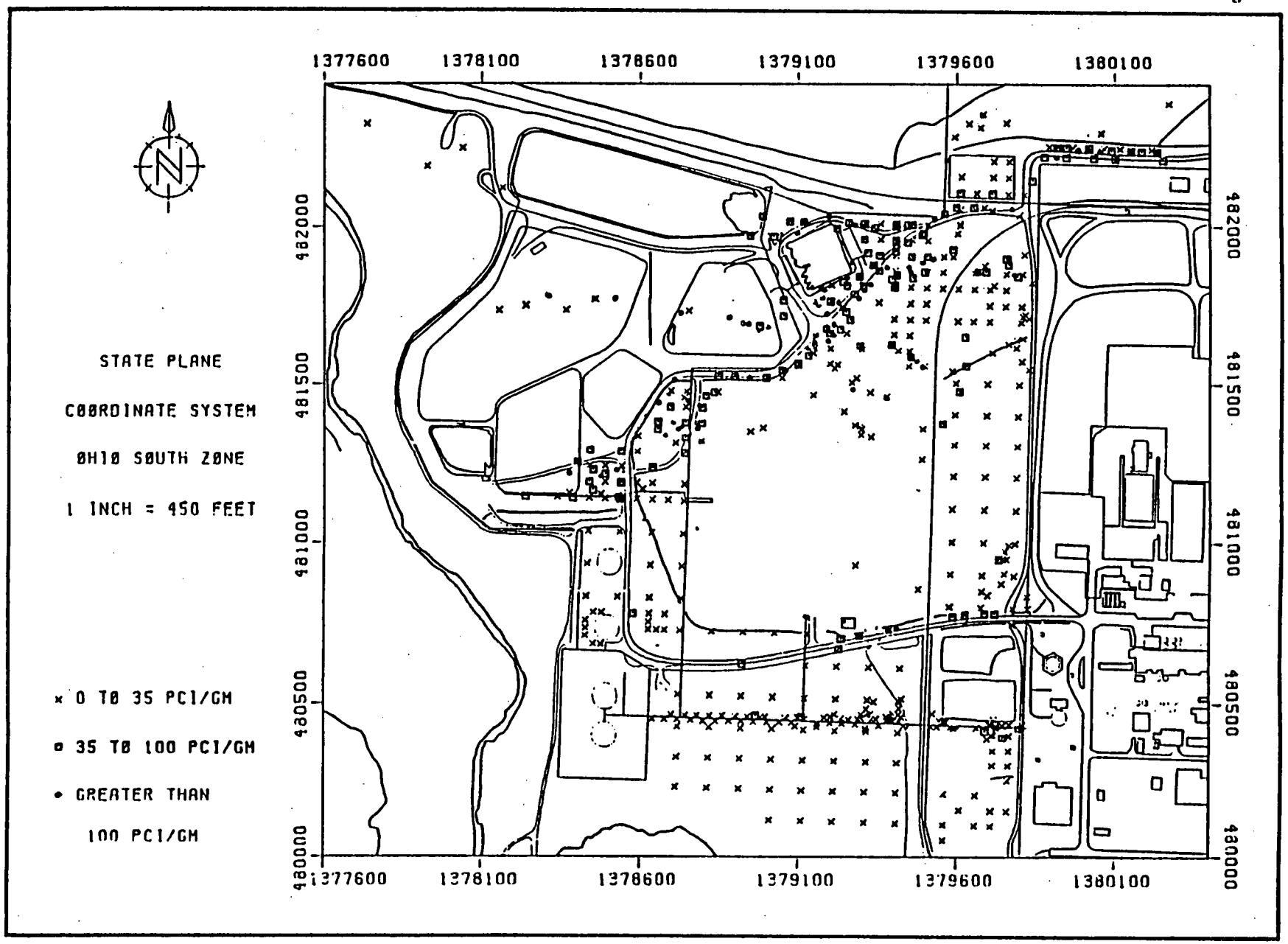
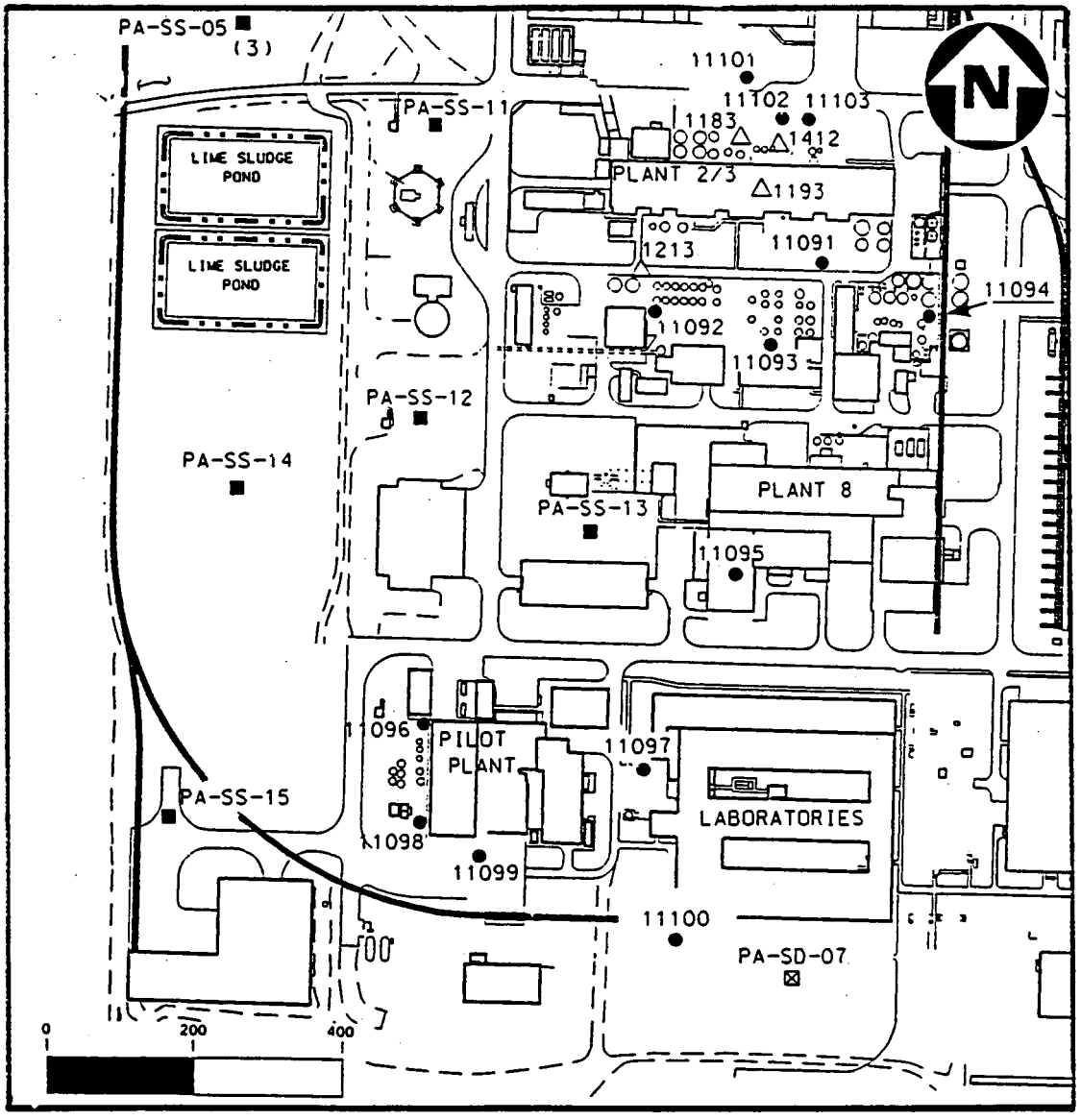


FIGURE 3-3
CHARACTERIZATION INVESTIGATION STUDY (CIS) URANIUM-238
ACTIVITY CONCENTRATIONS IN SOILS

FIGURE 3-4
SOIL SAMPLE LOCATIONS IN THE SOUTHWEST QUADRANT OF THE PRODUCTION AREA



LEGEND

■ SHALLOW SAMPLE LOCATION (0.0 to 0.5 ft., 1.0 to 1.5 ft.)

⊠ SHALLOW BORING LOCATION (0.0 to 0.5 ft., 1.0 to 1.5 ft., 2.5 to 3.0 ft., 4.5 to 5.0 ft.)

● DEEP BORING AND HYDROPUNCH LOCATION (0.0 to 0.5 ft., 1.0 to 1.5 ft., 2.5 to 3.0 ft., and three foot increments thereafter to the water table)

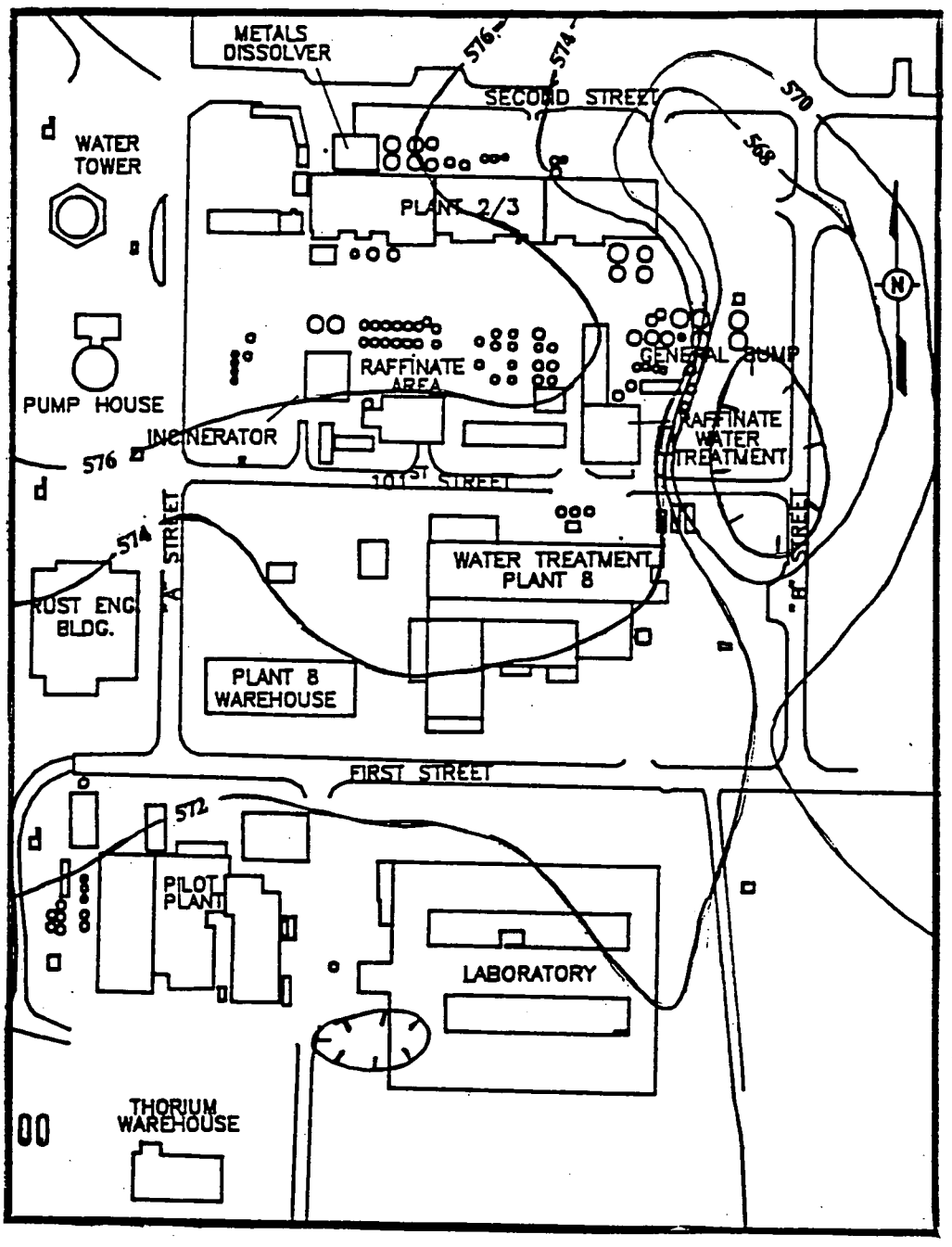
△ EXISTING BORING LOCATION

TABLE 3-2
CHEMICAL CONCENTRATIONS IN SOILS FROM THE PLANT 2/3 AREA IN THE SOUTHWEST QUADRANT

Data presented by location, sample number and sample depth. NA indicates not available. For inorganic constituents, dashes indicate concentrations below background; for organic constituents, pesticides and PCBs, dashes indicate no detection.

	Location	1183	1183	1213	1193	1412
	Sample ID	16595	16597	17276	51954	55089
Constituents	Depth (feet)	0.0 - 0.5	0.5 - 1.0	6.0 - 7.0	6.0 - 7.5	5.5 - 6.0
Inorganic constituents (mg/kg)						
Arsenic		8.4	–	NA	NA	26.5
Beryllium		2.4	1.7	NA	NA	1
Cadmium		6.9	5.2	NA	NA	4.1
Calcium		105,000	115,000	NA	NA	48,200
Chromium		75.5	–	NA	NA	–
Cobalt		17.4	14.3	NA	NA	12.8
Copper		38.5	–	NA	NA	–
Lead		334	440	NA	NA	161
Magnesium		38,600	21,400	NA	NA	17,500
Molybdenum		2.9	–	NA	NA	–
Nickel		50	42.3	NA	NA	38
Silver		17.2	5.9	NA	NA	3.9
Zinc		247	89	NA	NA	65.5
Organic constituents (ug/kg)						
Volatiles						
1-1-Dichloroethane		–	–	–	–	14
1,1,1-Trichloroethane		–	–	–	–	6
2-Butanone		4	4	–	10	110
2-Propanone		14	5	9	29	98
Methylene chloride		8	5	17	17	78
Toluene		2	2	–	2	–
Semivolatiles						
Benzoic acid		–	88	NA	NA	–
bis(2-Ethylhexl) phthalate		180	–	NA	NA	–
Fluoranthene		–	–	NA	NA	81
N-Nitrosodiphenlamine		100	130	NA	NA	630
Phenanthrene		–	–	NA	NA	88
Pesticides and PCBs (mg/kg)						
PCB-1254		360	–	NA	NA	–

FIGURE 3-5
AVERAGED PERCHED GROUNDWATER CONTOUR MAP (1988-1992)
IN THE PLANT 2/3 AREA



LEGEND

572 AVERAGED PERCHED GROUNDWATER ELEVATION (1988 through 1992)

isotopic uranium, thorium and radium, as shown in TAL 50.13.18A, Appendix A. After the soil samples are collected, the perched groundwater will be sampled with the Hydropunch in Borings 11101, 11102 and 11103. Groundwater samples will be collected at or immediately below the perched water table. The groundwater samples will be analyzed for HSL volatile organic compounds listed in TAL 50.03.18B, Appendix A.

In areas surrounding Plant 8, several above-ground storage tanks and sumps represent possible sources of soil contamination. There is no existing inorganic or organic data in this immediate area. Similarly, organics have been found in some borings in the Pilot Plant area; however, the vertical and lateral extent of the contamination is not well defined. As is shown in Figure 3-4, deep Borings 11091, 11092, 11093, 11094 and 11095 will be sampled to investigate possible contamination in and around Plant 8. In addition, deep Borings 11096, 11097, 11098, 11099 and 11100 will be drilled around the Pilot Plant and southwest of the Laboratory Building.

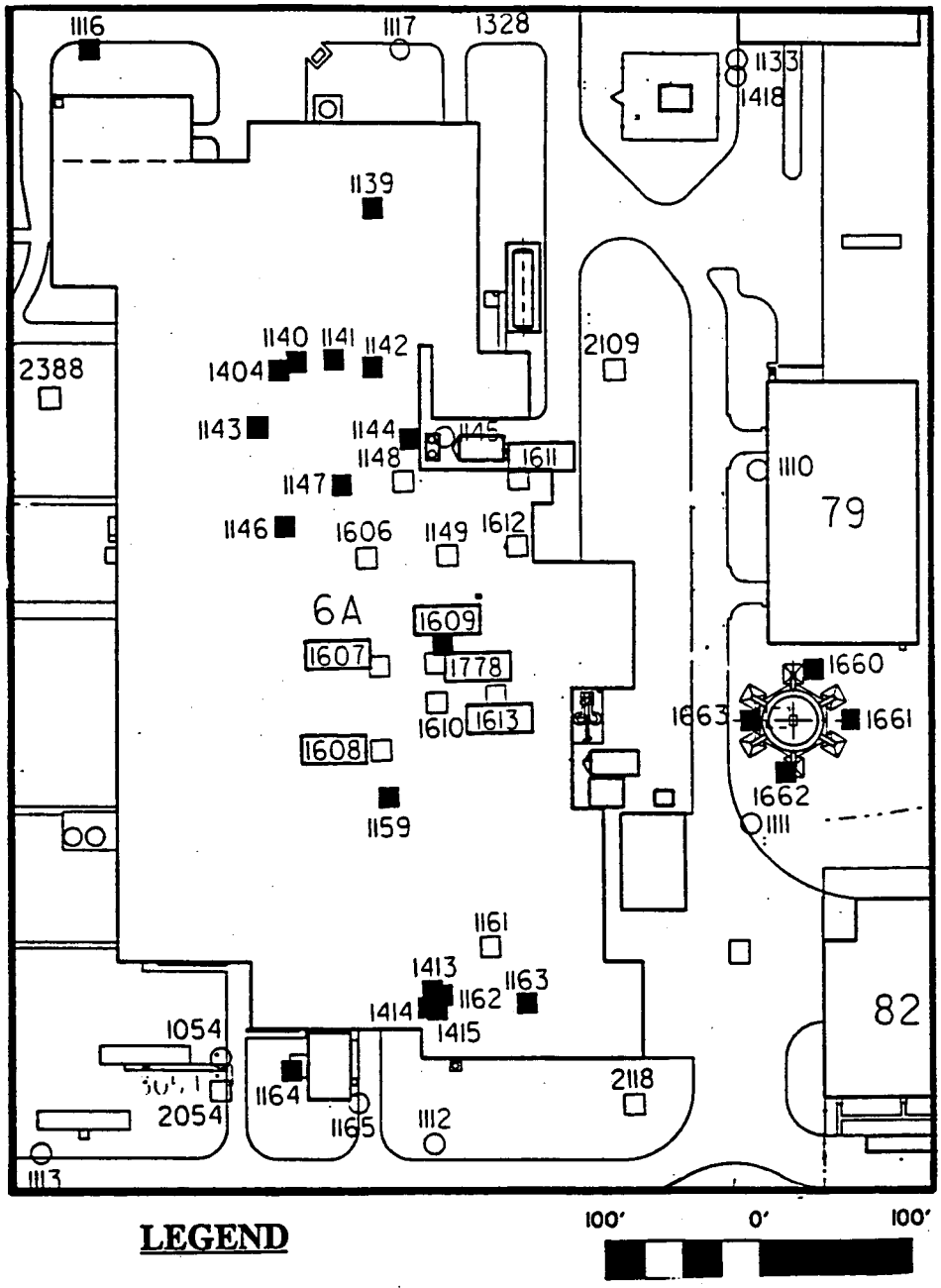
As in the Plant 2/3 area discussed above, soil will be sampled from the surface to the perched groundwater table. In Borings 11091 through 11100 around Plant 8 and the Pilot Plant, hydropunch samples of perched groundwater will be collected and analyzed for HSL volatile organic compounds (TAL 50.03.18B, Appendix A).

All 13 of the borings, three north of Plant 2/3, five in the Plant 8 area, and five in the Pilot Plant area, will be sampled at 0.0 to 0.5, 1.0 to 1.5, 2.5 to 3.0-foot intervals and over a six-inch interval for every three feet from there to the water table or 20 feet. As shown in Figure 3-4, one shallow boring south of the Laboratory Building will be sampled at 0.0 to 0.5, 1.0 to 1.5, 2.5 to 3.0 and 4.5 to 5.0 feet to refine the vertical extent of surface contamination. Also, five shallow soil sampling locations are spaced along the west side of the southwest quadrant where samples will be collected at 0.0 to 0.5 and 1.0 to 1.5-foot intervals. All soil samples will be analyzed for the parameters listed in (TAL 50.03.18A, Appendix A).

3.1.3 Southeast Quadrant

Sampling results indicate that soils are contaminated with organics at a depth of four to five feet and to greater depths with uranium in the Plant 6 area (Figure 3-6). The contamination is probably the result

FIGURE 3-6
ORGANIC CONTAMINATION IN SOILS UNDER PLANT 6



LEGEND

- ○ 2" WELL CASING
- □ 4" WELL CASING
- ■ BORING
- [1152] ORGANIC CONTAMINATION IN SOILS EXISTS (>1.5 feet deep) AT THIS LOCATION

of leaking sumps and pipelines in Plant 6. Figure 3-6 shows the distribution of borings from previous investigations. Borings with boxes around the numbers contained organic soil contamination.

Production activities in the Plant 6 area near Boring 1148 (Figure 3-6) included the extrusion, cutting, heating and machining of uranium billets. These activities represent possible sources of hydrocarbon, solvent and radionuclide contamination to soils in the area. The proposed sampling (Figure 3-7) will refine the horizontal and vertical boundaries of the soil contamination in the area. Deep Borings 11106 and 11107 and one shallow Boring PA-SD-08 will be sampled in the area east of Plant 6 to determine lateral migration from source areas within the plant. One shallow soil sample PA-SS-18 and deep Boring 11105 will be sampled on the west side of Plant 6 to investigate the lateral extent of possible organic contamination from Plant 6.

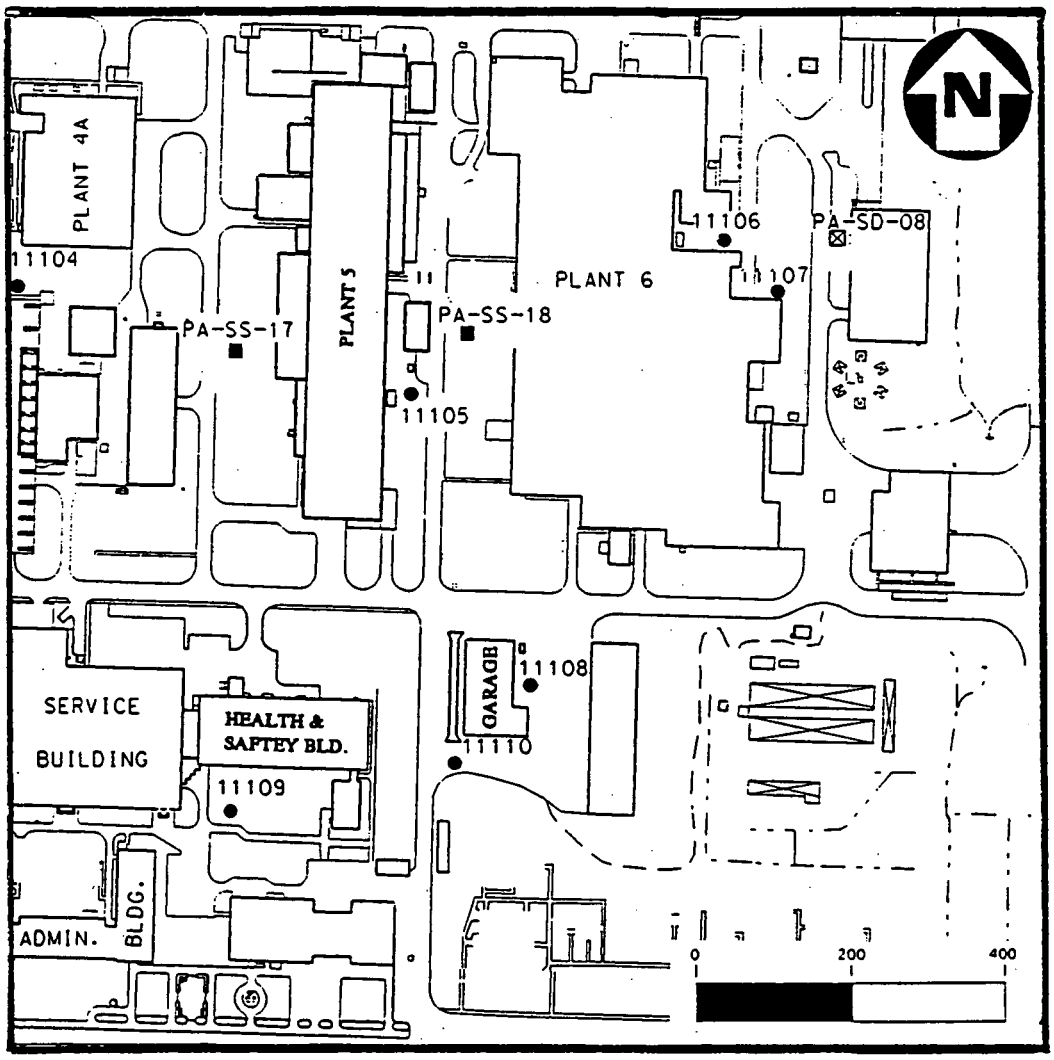
Shallow samples will be collected west of Plant 5 at 0.0 to 0.5 and 1.0 to 1.5 feet to provide a more even coverage of HSL analyses of the former production area. For the same reason, deep Boring 11104 will be sampled to the water table or 20 feet on the west side of Plant 4. Deep Boring 11108 will also be sampled on the south side of the former fuel tank area east of the garage and Boring 1110 will be located southeast of the garage where significant uranium contamination has been found in perched groundwater. Deep Boring 11109 will also be sampled south of the Health and Safety Building to investigate the lateral extent of contamination downgradient of the garage area.

3.1.4 Northeast Quadrant

Sample results from the 1988 RI/FS Work Plan and OU 5 Addenda indicate there are additional data needs in the northeast quadrant, specifically, the southeast corner of Plant 9, an area just north of the maintenance building, and the graphite furnace/oil burner area (Figure 3-8).

Results from soil Borings 1283, 1287, 1288 and 1363 in the graphite furnace/oil burner area (Table 3-3) and subsequent borings (Table 3-4), indicate inorganic and organic contamination exists. However, the soil samples were collected at depths no greater than 4.5 feet and the data do not sufficiently define the vertical extent of soil contamination. As shown in Figure 3-9, four shallow soil borings will be sampled around the graphite furnace/oil burner and coal pile area to refine the lateral extent of contamination. Deep Borings 11087 and 11088 will be sampled in the graphite furnace/oil burner area to determine the vertical extent of organic contamination.

FIGURE 3-7
SOIL SAMPLE LOCATIONS IN THE SOUTHEAST QUADRANT OF THE PRODUCTION AREA



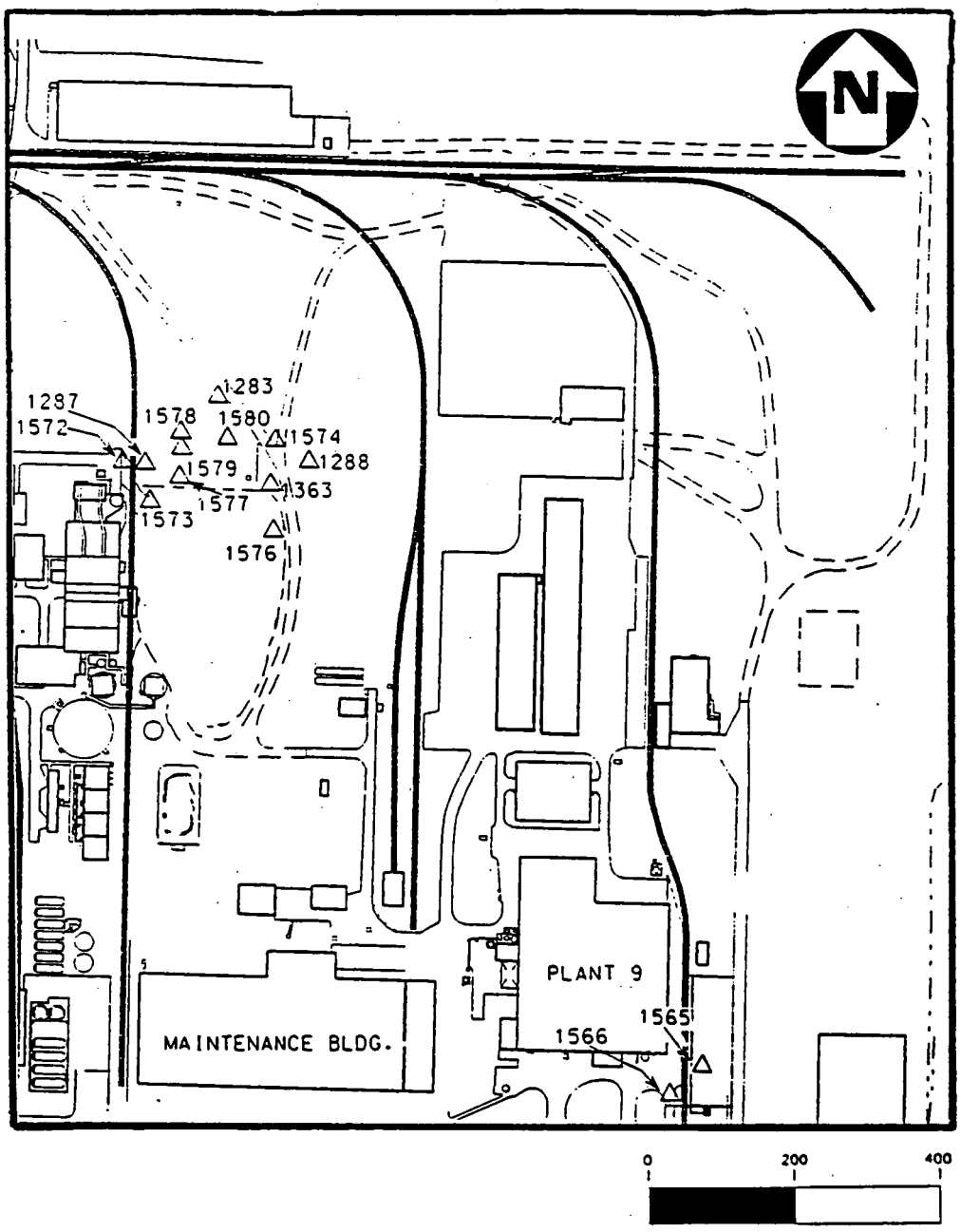
LEGEND

■ SHALLOW SAMPLE LOCATION (0.0 to 0.5 ft., 1.0 to 1.5 ft.)

⊠ SHALLOW BORING LOCATION (0.0 to 0.5 ft., 1.0 to 1.5 ft., 2.5 to 3.0 ft., 4.5 to 5.0 ft.)

● DEEP BORING LOCATION (0.0 to 0.5 ft., 1.0 to 1.5 ft., 2.5 to 3.0 ft., and three foot increments thereafter to 20 feet or the water table)

FIGURE 3-8
BORING LOCATIONS IN THE NORTHEAST QUADRANT OF THE PRODUCTION AREA



LEGEND

△ BORING WHERE ORGANIC CONTAMINATION BELOW THE SURFACE EXISTS

TABLE 3-3
CHEMICAL CONCENTRATIONS IN SOILS FROM THE GRAPHITE FURNACE AND OIL BURNER AREA IN THE NORTHEAST QUADRANT

Data presented by location, sample number and sample depth. NA indicates not available. For inorganic constituents, dashes indicate concentrations below background; for organic constituents, pesticides and PCBs, dashes indicate no detection.

Constituents	Location	1283	1283	1287	1287	1288	1288	1363	1363
	Sample ID	18795	18796	18883	18884	53473	53474	50554	50555
	Depth (feet)	0.0 - 0.5	0.5 - 1.0	0.0 - 0.5	0.5 - 1.0	0.0 - 0.5	0.5 - 1.0	0.0 - 0.5	05 - 1.0
Inorganic Constituents (mg/kg)									
Arsenic		7.5	17.2	22.6	12	8.7	–	7.6	–
Barium		–	–	–	523	512	456	–	–
Beryllium		1.8	1.2	–	1.3	1.2	1.2	0.9	0.8
								8	7
Cadmium		6.2	3.9	3.5	2.9	4	4.4	4.7	4.9
Calcium		205,000	110,000	21,000	8,000	44,200	42,700	88,100	162,000
Cobalt		11.8	11.4	15.7	12.6	13.4	16.1	12.6	10.4
Copper		–	–	24.9	–	–	–	–	–
Iron		–	–	–	–	–	–	–	–
Lead		50.3	29.4	57.2	27	25.3	–	–	38.2
Magnesium		45,100	19,600	6,710	–	13,200	15,000	20,800	29,300
Manganese		–	–	–	818	–	661	–	–
Mercury		0.1	0.1	0.2	–	0.2	0.3	–	–
		6	6	2		8	2		
Molybdenum		2.3	–	–	–	–	–	–	–
Nickel		30.5	32	40.7	44.8	37.5	44.3	35	28.2
Silver		–	2.3	–	–	4	3.9	–	–
Thallium		–	0.2	0.5	–	0.4	0.4	–	–
			4	7		2	2		
Zinc		194	203	248	285	270	232	233	145
Organic constituents (ug/kg)									
Volatiles									
1,1,1-Trichloroethane		–	120	–	–	–	–	7	7
1,2-Dichloroethylene		–	–	–	–	–	–	1	–
2-Butanone		–	67	2	6	12	1	3	–
2-Propanone		13	–	17	–	–	7	16	16
Chloroform		–	–	–	–	9	7	–	2
Ethylbenzene		–	140	–	–	–	–	–	–
Methylene chloride		22	640	24	13	24	27	28	27
Tetrachloroethene		12	140	10	12	–	–	5	7

TABLE 3-3 (Continued)
CHEMICAL CONCENTRATIONS IN SOILS FROM THE GRAPHITE FURNACE AND OIL BURNER AREA IN THE NORTHEAST QUADRANT

Data presented by location, sample number and sample depth. NA indicates not available. For inorganic constituents, dashes indicate concentrations below background; for organic constituents, pesticides and PCBs, dashes indicate no detection.

	Location	1283	1283	1287	1287	1288	1288	1363	1363
	Sample ID	18795	18796	18883	18884	53473	53474	50554	50555
Constituents	Depth (feet)	0.0 - 0.5	0.5 - 1.0	0.0 - 0.5	0.5 - 1.0	0.0 - 0.5	0.5 - 1.0	0.0 - 0.5	0.5 - 1.0
Volatiles (continued)									
Toluene		2	160	2	--	--	--	1	3
Total xylenes		--	120	--	--	--	--	--	--
Trichloroethene		12	52	5	2	--	--	1	2
Semivolatiles									
2-Methylnaphthalene		280	590	320	--	150	--	100	--
Benzo(a)anthracene		--	--	--	--	51	--	--	--
Benzo(b)fluoranthene		--	--	--	--	95	--	--	--
Benzo(k)fluoranthene		--	--	--	--	81	--	--	--
bis(2-Ethylhexyl) phthalate		--	--	--	--	--	--	--	310
Chrysene		--	--	--	--	83	--	--	--
Dibenzofuran		--	--	81	--	--	--	--	--
Di-n-butyl phthalate		240	--	--	--	--	--	--	--
Fluoranthene		--	--	81	--	150	--	--	--
Naphthaslene		--	390	190	--	89	--	--	--
N-Nitrosodiphenylamine		530	370	--	--	--	--	120	--
Phenanthrene		310	330	190	--	180	--	79	--
Pyrene		--	--	--	--	140	--	--	--
Pesticides and PCB (ug/kg)									
beta-BHC		--	--	--	--	--	--	100	--
PCB-1254		1200	370	1200	85	--	--	--	--
PCB-1260		560	150	2800	--	230	--	--	150

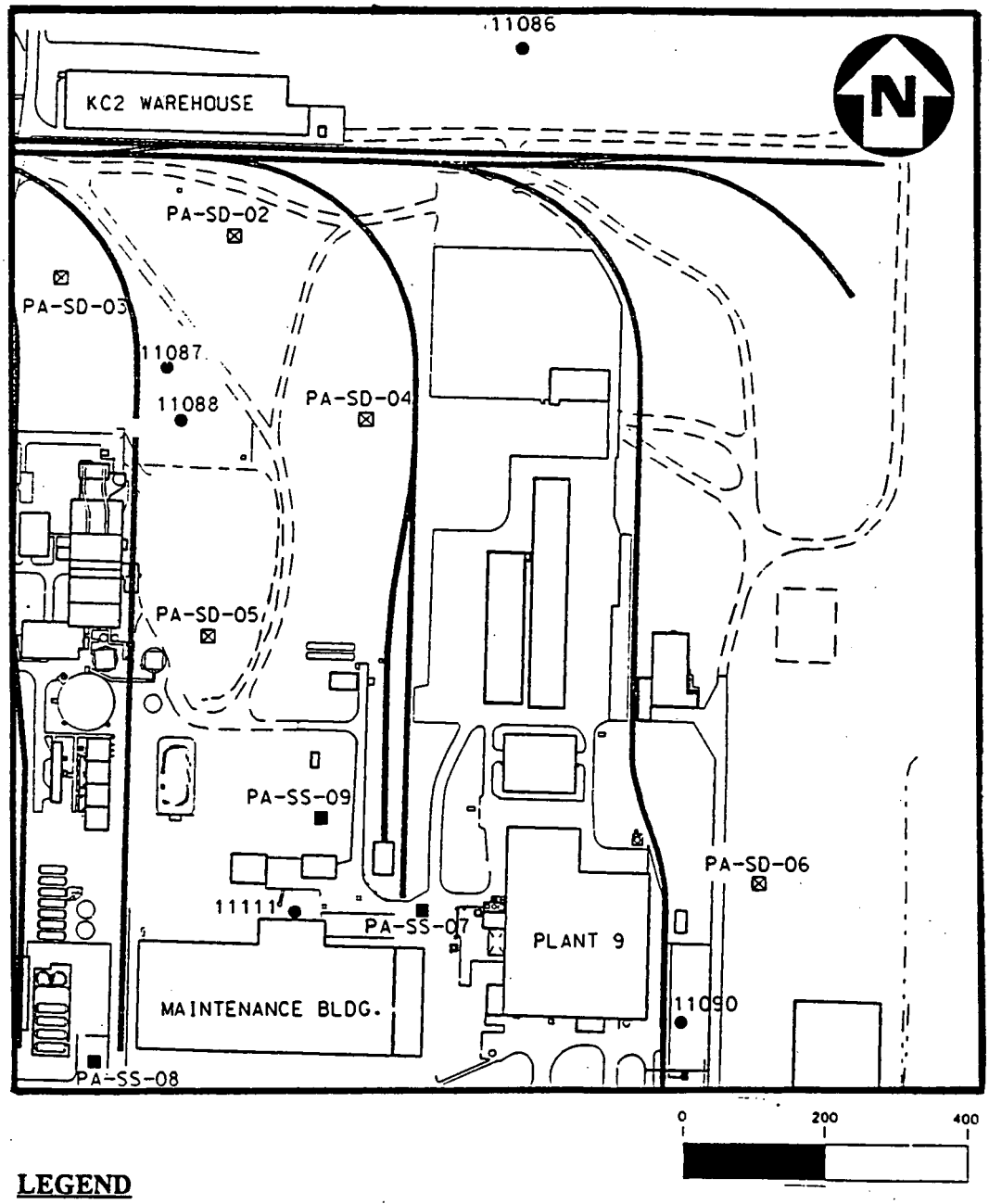
TABLE 3-4
CHEMICAL CONCENTRATIONS IN SOIL GRAPHITE FURNACE/OIL BURNER AREA IN THE NORTHWEST QUADRANT

Total Volatile, Total Semivolatile, Total Pesticide/PCB in µg/kg.

Boring No/ Depth (ft)	TVOC	TSVOC	TP/P	Boring No/ Depth (ft)	TVOC	TSVOC	TP/P
1572				1579			
0.5 - 1.0	12	1700	173	0.5 - 1.0	29	1855	960
2.0 - 2.5	228	14,000	ND[a]	2.0 - 2.5	96	ND	ND
4.0 - 4.5	36	2600	ND	4.0 - 4.5	230	ND	ND
1573				1580			
0.5 - 1.0	17	266	200	0.5 - 1.0	35	1178	506
2.0 - 2.5	13	217	ND	2.0 - 2.5	ND	ND	ND
4.0 - 4.5	23	ND	ND	4.0 - 4.5	438	ND	ND
1577				1574			
0.5 - 1.0	10	8563	327	0.5 - 1.0	---[b]	3700	187
2.0 - 2.5	3	2500	ND	2.0 - 2.5	---	6900	ND
4.0 - 4.5	ND	5100	ND	3.5 - 4.0	---	8000	ND
1578				1576			
0.5 - 1.0	17984	1700	ND	0.5 - 1.0	33	1004	ND
2.0 - 2.5	979	230	ND	2.0 - 2.5	ND	4200	ND
4.0 - 4.5	23,180	1756	450	4.0 - 4.5	3	3000	ND

[a] Not detected [b] No data available

FIGURE 3-9
SOIL SAMPLE LOCATIONS IN THE NORTHEAST QUADRANT OF THE PRODUCTION AREA



LEGEND

- ■ SHALLOW SAMPLE LOCATION (0.0 to 0.5 ft., 1.0 to 1.5 ft.)
- ⊠ SHALLOW BORING LOCATION (0.0 to 0.5 ft., 1.0 to 1.5 ft., 2.5 to 3.0 ft., 4.5 to 5.0 ft.)
- ● DEEP BORING LOCATION (0.0 to 0.5 ft., 1.0 to 1.5 ft., 2.5 to 3.0 ft., and three foot increments thereafter to 20 feet or the water table)

Similarly, deep Boring 11111 and two shallow samples will be sampled on the north side and one surface sample in the southwest corner of the Maintenance Building, as shown in Figure 3-9. Data from these samples will refine the extent of the known contamination.

Elevated volatile organic concentrations occur at a depth of 15 feet near the southeastern corner of Plant 9 in Boring 1566. Results from several other borings in the area show surface soil contamination only. To confirm the data from Boring 1566, deep soil Boring 11090 will be sampled in the same area that 1566 was drilled. To provide a reasonable coverage of HSL samples in the area, a shallow sample will be sampled in the area west of Plant 9 and deep Boring 11086 will be sampled in the buffer zone north of the scrap metal pile area.

3.1.5 Summary of Former Production Area Sampling

Table 3-5 provides a summary of the soil sample locations by quadrant. All the samples will be analyzed for those parameters shown in the TAL 30.03.18A, Appendix A.

Surface sample locations will include samples from a depth of 0.0 to 0.5 feet and from 1.0 to 1.5 feet. Shallow borings are sampled at depths from 0.0 to 0.5, 1.0 to 1.5, 2.5 to 3.0 and 4.5 to 5.0 feet. Deep borings will be sampled at depths from 0.0 to 0.5, 1.0 to 1.5, 2.5 to 3.0 feet and over six-inch intervals every three feet from there to a depth of 20 feet or until groundwater is encountered. The shallow and deep borings will be sampled using a 3-inch diameter split spoon sampler. If additional borings are required to obtain enough material for the specified analysis over the above specified six-inch intervals, the borings should all be within a two-foot circle. The shallow soil samples will be collected using hand augers and stainless steel trowels.

If the deepest prescribed sample shows elevated field screening readings for either chemical or radiological parameters, the boring will be advanced another three feet, or until groundwater, or a total depth of 20 feet, is encountered. The CRU5 RI/FS Project Manager will be notified immediately if field screening causes sampling to go deeper than prescribed in this PSP. Under no circumstance will a boring go beyond a depth of 20 feet without specific direction from the CRU5 RI/FS Project Manager.

TABLE 3-5
SUMMARY OF SOIL SAMPLING
LOCATIONS WITHIN THE PRODUCTION AREA

Production Area Location	Shallow Soil Samples (0.0-1.5 feet)	Shallow Borings (0.0-5.0 feet)	Deep Borings (0-20 feet)
Northwest Quadrant	PA-SS-03, PA-SS-04, PA-SS-06	PA-SD-01, PA-SD-09, PA-SD-10	
Northeast Quadrant	PA-SS-07, PA-SS-08, PA-SS-09	PA-SD-02, PA-SD-03, PA-SD-O4, PA-SD-05, PA-SD-06	11086, 11087, 11088, 11090, 11111
Southwest Quadrant	PA-SS-05, PA-SS-11, PA-SS-12, PA-SS-13, PA-SS-14, PA-SS-15, PA-SS-16	PA-SD-07	11091, 11092, 11093, 11094, 11095, 11096, 11097, 11098, 11099, 11100, 11101, 11102, 11103
Southeast Quadrant	PA-SS-17, PA-SS-18	PA-SD-08	11104, 11105, 11106, 11107, 11108, 11109, 11110

Both shallow and deep soil borings will be advanced using a conventional auger rig. If shallow soil samples are required in areas where pavement, concrete or road gravel exist, the pavement will be removed and the first sample will be collected over the six-inch interval beginning at the top of the soil. The next six-inch interval will be discarded (unless field screening of this interval indicates it should be analyzed) and the third six-inch interval below the top of the soil will be collected as the second sample.

Field screening using an HNu or equivalent and a pancake GM, as specified in the SCQ, Section 5 and Appendix K, will be used to identify possible additional sampling intervals. If field screening indicates levels of either organic or radiological material greater than the field screening levels at the designated sampling interval, the six-inch interval with the highest screening results will be an additional sample for that location.

3.2 SURFACE SOILS IN AREAS BORDERING THE FORMER PRODUCTION AREA

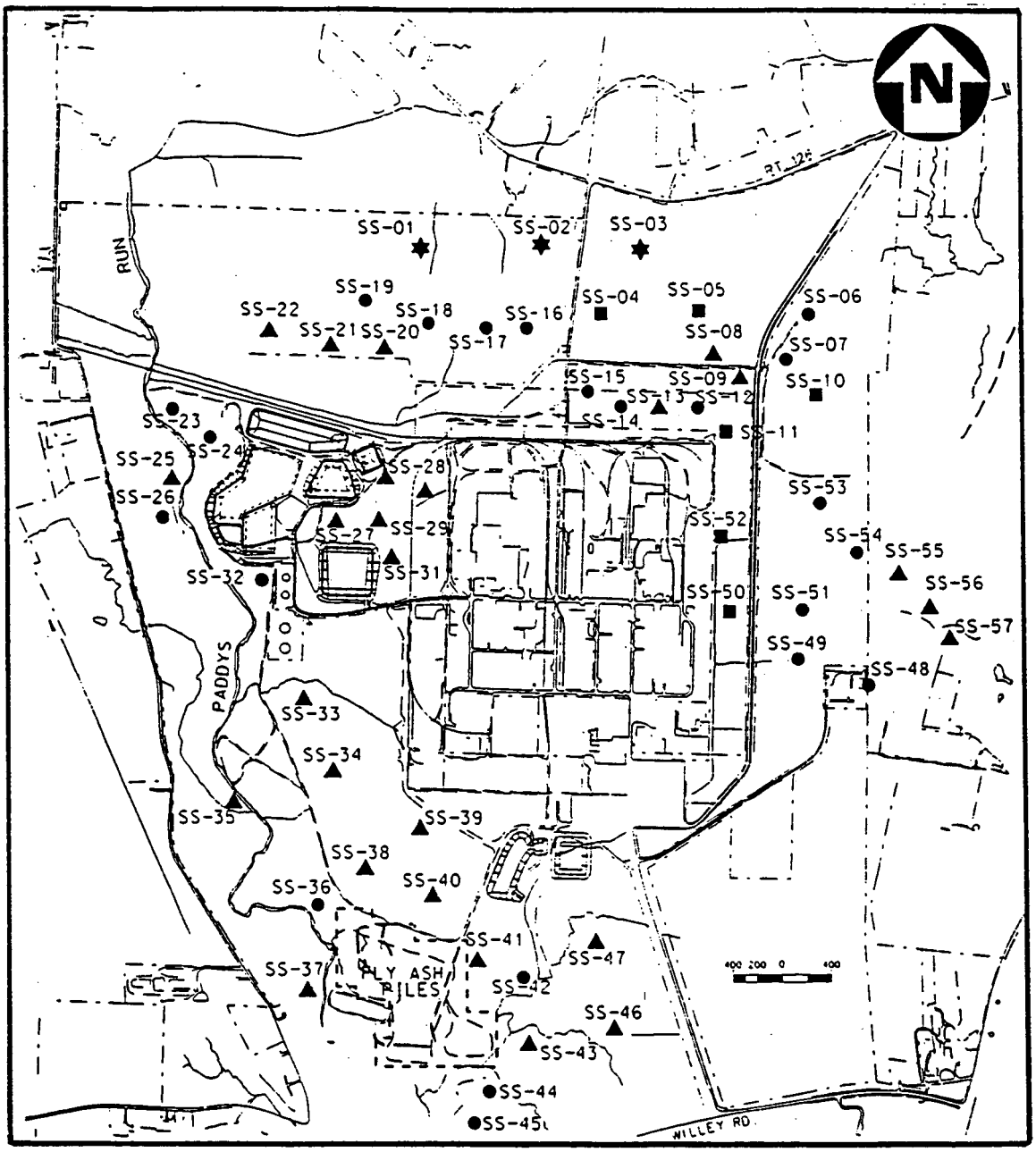
The available HSL (organic/inorganic) data for locations bordering the former production area were reviewed to determine data needs for baseline and ecological risk assessment. Minimal HSL data are available in the areas bordering the former production area where airborne contaminants could have been deposited.

Surface soil sampling locations will be sampled in areas bordering the former production area (Figure 3-10). Twenty-two of these sampling locations were selected to provide HSL data for the ecological risk assessment. Radiological data are available in these areas; therefore, only HSL analyses are required. These locations target ecologically-sensitive areas identified by FERMCO and the United States Environment Protection Agency (U.S. EPA), Region V risk assessment personnel. Thirty-six of the proposed sampling locations were selected to provide HSL and radiological data for the air pathway evaluation in the risk assessment.

As shown in Figure 3-10, three samples will be collected along the northern edge of the FEMP property for HSL inorganics and pesticides/PCBs (TAL 50.03.18C). Six samples will be collected on the north and east sides of the former production area for HSL inorganics, organics and pesticides/PCBs TAL 50.03.18E. Twenty-two samples will be collected from ecologically-sensitive areas for HSL inorganics, organics and pesticides/PCBs (TAL 50.03.18E). Twenty-six locations will be sampled for full HSL inorganics, organics, pesticides/PCBs and full radiological analyses (TAL 50.03.18F). In addition to the 57 locations shown in Figure 3-10, four soil samples will be collected for radionuclides and pesticides/PCBs (TAL 50.03.18D) to the east and northeast of the FEMP property to verify the data from the 1986 Health Risk Assessment for the FEMP (IT 1986) using current analytical procedures and validation protocol.

Samples will be collected just off the northeast corner of the FEMP, one and two miles northeast of the FEMP and on top of the bluff on the east side of the Great Miami River Valley due east of the FEMP. All soil samples collected outside the former production area will be collected from 0.0 to 0.5 feet of depth. Field screening, as specified in the SCQ, will be conducted during the surface soil sampling. If elevated levels result from field screening or if visual evidence of staining/contamination is evident, additional samples will be collected at 1.0 to 1.5, 2.0 to 2.5 and 3.0 to 3.5-foot intervals. Each surface

FIGURE 3-10
SOIL SAMPLE LOCATIONS OUTSIDE THE PRODUCTION AREA



LEGEND

- ✱ SAMPLE LOCATION FOR HSL INORGANICS (TAL 50.03.18 C)
- ■ SAMPLE LOCATION FOR FULL HSLs (TAL 50.03.18 E)
- ● ECOLOGICALLY SENSITIVE AREA TO BE SAMPLED FOR FULL HSLs (TAL 50.03.18 E)
- ▲ SAMPLE LOCATION FOR FULL HSLs AND FULL RADIONUCLIDES (TAL 50.03.18 F)

soil sample will be collected by using a stainless steel trowel and placing the soil in appropriate sample containers necessary for laboratory analysis. Hand augers will be used if sampling is required below 0.5 feet.

3.3 WEST OF K-65 SILOS

The K-65 Silos, located on the western side of the FEMP and the eastern side of Paddys Run, include four silos. These silos were constructed for storing waste slurries resulting from the processing of pitch blend ores and uranium concentrates. Currently, Silos 1 and 2 contain waste residues, Silo 3 contains metal oxide and Silo 4 is empty. In order to remove liquids after settling had occurred, decant ports were installed for Silos 1 and 2. These decant ports were each valved into a single pipe that led to a 9000-gallon decant sump tank. The decant sump is located between Silos 1 and 2 (Figure 3-11) at a level below the base of the silos to allow for gravity drainage.

The surface and subsurface soil in the K-65 Silo area has been sampled and analyzed during the 1987 CIS, followed by the FEMP Site-Wide Remedial Investigation and the Waste Pit Area Runoff Control Removal Action. As shown in Figure 3-11, one three-well cluster, five slant borings and three profile samplings associated with a trench west of Silos 1 and 2, provide historical data, which are discussed in detail in Chapter 4 of the Operable Unit 4 RI report, April 1993. In addition, three piezometers/lysimeters were recently installed. A soil analysis from slant-Boring 1616, at a depth of 3.92 to 4.42 feet (which corresponds to an approximate vertical depth of three feet), revealed contamination by total uranium at 26.6 μg/g, radium-226 at 137 pCi/g, lead-210 at 34 pCi/g, and polonium-210 at 20.9 pCi/g.

Aerial photos of the area around and west of Boring 1616, show a slight color change to white among the trees in the direction of Paddys Run. This could be interpreted as a small drainageway where surface water from the silo area could have drained into Paddys Run. The color change appears on the aerial photos from April 6, 1954 through September 12, 1968. During installation of the lysimeters, surface contamination was identified by the health and safety screening in the vicinity of Lysimeter 1895.

This PSP provides a sampling program to address the nature and extent of contamination associated with this interpreted drainageway. The suspected area of contamination is shown in Figure 3-12. Sampling

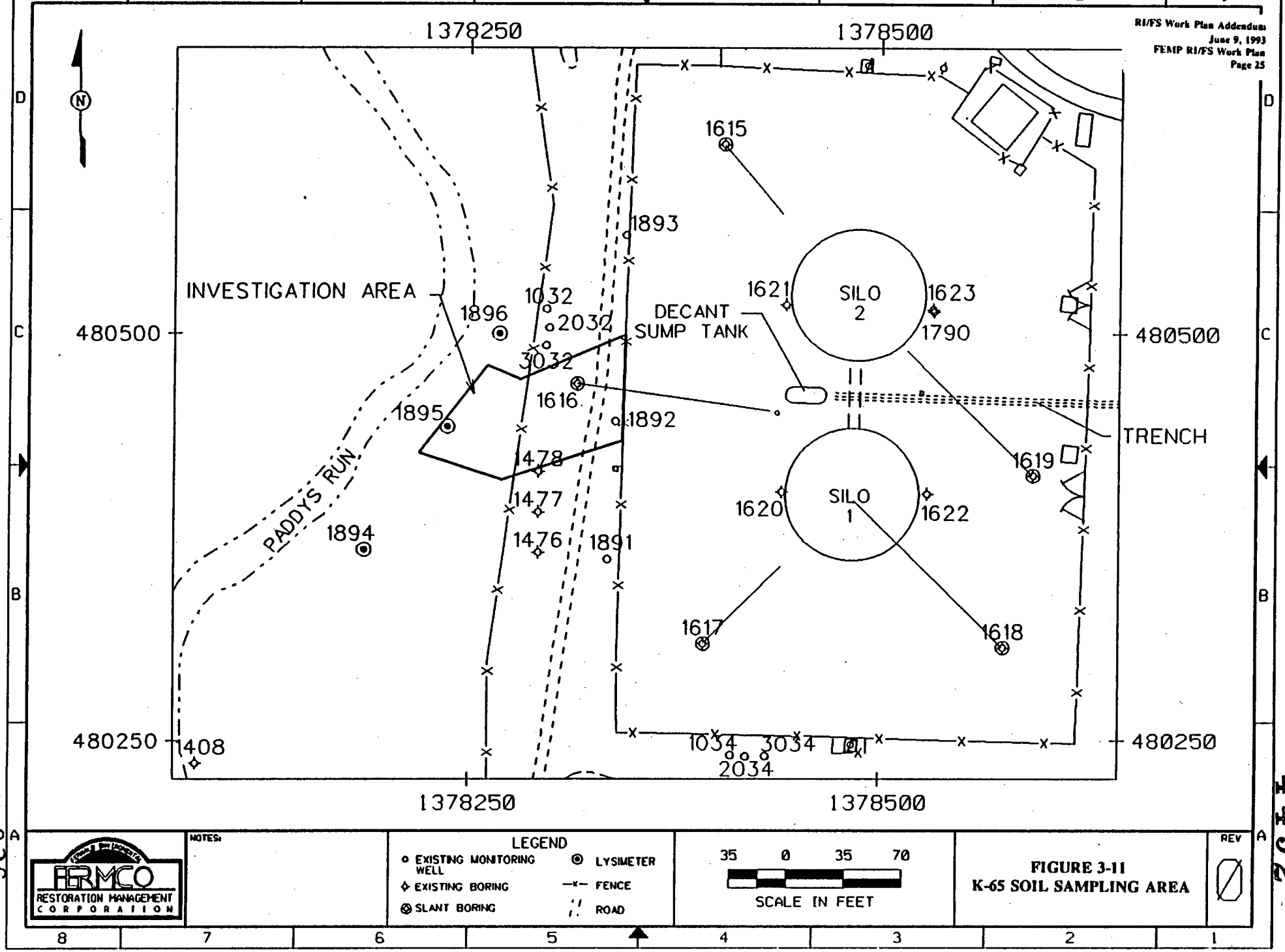
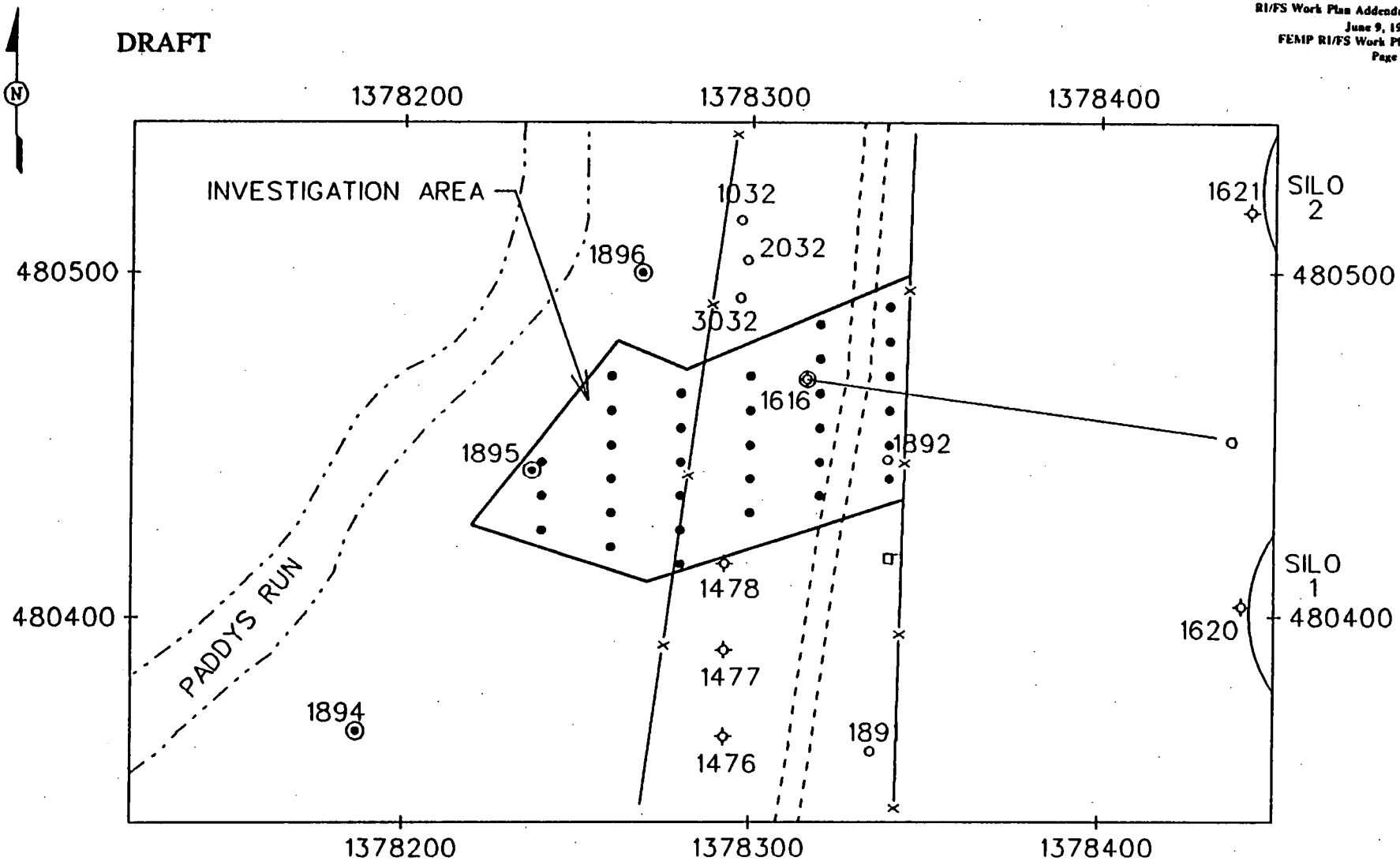


FIGURE 3-11
K-65 SOIL SAMPLING AREA

DRAFT



NOTES:
SOIL SAMPLE GRIDDING 10' X 20'

LEGEND
- EXISTING MONITORING WELL
- EXISTING BORING
- SLANT BORING
- SAMPLE LOCATION
- FENCE
- LYSIMETER
- ROAD

20 0 20 40
SCALE IN FEET

FERMCO RESTORATION MANAGEMENT CORPORATION

FIGURE 3-12
SOIL SAMPLE LOCATIONS WEST OF THE K-65 SILOS

REV

grid points will be spaced 20 feet apart along an east-west axis and 10 feet apart on a north-south axis. This grid spacing will be appropriate for identifying contamination that may exist along the narrow east-west alignment of the former drainage.

The area will be characterized by a surface radiological survey followed by soil sampling and analysis. A surface radiological walkover survey will be conducted within the investigation area using the Eberline SPA-3 scintillation detector. Surface hot spots will be flagged during the walkover and their area will be plotted on the grid map. These data will be plotted to identify areas exhibiting elevated surface radiation. If the surface radiation survey identifies elevated readings within the grid, the sample location will be moved to the location of the surface contamination. The area of the investigation may be expanded based on the walkover survey results.

All soil sampling will be done with a split spoon sampler using a conventional auger rig to a depth of six feet. Soil sampling will be completed at each grid point and at additional sampling points defined as hot spots from the walkover survey, if necessary. Soil samples from each location will be field screened for radiological contaminants using a SPA-3 radiation detection meter. The soil sample exhibiting the greatest radiological activity reading will be retained for HSL metals and radiological analyses (TAL 50.03.18G in Appendix A). The suite of radiological parameters has been expanded to include isotopes of lead and polonium identified in the April 1993, OU 4 RI. The bottom most sample from each boring will also be retained for the same analysis. If the bottom most sample also exhibits the most radiological activity, the split spoon will be advanced an additional 18 inches and that sample will be retained for analysis. With 33 planned soil sample grid locations and with two samples per location, the planned number of samples to be analyzed is 66. Additional samples may be collected if the walkover survey shows a larger area is contaminated.

3.4 OBJECTIVES SUMMARY

This PSP is designed to provide comprehensive soils data coverage inside and outside the former production area at the FEMP. HSL organics and inorganics represent the largest data need. As discussed earlier in this PSP, radiological data will also be collected because much of the soil characterization of the site is dependent on radiological analyzed at the on-site laboratory. The proposed sampling for radiological data in this PSP will supplement and support existing data collected for the RI. A

combination of all the historic data and that data obtained under this PSP will serve the needs of the OU 5 RI report, air modeling and risk assessment, as well as remedial alternative selection. Specific activities and objectives are summarized in Table 3-6. Table 3-7 provides a summary of the samples and analyses to be conducted under this PSP.

TABLE 3-6
SUMMARY OBJECTIVES FOR SOIL SAMPLING PROGRAM

Activities	Collect soil samples in the former production area to refine the vertical and lateral extent of soil contamination. Collect surface soil samples outside the former production area to support the ecological risk assessment and air modeling effort.
Objectives	Fill data needs regarding nature and extent of contamination in soil for the OU 5 RI report. Provide data of sufficient coverage and quality for the risk assessment and air modeling for the FEMP.
Prioritized Data Uses	Determine the levels of HSL and radionuclide contamination in soil and refine the vertical and lateral boundaries of soil contamination. Provide data for the ecological risk assessment. Provide data for the OU 5 RI, risk assessment and air modeling.
Appropriate Analytical Levels	PID (organics) screening and SPA-3 (Radiological) field screening: ASL A; HSL inorganics, organics, volatiles and semivolatiles: ASL C; Pesticides/PCBs: ASL C; Limited radiologicals: ASL C. Ten percent of the ASL C analyses will be designated as ASL D. Field blanks and rinsates will be collected at a frequency of one in 20 for all ASL C analyses.
Constituents of Concern	Total and Isotopic Uranium, Total and Isotopic Thorium, Radium 226 and 228. HSL inorganics and organics. Pesticides/PCBs. Full isotopic radionuclides as specified in target analyte lists in Appendix A.
Level of Concern	MCL levels, preliminary remediation goals for radionuclides.
Required Detection Limits	Specified in the SCQ, and preliminary remediation goals for radionuclides.
Critical Samples	All samples will be used in the site characterization, risk assessment and remedial alternative selection processes. It is essential that 90 percent of the samples specified in this PSP be collected. Validation will be performed on all samples collected.

TABLE 3-7
SUMMARY LIST OF SAMPLES

Sample Type	Inside Former Production Area	Outside Former Production Area
Shallow Soil[a]	28	
Shallow Boring[a]	40	
Deep Boring[a]	175	
Hydropunch[b]	13	
Surface Soil[c]		3
Surface Soil[d]		4
Surface Soil[e]		28
Surface Soil[f]		26
Subsurface Soil[g]		66
Duplicate Soils[h]	13	7
Trip Blanks[b]	15	20
Rinsates[h]	13	10
Total	297	164

[a]TAL 50.03.18A
[b]TAL 50.03.18B
[c]TAL 50.03.18C
[d]TAL 50.03.18D
[e]TAL 50.03.18E
[f]TAL 50.03.18F
[g]TAL 50.03.18G

All TALs are located in Appendix A.

[h]Duplicates and Rinsates will be analyzed for the same TAL as the soil sample.

3.5 ANALYTICAL PROGRAM

The target analyte lists (TALs) for the various soil samples are included in Appendix A. All radiological and HSL analyses will be conducted at ASL C. Ten percent of analyses at ASL C will be reported at ASL level D. All analytical procedures will be in accordance with the SCQ.

3.6 SAMPLING PROCEDURES

Surface soil, shallow soil and soil boring samples will be collected at the proposed locations using sampling procedures, including the preparation of boring logs, as discussed in Appendix K of the SCQ. Each sample will be field screened for radiological and organic contaminants as specified in Appendix K of the SCQ. If contamination is found by field screening, the portion of the soil with the highest radiological activity or organics field screening results will be sampled in addition to the sample intervals specified for that location. Field screening results will be used as a tool for determining the ultimate depth of each location where sampling will be performed. All analyses will be conducted by a designated and pre-approved laboratory using procedures which meet the standards established in the SCQ. One soil analyses in ten will be designated for ASL D reporting.

4.0 ORGANIZATION AND RESPONSIBILITIES

This PSP has been developed by CRU5 to fulfill data needs for the OU 5 RI. The CRU5 RI/FS Project Manager has full responsibility and authority for the content and specifications in this PSP. Any changes to the activities specified in this PSP must have the approval of the CRU5 RI/FS Project Manager prior to implementation. It is the CRU5 RI/FS Project Manager's responsibility to secure any off-FEMP property access permits required for the completion of this PSP.

4.1 FIELD ACTIVITIES

Field activities are to be conducted by the FEMP Site Characterization/Data Management (SC/DM) staff using SCQ-approved work procedures and sampling procedures specified in Section 6 and Appendix K of the SCQ for surface and subsurface soil sampling. The Site Characterization staff have the responsibility for adhering to the SCQ and Section 5 (Health and Safety Considerations) and Section 6 (QA/QC) of this PSP. The Site Characterization staff will assign unique sample numbers for all samples collected. Field activities include: sample handling, preservation shipment and notification of the laboratories and management of subcontracted drilling and geologic services.

At the completion of field activities associated with surface soil sampling and each boring, a task completion report will be prepared by the SC/DM and submitted to the CRU5 RI/FS Project Manager, which includes copies of all field forms, data sheets and activity logs, as well as a written summary of the field activities noting any variances from either this PSP or SCQ procedures. Appropriate SCQ forms

(D-1 through D-13), Appendix B of the SCQ, must also be completed for data validation and submitted to the FEMP laboratory as part of the field activity.

4.2 QUALITY ASSURANCE (QA) AND QUALITY CONTROL (QC)

The FERMCO QA department will assure that the contents of this PSP conform to the requirements of the SCQ. The FERMCO QC department will monitor field activities to assure that all work conducted in the execution of this PSP conforms to the appropriate standards specified in the SCQ.

5.0 HEALTH AND SAFETY CONSIDERATIONS

Effective health and safety programs for any activity are based on an effective training program. All involved personnel will receive adequate training prior to implementation of the field work. This training will make all employees aware of all physical, radiological and chemical hazards which may be encountered during the execution of this project.

All FEMP employees and subcontractor personnel who will be performing field work during this project are required to have completed all OSHA-mandated 1910.120 Hazardous Waste Site Worker training. In addition, all applicable annual refresher training will have been taken by the individuals. The Department of Energy (DOE) regulations at the FEMP require a series of site specific training courses. These courses are designed to augment OSHA-required training and provide additional training specific to the hazards which exist at the FEMP. For health and safety considerations, field personnel participating in the performance of this project will be trained according to the FEMP SCQ and this PSP. In summary, employee awareness and clearly delineated lines of authority and responsibility have been designed to provide for effective health- and safety-related knowledge specific to each activity.

5.1 TASK SPECIFIC PLANS

All aspects of this PSP will be performed in accordance with all existing applicable DOE, U.S. EPA, Occupational Safety and Health Administration (OSHA), and State of Ohio health and safety regulations. Additionally, all practices will be managed in accordance with commonly-accepted practices used in the hazardous waste industry.

Prior to the implementation of field work, which will involve drilling, trenching or soil boring, a "Penetration Permit" is issued. Before a Penetration Permit is obtained, the area of concern is investigated and compared against the site database for underground utilities in the area. No drilling, trenching or soil borings will be performed without a valid Penetration Permit being obtained prior to actual performance of the field work.

Each field activity to be performed must have a separate task specific health and safety plan. Task specific health and safety plans have been prepared for the work described in this PSP in accordance with the FEMP Site Health and Safety Plan. For each project task and sub-task, health and safety technician coverage is provided by the assignment of a technician to monitor the field crew's activities.

Project specific health and safety plans address the hazards typically encountered by personnel when performing the field work, the proper equipment to be used for health and safety monitoring and personnel protection, and details the criteria for the selection of monitoring equipment and protective clothing. Each member of the field crew is required to participate in a health and safety training session, which is specific to each field project, prior to performance of the field work.

In addition to the task specific health and safety plans, formal approval of the field activities specified in this PSP will be obtained prior to the implementation of field work.

5.2 RADIOLOGICAL MONITORING AND CONTROLS

Radiological monitoring for this PSP will be performed using existing institutional controls commonly utilized at the FEMP. In FEMP areas where there is existing institutional radiological control, employees are required to wear Thermal Luminescent Detector (TLD) which monitors exposure to radiological contamination. In addition, each employee is required to participate in a regularly-scheduled urine analysis program which is designed to monitor for radiological exposure.

For areas which are subject to more restrictive radiological controls where the potential for exposure is greater, Radiation Worker Permits are necessary and will be obtained prior to the field work being performed in those areas. A radiological technician will be assigned to each field crew who is performing

any activities in an area which could be expected or result in site workers being exposed to levels of radiological contamination exceeding DOE limitations.

Ingress and egress of personnel, equipment and vehicles to and from radiologically-controlled areas will be monitored with "real time" radiation detection instrumentation. Monitoring results, which exceed FEMP-determined exposure guidelines, will be further evaluated to determine the possible source(s). Measures necessary to remediate radiological contamination sources will be implemented. Such measures may include, but are not limited to: personnel training, decontamination, employee exposure monitoring, increased personnel monitoring, personnel protective equipment and sampling of suspect materials encountered.

If the responsible radiological technician, assigned to the field activities being performed, identifies a real or potential condition which could or will result in an unsafe condition, then that person has the authority to cease field operations until such time as the unsafe condition has been corrected.

5.3 NONRADIOLOGICAL MONITORING AND CONTROLS

Monitoring of potential health and safety problems associated with nonradiological hazards are evaluated by a health and safety technician. Also, all field crews are responsible for hazard awareness and recognition. Task specific training is designed to enhance the performance of all field work using good and safe work practices.

Evaluating the potential for personnel exposure to organic contaminants will be achieved mainly through the use of an HNu P-101 Photoionization Detector or equivalent instrument. Other equipment which could potentially be used include: Drager tubes, oxygen meters and combustible gas indicators.

6.0 QUALITY ASSURANCE AND QUALITY CONTROL

The primary objectives of the QA and QC sections of this plan relate to the collection of field information and data which are sufficient to accurately characterize surface and subsurface soil contamination in the former production area and other areas on the FEMP. Specific objectives of this field sampling effort are designed, organized and implemented in a manner which will optimize the collection of information that meets predetermined data quality objectives. To ensure that information is gathered in such a manner

that data quality objectives are met, quality control measures will be used to determine conformance with overall OU 5 RI/FS program objectives.

6.1 FIELD AND LABORATORY QUALITY CONTROL SAMPLES

Field quality control samples will be taken to evaluate the possibility that some controllable practice, such as decontamination or sampling technique, may be responsible for introducing bias in project analytical results. Two types of QC samples will be collected: sampling equipment rinsates and trip blanks. During soil sampling, rinsate samples will be collected at a rate of one in 20 washings and analyzed for the same parameters as the soil samples (Appendix A). Trip blanks for HSL volatile organic compounds (TAL 50.03.18B, Appendix A) will be prepared for each sample cooler containing VOC. Certified blank samples for soil matrices will be added to sample shipments weekly for HSL analytical parameters. Duplicate samples will be collected as adjacent samples at surface locations and in adjacent six-inch intervals in borings at a rate of one in twenty samples.

Five percent of the radiation walkover survey will be repeated to verify results as specified in the SCQ, Section 5.3.2 for surface geophysical surveys.

Samples for Interlaboratory Data Comparability will be added to sample shipments by FERMCO Quality Control on an "as needed" basis, as required by the SCQ. FERMCO Quality Control will coordinate this program.

6.2 QUALITY ASSURANCE AUDITS

To verify compliance with the SCQ and project-specific requirements, the CRU 5 RI/FS Project Manager or representative and designated QA personnel will conduct audits and surveillances. The U.S. EPA may obtain audit results of activities covered by the SCQ upon written request to the Department of Energy, Fernald Field Office (DOE-FN). They may also conduct external audits of FEMP activities covered by the 1991 Amended Consent Agreement.

As a minimum, audits and surveillances shall consist of evaluation of the QA program and procedures, effectiveness of implementation and review of associated project documentation and final reports. Audits and surveillances shall be performed in accordance with DOE guidelines and the SCQ.

6.3 QUALITY CONTROL SURVEILLANCES

Surveillances shall consist of monitoring/observing on-going project activity and work areas to verify item and activity conformance to specified requirements. Project surveillance activities will be scheduled, planned and documented as specified in Section 12 of the SCQ.

7.0 FIELD ACTIVITY GUIDELINES

This section presents a generalized description of the field activities to be implemented in order to provide the additional contaminant nature and extent information necessary for RI/FS purposes. Field activities will consist of surface and subsurface soil sampling. The information derived from the field investigation will provide information to further define the nature and extent of soil contamination at the FEMP.

Table 7-1 provides a summary listing of the procedures to be used in this PSP. The soil sample analyses will be conducted by a designated and approved laboratory using procedures which meet the data quality standards for the specified analytical packages. Soil sampling field procedures, sampling handling/shipment and decontamination procedures will be performed in accordance to Section 6 and Appendix K of the SCQ.

7.1 WASTE DISPOSITION

The following wastes will be generated during characterization activities:

- Soil cores and cuttings
- Contact wastes
- Equipment decontamination solutions

The following subsections provide the proposed disposition methodology for each type of waste generated.

7.1.1 Soil Cores and Cuttings

Unused soil cores and cuttings from subsurface will be placed in clean waste storage containers, labelled according to project, contents and location, and sent to the designated waste interim storage location for future characterization, disposition and disposal.

TABLE 7-1
SOIL SAMPLING AND BORING PROCEDURES

Administrative Procedures	Reference Document
Chain of Custody	SCQ, Volume I, Section 7.1
Corrective Action	SCQ, Volume I, Section 15.2
Daily Logs	SCQ, Section 5.1, Appendix J, Subsection J.4.1
Variances	SCQ, Section 15.4
Field Procedures	
General Drilling Practices	SCQ, Section 5.2.1, Appendix J, Subsection J.4.2
Surface and Subsurface Soil Sampling	SCQ, Section 6, Appendix K, Subsection K.5
Radiation Walkover Survey	SCQ, Section 5.3.2, Appendix J
Field Screening of Samples for Radioactive Contamination	SCQ, Appendix K, Subsection K.5.3.2
Decontamination	SCQ, Appendix K, Subsection K.11
Field Storage and Shipment of Samples	SCQ, Appendix K, Subsection K.10
Sample Handling Procedures	
Classification, Preservation, Transportation, and Shipment of FEMP RI/FS Samples	SCQ, Appendix A, Table 6.1

7.1.2 Contact Wastes

Contact wastes, such as personal protective equipment (PPE) and rags or wipes (paper towels, Chemwipes, etc.), will be placed in plastic bags or 55-gallon drums and transported to the FEMP for appropriate disposition. Contact waste handling and disposition is discussed in the SCQ, Appendix K.

7.1.3 Decontamination Solutions

Equipment decontamination solutions will be transferred to U.S. Department of Transportation (DOT)-approved bung-type, 55-gallon drums, labeled as "Decontamination Solutions." The drums will be placed on wooden pallets, underlaid by diked Herculite sheeting to prevent contaminant migration resulting from

spills or leaks. Upon completion of field activities for each characterization phase, the drummed decontamination solutions will be transported to the FEMP for storage and appropriate disposal.

8.0 FIELD SAMPLING SCHEME

Sampling for this project will be performed by the SC/DM Department of the FERMCO Environmental Management Division. Due to the nature, objectives and programmatic requirements of this project, actual sampling locations and parameter selection is determined by FERMCO personnel of CRU5, specifically, the RI/FS Project Manager.

8.1 SAMPLE TEAM ORGANIZATION

Soil sampling will be directly supervised by the SC/DM Field Operations Manager. Sampling will be accomplished by a minimum two-person field crews, consisting of a geologist/engineer and a sampling technician. Sample Management Office staff will be utilized to provide an interface between the sampling crews and the FEMP or contract laboratory to be used for sample analysis. The SC/DM staff will also provide the FEMP QA department with field sampling schedules.

8.2 RESPONSIBILITIES OF TEAM MEMBERS

The Field Operations Manager is responsible for the coordination and effective use of all personnel on site and for proper maintenance of the record of all field activities. In addition, the Field Operations Manager is responsible for field quality control, including issuance and tracking of measurement and test equipment.

Field sampling personnel are responsible for the collection of the samples in accordance with the approved PSP. All activities associated with the execution of sampling are to be documented on the appropriate Field Activity Daily Logs (FADLs) which are to be completed by the sampling technicians for each sampling location. These technicians are also responsible for ensuring that the proper sampling equipment is available, in serviceable condition and properly decontaminated between each sampling point. Field sampling personnel are responsible for sample labelling, handling and completion of a Chain of Custody/Request for Analysis (CC/RFA) form prior to submittal of the samples to the Sample Management Office.

The Sample Management Office staff will interface with the FEMP or contract laboratory and are responsible for ensuring that proper sampling containers, preservatives and sampling coolers are available and in serviceable condition. They are also responsible for logging in all collected samples, delivering the samples to the FEMP laboratory or sending the samples, with accompanying paperwork, to the appropriate contract laboratory.

8.3 SAMPLING SCHEDULE

In general, sampling will be performed concurrent with other investigative activities; however, it is imperative that sample results be available for validation by August 1, 1993. All field work must be completed to meet this schedule.

9.0 REFERENCES

IT Corporation, 1986, Air Soil, Water and Health Risk Assessment in the Vicinity of the FMPC, Fernald, Ohio, Final Interim Report and Data Package, prepared for the U.S. Department of Energy, Oak Ridge Operations, in Support of the Fernald Litigation.

Roy F. Weston, Inc., 1987, Characterization Investigation Study, Vol. 3, Radiological Characterization of Surface Soils in Waste Storage Areas.

Remedial Investigation Report for Operable Unit 4, April 1993, prepared for the U.S. Department of Energy, Oak Ridge Operations, in Support of the Fernald Office.

APPENDIX A

TARGET ANALYTE LISTS

DRAFT

SURFACE AND SUBSURFACE SOIL INVESTIGATION

PRODUCTION AREA SOIL SAMPLES, FIELD BLANKS AND RINSATES

TAL 50.03.18 A

FEMP RI/FS – FULL HSL – ANALYTICAL PARAMETERS

INORGANICS

		Pay Item
1	Aluminum	50
2	Antimony	
3	Arsenic	
4	Barium	
5	Beryllium	
6	Cadmium	
7	Calcium	
8	Chromium (Total)	
9	Cobalt	
10	Copper	
11	Cyanide	
12	Iron	
13	Lead	
14	Magnesium	
15	Manganese	
16	Mercury	
17	Molybdenum	
18	Nickel	
19	Potassium	
20	Selenium	
21	Silicon	
22	Silver	
23	Sodium	
24	Thallium	
25	Vanadium	
26	Zinc	

VOLATILE ORGANICS

1	1,1–Dichloroethane	47
2	1,1–Dichloroethene	
3	1,1,1–Trichloroethane	
4	1,1,2–Trichloroethane	
5	1,1,2,2–Tetrachloroethane	
6	1,2–Dichloroethane	
7	1,2–Dichloroethene (total)	
8	1,2–Dichloroethylene	
9	1,2–Dichloropropane	
10	2–Butanone	
11	2–Hexanone	
12	4–Methyl–2–pentanone	
13	Acetone	
14	Benzene	
15	Bromodichloromethane	
16	Bromoform	
17	Bromomethane	
18	Carbon disulfide	
19	Carbon tetrachloride	
20	Chlorobenzene	
21	Chloroethane	
22	Chloroform	
23	Chloromethane	
24	cis–1,3–Dichloropropene	
25	Dibromochloromethane	
26	Ethylbenzene	
27	Methylene chloride	
28	Styrene	
29	Tetrachloroethene	
30	Toluene	
31	Total xylenes	
32	trans–1,3–Dichloropropene	
33	Trichloroethene	
34	Vinyl acetate	
35	Vinyl chloride	

SEMIVOLATILE ORGANICS

		Pay Item
1	1,2–Dichlorobenzene	48
2	1,2,4–Trichlorobenzene	
3	1,3–Dichlorobenzene	
4	1,4–Dichlorobenzene	
5	2–Chloronaphthalene	
6	2–Chlorophenol	
7	2–Methylnaphthalene	
8	2–Methylphenol	
9	2–Nitroaniline	
10	2–Nitrophenol	
11	2,4–Dichlorophenol	
12	2,4–Dimethylphenol	
13	2,4–Dinitrophenol	
14	2,4–Dinitrotoluene	
15	2,4,5–Trichlorophenol	
16	2,4,6–Trichlorophenol	
17	2,6–Dinitrotoluene	
18	3–Nitroaniline	
19	3,3'–Dichlorobenzidine	
20	4–Bromophenyl phenylether	
21	4–Chloro–3–methylphenol	
22	4–Chloroaniline	
23	4–Chlorophenyl–phenyl ether	
24	4–Methylphenol	
25	4–Nitroaniline	
26	4–Nitrophenol	
27	4,6–Dinitro–2–methylphenol	
28	Acenaphthene	
29	Acenaphthylene	
30	Anthracene	
31	Benzoic acid	
32	Benzo(a)anthracene	
33	Benzo(a)pyrene	
34	Benzo(b)fluoranthene	
35	Benzo(g,h,i)perylene	
36	Benzo(k)fluoranthene	
37	Benzyl alcohol	
38	bis(2–Chloroethoxy)methane	
39	bis(2–Chloroethyl)ether	
40	bis(2–Chloroisopropyl) ether	
41	bis(2–Ethylhexyl)phthalate	
42	Butyl benzyl phthalate	
43	Carbazole	
44	Chrysene	
45	Dibenzofuran	
46	Dibenzo(a,h)anthracene	
47	Diethylphthalate	
48	Dimethylphthalate	
49	Di–n–butyl phthalate	
50	Di–n–octyl phthalate	
51	Fluoranthene	
52	Fluorene	
53	Hexachlorobenzene	
54	Hexachlorobutadiene	
55	Hexachlorocyclopentadiene	
56	Hexachloroethane	
57	Indeno(1,2,3–cd)pyrene	
58	Isophorone	
59	Naphthalene	
60	Nitrobenzene	
61	N–Nitroso–di–n–propylamine	
62	N–Nitrosodiphenylamine	
63	Pentachlorophenol	
64	Phenanthrene	
65	Phenol	
66	Pyrene	

PESTICIDES / PCBs

		Pay Item
1	4,4'–DDD	49
2	4,4'–DDE	
3	4,4'–DDT	
4	Aldrin	
5	alpha–BHC	
6	alpha–Chlordane	
7	Aroclor 1016	
8	Aroclor 1221	
9	Aroclor 1232	
10	Aroclor 1242	
11	Aroclor 1248	
12	Aroclor 1254	
13	Aroclor 1260	
14	beta–BHC	
15	delta–BHC	
16	Dieldrin	
17	Endosulfan sulfate	
18	Endosulfan–I	
19	Endosulfan–II	
20	Endrin	
21	Endrin aldehyde	
22	Endrin ketone	
23	gamma–BHC	
24	gamma–Chlordane	
25	Heptachlor	
26	Heptachlor epoxide	
27	Methoxychlor	
28	Toxaphene	

FEMP RI/FS – FULL RADIOLOGICAL – ANALYTICAL PARAMETERS

RADIOLOGICAL

1	Radium 226	114
2	Radium 228	
3	Thorium 228	116
4	Thorium 230	
5	Thorium 232	
6	Total Thorium	
7	Total Uranium	120
8	Uranium 234	
9	Uranium 235/236	
10	Uranium 238	

SURFACE AND SUBSURFACE SOIL INVESTIGATION

HYDROPUNCH GROUNDWATER SAMPLES IN THE PLANT 2/3 AREA

TAL 50.03.18 B

FEMP RI/FS – LIMITED HSL (VOCs) – ANALYTICAL PARAMETERS

	VOLATILE ORGANICS	Pay Item
1	1,1-Dichloroethane	47
2	1,1-Dichloroethene	
3	1,1,1-Trichloroethane	
4	1,1,2-Trichloroethane	
5	1,1,2,2-Tetrachloroethane	
6	1,2-Dichloroethane	
7	1,2-Dichloroethene (total)	
8	1,2-Dichloroethylene	
9	1,2-Dichloropropane	
10	2-Butanone	
11	2-Hexanone	
12	4-Methyl-2-pentanone	
13	Acetone	
14	Benzene	
15	Bromodichloromethane	
16	Bromoform	
17	Bromomethane	
18	Carbon disulfide	
19	Carbon tetrachloride	
20	Chlorobenzene	
21	Chloroethane	
22	Chloroform	
23	Chloromethane	
24	cis-1,3-Dichloropropene	
25	Dibromochloromethane	
26	Ethylbenzene	
27	Methylene chloride	
28	Styrene	
29	Tetrachloroethene	
30	Toluene	
31	Total xylenes	
32	trans-1,3-Dichloropropene	
33	Trichloroethene	
34	Vinyl acetate	
35	Vinyl chloride	

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SURFACE AND SUBSURFACE SOIL INVESTIGATION

SURFACE SOIL SAMPLES, FIELD BLANKS AND RINSATES OUTSIDE THE PRODUCTION AREA

TAL 50.03.18 C

FEMP RI/FS – LIMITED FULL HSL (METALS AND PEST/PCBs) – ANALYTICAL PARAMETERS

	INORGANICS	Pay Item
1	Aluminum	50
2	Antimony	
3	Arsenic	
4	Barium	
5	Beryllium	
6	Cadmium	
7	Calcium	
8	Chromium (Total)	
9	Cobalt	
10	Copper	
11	Cyanide	
12	Iron	
13	Lead	
14	Magnesium	
15	Manganese	
16	Mercury	
17	Molybdenum	
18	Nickel	
19	Potassium	
20	Selenium	
21	Silicon	
22	Silver	
23	Sodium	
24	Thallium	
25	Vanadium	
26	Zinc	

	PESTICIDES / PCBs	Pay Item
1	4,4'-DDD	49
2	4,4'-DDE	
3	4,4'-DDT	
4	Aldrin	
5	alpha-BHC	
6	alpha-Chlordane	
7	Aroclor 1016	
8	Aroclor 1221	
9	Aroclor 1232	
10	Aroclor 1242	
11	Aroclor 1248	
12	Aroclor 1254	
13	Aroclor 1260	
14	beta-BHC	
15	delta-BHC	
16	Dieldrin	
17	Endosulfan sulfate	
18	Endosulfan-I	
19	Endosulfan-II	
20	Endrin	
21	Endrin aldehyde	
22	Endrin ketone	
23	gamma-BHC	
24	gamma-Chlordane	
25	Heptachlor	
26	Heptachlor epoxide	
27	Methoxychlor	
28	Toxaphene	

SURFACE AND SUBSURFACE SOIL INVESTIGATION

SURFACE SOIL SAMPLES, FIELD BLANKS AND RINSATES OUTSIDE THE PRODUCTION AREA

TAL 50.03.18 D

FEMP RI/FS - LIMITED FULL HSL (PEST/PCBs) - ANALYTICAL PARAMETERS

	PESTICIDES / PCBs	Pay Item
1	4,4'-DDD	49
2	4,4'-DDE	
3	4,4'-DDT	
4	Aldrin	
5	alpha-BHC	
6	alpha-Chlordane	
7	Aroclor 1016	
8	Aroclor 1221	
9	Aroclor 1232	
10	Aroclor 1242	
11	Aroclor 1248	
12	Aroclor 1254	
13	Aroclor 1260	
14	beta-BHC	
15	delta-BHC	
16	Dieldrin	
17	Endosulfan sulfate	
18	Endosulfan-I	
19	Endosulfan-II	
20	Endrin	
21	Endrin aldehyde	
22	Endrin ketone	
23	gamma-BHC	
24	gamma-Chlordane	
25	Heptachlor	
26	Heptachlor epoxide	
27	Methoxychlor	
28	Toxaphene	

FEMP RI/FS - FULL RADIOLOGICAL - ANALYTICAL PARAMETERS

	RADIOLOGICAL	Pay Item
1	Cesium 137	56
2	Neptunium 237	
3	Plutonium 238	
4	Plutonium 239/240	
5	Radium 226	
6	Radium 228	
7	Ruthenium 106	
8	Strontium 90	
9	Technetium 99	
10	Thorium 228	
11	Thorium 230	
12	Thorium 232	
13	Total Thorium	
14	Total Uranium	
15	Uranium 234	
16	Uranium 235/236	
17	Uranium 238	

	MISC. RADIOLOGICAL	
1	Gross alpha	19
2	Gross beta	

SURFACE AND SUBSURFACE SOIL INVESTIGATION

SURFACE SOIL SAMPLES, FIELD BLANKS AND RINSATES OUTSIDE THE PRODUCTION AREA

TAL 50.03.18 E

FEMP RI/FS – FULL HSL – ANALYTICAL PARAMETERS

INORGANICS		Pay Item
1	Aluminum	50
2	Antimony	
3	Arsenic	
4	Barium	
5	Beryllium	
6	Cadmium	
7	Calcium	
8	Chromium (Total)	
9	Cobalt	
10	Copper	
11	Cyanide	
12	Iron	
13	Lead	
14	Magnesium	
15	Manganese	
16	Mercury	
17	Molybdenum	
18	Nickel	
19	Potassium	
20	Selenium	
21	Silicon	
22	Silver	
23	Sodium	
24	Thallium	
25	Vanadium	
26	Zinc	

VOLATILE ORGANICS		
1	1,1-Dichloroethane	47
2	1,1-Dichloroethene	
3	1,1,1-Trichloroethane	
4	1,1,2-Trichloroethane	
5	1,1,2,2-Tetrachloroethane	
6	1,2-Dichloroethane	
7	1,2-Dichloroethene (total)	
8	1,2-Dichloroethylene	
9	1,2-Dichloropropane	
10	2-Butanone	
11	2-Hexanone	
12	4-Methyl-2-pentanone	
13	Acetone	
14	Benzene	
15	Bromodichloromethane	
16	Bromoform	
17	Bromomethane	
18	Carbon disulfide	
19	Carbon tetrachloride	
20	Chlorobenzene	
21	Chloroethane	
22	Chloroform	
23	Chloromethane	
24	cis-1,3-Dichloropropene	
25	Dibromochloromethane	
26	Ethylbenzene	
27	Methylene chloride	
28	Styrene	
29	Tetrachloroethene	
30	Toluene	
31	Total xylenes	
32	trans-1,3-Dichloropropene	
33	Trichloroethene	
34	Vinyl acetate	
35	Vinyl chloride	

SEMIVOLATILE ORGANICS		Pay Item
1	1,2-Dichlorobenzene	48
2	1,2,4-Trichlorobenzene	
3	1,3-Dichlorobenzene	
4	1,4-Dichlorobenzene	
5	2-Chloronaphthalene	
6	2-Chlorophenol	
7	2-Methylnaphthalene	
8	2-Methylphenol	
9	2-Nitroaniline	
10	2-Nitrophenol	
11	2,4-Dichlorophenol	
12	2,4-Dimethylphenol	
13	2,4-Dinitrophenol	
14	2,4-Dinitrotoluene	
15	2,4,5-Trichlorophenol	
16	2,4,6-Trichlorophenol	
17	2,6-Dinitrotoluene	
18	3-Nitroaniline	
19	3,3'-Dichlorobenzidine	
20	4-Bromophenyl phenylether	
21	4-Chloro-3-methylphenol	
22	4-Chloroaniline	
23	4-Chlorophenyl-phenyl ether	
24	4-Methylphenol	
25	4-Nitroaniline	
26	4-Nitrophenol	
27	4,6-Dinitro-2-methylphenol	
28	Acenaphthene	
29	Acenaphthylene	
30	Anthracene	
31	Benzoic acid	
32	Benzo(a)anthracene	
33	Benzo(a)pyrene	
34	Benzo(b)fluoranthene	
35	Benzo(g,h,i)perylene	
36	Benzo(k)fluoranthene	
37	Benzyl alcohol	
38	bis(2-Chloroethoxy)methane	
39	bis(2-Chloroethyl)ether	
40	bis(2-Chloroisopropyl) ether	
41	bis(2-Ethylhexyl)phthalate	
42	Butyl benzyl phthalate	
43	Carbazole	
44	Chrysene	
45	Dibenzofuran	
46	Dibenzo(a,h)anthracene	
47	Diethylphthalate	
48	Dimethylphthalate	
49	Di-n-butyl phthalate	
50	Di-n-octyl phthalate	
51	Fluoranthene	
52	Fluorene	
53	Hexachlorobenzene	
54	Hexachlorobutadiene	
55	Hexachlorocyclopentadiene	
56	Hexachloroethane	
57	Indeno(1,2,3-cd)pyrene	
58	Isophorone	
59	Naphthalene	
60	Nitrobenzene	
61	N-Nitroso-di-n-propylamine	
62	N-Nitrosodiphenylamine	
63	Pentachlorophenol	
64	Phenanthrene	
65	Phenol	
66	Pyrene	

PESTICIDES / PCBs		Pay Item
1	4,4'-DDD	49
2	4,4'-DDE	
3	4,4'-DDT	
4	Aldrin	
5	alpha-BHC	
6	alpha-Chlordane	
7	Aroclor 1016	
8	Aroclor 1221	
9	Aroclor 1232	
10	Aroclor 1242	
11	Aroclor 1248	
12	Aroclor 1254	
13	Aroclor 1260	
14	beta-BHC	
15	delta-BHC	
16	Dieldrin	
17	Endosulfan sulfate	
18	Endosulfan-I	
19	Endosulfan-II	
20	Endrin	
21	Endrin aldehyde	
22	Endrin ketone	
23	gamma-BHC	
24	gamma-Chlordane	
25	Heptachlor	
26	Heptachlor epoxide	
27	Methoxychlor	
28	Toxaphene	

SURFACE AND SUBSURFACE SOIL INVESTIGATION

SURFACE SOIL SAMPLES, FIELD BLANKS AND RINSATES OUTSIDE THE PRODUCTION AREA

TAL 50.03.18 F

FEMP RI/FS – FULL HSL – ANALYTICAL PARAMETERS

INORGANICS		Pay Item
1	Aluminum	50
2	Antimony	
3	Arsenic	
4	Barium	
5	Beryllium	
6	Cadmium	
7	Calcium	
8	Chromium (Total)	
9	Cobalt	
10	Copper	
11	Cyanide	
12	Iron	
13	Lead	
14	Magnesium	
15	Manganese	
16	Mercury	
17	Molybdenum	
18	Nickel	
19	Potassium	
20	Selenium	
21	Silicon	
22	Silver	
23	Sodium	
24	Thallium	
25	Vanadium	
26	Zinc	

VOLATILE ORGANICS		Pay Item
1	1,1-Dichloroethane	47
2	1,1-Dichloroethene	
3	1,1,1-Trichloroethane	
4	1,1,2-Trichloroethane	
5	1,1,2,2-Tetrachloroethane	
6	1,2-Dichloroethane	
7	1,2-Dichloroethene (total)	
8	1,2-Dichloroethylene	
9	1,2-Dichloropropane	
10	2-Butanone	
11	2-Hexanone	
12	4-Methyl-2-pentanone	
13	Acetone	
14	Benzene	
15	Bromodichloromethane	
16	Bromoform	
17	Bromomethane	
18	Carbon disulfide	
19	Carbon tetrachloride	
20	Chlorobenzene	
21	Chloroethane	
22	Chloroform	
23	Chloromethane	
24	cis-1,3-Dichloropropene	
25	Dibromochloromethane	
26	Ethylbenzene	
27	Methylene chloride	
28	Styrene	
29	Tetrachloroethene	
30	Toluene	
31	Total xylenes	
32	trans-1,3-Dichloropropene	
33	Trichloroethene	
34	Vinyl acetate	
35	Vinyl chloride	

SEMIVOLATILE ORGANICS		Pay Item
1	1,2-Dichlorobenzene	48
2	1,2,4-Trichlorobenzene	
3	1,3-Dichlorobenzene	
4	1,4-Dichlorobenzene	
5	2-Chloronaphthalene	
6	2-Chlorophenol	
7	2-Methylnaphthalene	
8	2-Methylphenol	
9	2-Nitroaniline	
10	2-Nitrophenol	
11	2,4-Dichlorophenol	
12	2,4-Dimethylphenol	
13	2,4-Dinitrophenol	
14	2,4-Dinitrotoluene	
15	2,4,5-Trichlorophenol	
16	2,4,6-Trichlorophenol	
17	2,6-Dinitrotoluene	
18	3-Nitroaniline	
19	3,3'-Dichlorobenzidine	
20	4-Bromophenyl phenylether	
21	4-Chloro-3-methylphenol	
22	4-Chloroaniline	
23	4-Chlorophenyl-phenyl ether	
24	4-Methylphenol	
25	4-Nitroaniline	
26	4-Nitrophenol	
27	4,6-Dinitro-2-methylphenol	
28	Acenaphthene	
29	Acenaphthylene	
30	Anthracene	
31	Benzoic acid	
32	Benzo(a)anthracene	
33	Benzo(a)pyrene	
34	Benzo(b)fluoranthene	
35	Benzo(g,h,i)perylene	
36	Benzo(k)fluoranthene	
37	Benzyl alcohol	
38	bis(2-Chloroethoxy)methane	
39	bis(2-Chloroethyl)ether	
40	bis(2-Chloroisopropyl) ether	
41	bis(2-Ethylhexyl)phthalate	
42	Butyl benzyl phthalate	
43	Carbazole	
44	Chrysene	
45	Dibenzofuran	
46	Dibenzo(a,h)anthracene	
47	Diethylphthalate	
48	Dimethylphthalate	
49	Di-n-butyl phthalate	
50	Di-n-octyl phthalate	
51	Fluoranthene	
52	Fluorene	
53	Hexachlorobenzene	
54	Hexachlorobutadiene	
55	Hexachlorocyclopentadiene	
56	Hexachloroethane	
57	Indeno(1,2,3-cd)pyrene	
58	Isophorone	
59	Naphthalene	
60	Nitrobenzene	
61	N-Nitroso-di-n-propylamine	
62	N-Nitrosodiphenylamine	
63	Pentachlorophenol	
64	Phenanthrene	
65	Phenol	
66	Pyrene	

PESTICIDES / PCBs		Pay Item
1	4,4'-DDD	49
2	4,4'-DDE	
3	4,4'-DDT	
4	Aldrin	
5	alpha-BHC	
6	alpha-Chlordane	
7	Aroclor 1016	
8	Aroclor 1221	
9	Aroclor 1232	
10	Aroclor 1242	
11	Aroclor 1248	
12	Aroclor 1254	
13	Aroclor 1260	
14	beta-BHC	
15	delta-BHC	
16	Dieldrin	
17	Endosulfan sulfate	
18	Endosulfan-I	
19	Endosulfan-II	
20	Endrin	
21	Endrin aldehyde	
22	Endrin ketone	
23	gamma-BHC	
24	gamma-Chlordane	
25	Heptachlor	
26	Heptachlor epoxide	
27	Methoxychlor	
28	Toxaphene	

FEMP RI/FS – FULL RADIOLOGICAL – ANALYTICAL PARAMETERS

RADIOLOGICAL		Pay Item
1	Cesium 137	56
2	Neptunium 237	
3	Plutonium 238	
4	Plutonium 239/240	
5	Radium 226	
6	Radium 228	
7	Ruthenium 106	
8	Strontium 90	
9	Technetium 99	
10	Thorium 228	
11	Thorium 230	
12	Thorium 232	
13	Total Thorium	
14	Total Uranium	
15	Uranium 234	
16	Uranium 235/236	
17	Uranium 238	

MISC. RADIOLOGICAL		
1	Gross alpha	19
2	Gross beta	

SURFACE AND SUBSURFACE SOIL INVESTIGATION

SOIL SAMPLES, FIELD BLANKS AND RINSATES WEST OF THE K-65 SILOS

TAL 50.03.18 G

FEMP RI/FS – HSL METALS – ANALYTICAL PARAMETERS

	INORGANICS	Pay Item
1	Aluminum	50
2	Antimony	
3	Arsenic	
4	Barium	
5	Beryllium	
6	Cadmium	
7	Calcium	
8	Chromium (Total)	
9	Cobalt	
10	Copper	
11	Cyanide	
12	Iron	
13	Lead	
14	Magnesium	
15	Manganese	
16	Mercury	
17	Molybdenum	
18	Nickel	
19	Potassium	
20	Selenium	
21	Silicon	
22	Silver	
23	Sodium	
24	Thallium	
25	Vanadium	
26	Zinc	

FEMP RI/FS – FULL RADIOLOGICAL – ANALYTICAL PARAMETERS

	RADIOLOGICAL	Pay Item
1	Cesium 137	56
2	Neptunium 237	
3	Plutonium 238	
4	Plutonium 239/240	
5	Radium 226	
6	Radium 228	
7	Ruthenium 106	
8	Strontium 90	
9	Technetium 99	
10	Thorium 228	
11	Thorium 230	
12	Thorium 232	
13	Total Thorium	
14	Total Uranium	
15	Uranium 234	
16	Uranium 235/236	
17	Uranium 238	

	MISC. RADIOLOGICAL	
1	Gross alpha	19
2	Gross beta	
3	Lead 210	110
4	Polonium 210	111

APPENDIX B

EXISTING HAZARDOUS SUBSTANCE LIST (HSL) INORGANIC/ORGANIC DATA COLLECTED IN SUPPORT OF THE 1988 RI/FS

These tables contain unvalidated data available in March 1993, and does not represent a complete listing of all samples analyzed for the FEMP.

PRELIMINARY SUMMARY OF METAL CONCENTRATIONS IN SOIL SIGNIFICANTLY EXCEEDING BACKGROUND, mg/kg (1)
AND CORRESPONDING ACTION LEVELS, mg/kg
OPERABLE UNIT #5
FERMCO
CINCINNATI, OHIO

SOURCE	PARAMETER	RANGE OF CONCENTRATIONS SIGNIFICANTLY EXCEEDING BACKGROUND (1)	LOCATION OF MAXIMUM CONCENTRATION (Depth Interval, Feet)	NUMBER OF CONCENTRATIONS SIGNIFICANTLY EXCEEDING BACKGROUND / TOTAL NO. SAMPLES (2)	ACTION LEVEL
Plant 6 Area	Cadmium	2.4 – 6.2	1609 (4–5)	9/10	
	Lead	31.8 – 51.8	1662 (0–1)	3/10	
South of Maintenance Building	Beryllium	1.1	1601 (0.5–1)	1/17	
	Cadmium	2.9 – 7.2	1327 (0–1)	16/17	
	Lead	116	1327 (0–1)	2/17	
	Mercury	0.25 – 0.37	1327 (0–1)	3/17	
	Nickel	63.3	1327 (0–1)	2/17	
North of Maintenance Building 12	Cadmium	2.5 – 8	1308 (0–1)	6/8	
	Lead	982	1308 (0–1)	1/8	
	Mercury	0.53	1308 (0–1)	1/8	
	Nickel	67.8	1308 (0–1)	1/8	
	Cyanide	22.8	1308 (0–1)	0/8	
Coal Pile Runoff Basin	Barium	132	1584 (2–2.5)	1/18	
	Cadmium	2 – 120,000	1676 (unknown)	17/18	
	Chromium	87.7	1676 (2–2.5)	1/18	
	Copper	34.6	1676 (2–2.5)	1/18	
	Lead	26.1 – 63.4	1586 (0.5–1)	2/18	
	Nickel	41.9	1676 (2–2.5)	1/18	
	Selenium	2.6	1584 (0.5–1)	1/18	
Tank Farm North of Maintenance Building 12	Arsenic	12.6	1307 (0–0.5)	1/26	
	Beryllium	1.1 – 1.2	1589 (2–2.5) & 1590 (9.5–10)	4/26	
	Cadmium	3.3 – 6.7	1307 (0–0.5)	26/26	
	Chromium	67.5	1307 (0–0.5)	1/26	
	Copper	48.9	1307 (0–0.5)	1/26	
	Lead	32.2 – 334	1307 (0–0.5)	2/26	
	Mercury	0.46	1307 (0.5–1)	1/26	
	Nickel	36.7 – 72.2	1307 (0–0.5)	1/26	
	Thallium	0.39	1307 (0.5–1)	1/26	
Plant 4 Area	Barium	456	1302 (0.5–1)	1/9	
	Beryllium	0.67 – 0.83	1593 (0.5–1)	4/9	
	Cadmium	3.6 – 5.4	1302 (0.5–1)	9/9	
	Chromium	32.1 – 94.6	1593 (0.5–1)	2/9	
	Lead	32.2 – 49.7	1593 (0.5–1)	2/9	
	Nickel	36.7 – 102	1593 (0.5–1)	2/9	
Graphite Furnace / Oil Burner Area	Arsenic	11.5 – 81.9	1576 (0.5–1)	8/30	
	Barium	121 – 512	1288 (0.5–1)	13/30	
	Beryllium	1.2 – 1.9	1576 (0.5–1)	6/30	
	Cadmium	2.3 – 12.4	1578 (0.5–1)	26/30	
	Chromium	22.5 – 59.2	1578 (0.5–1)	8/30	
Graphite Furnace / Oil Burner Area (Continued)	Copper	21.8 – 43.9	1578 (2–2.5)	13/30	
	Lead	25.3 – 50.3	1283 (0.5–1)	6/30	
	Mercury	0.13 – 0.28	1288 (0.5–1)	7/30	
	Nickel	33.8 – 52.4	1577 (2–2.5)	6/30	
	Selenium	1.2 – 1.6	1578 (4–4.5)	2/30	

PRELIMINARY SUMMARY OF METAL CONCENTRATIONS IN SOIL SIGNIFICANTLY EXCEEDING BACKGROUND, mg/kg (1)
AND CORRESPONDING ACTION LEVELS, mg/kg
OPERABLE UNIT #5
FERMCO
CINCINNATI, OHIO

SOURCE	PARAMETER	RANGE OF CONCENTRATIONS SIGNIFICANTLY EXCEEDING BACKGROUND (1)	LOCATION OF MAXIMUM CONCENTRATION (Depth Interval, Feet)	NUMBER OF CONCENTRATIONS SIGNIFICANTLY EXCEEDING BACKGROUND / TOTAL NO. SAMPLES (2)	ACTION LEVEL
Fire Training Area	Arsenic	10	1514 (2–2.5)	1/14	
	Barium	119 – 156	1514 (2–2.5)	5/14	
	Beryllium	1.4 – 1.9	1514 (2–2.5)	8/14	
	Cadmium	2.6 – 7.6	1672 (0–0.5)	14/14	
	Chromium	20.7 – 23.5	1672 (0–0.5)	3/14	
	Copper	52.9	1672 (0–0.5)	1/14	
	Lead	20.9 – 99.3	1672 (0–0.5)	6/14	
	Mercury	0.11 – 0.18	1508 (2–2.5) & 1509 (2–2.5)	3/14	
	Nickel	34.1 – 67.1	1509 (2–2.5)	7/14	
Plant 1 Area, Plant 1 Pad	Arsenic	10.8	P1P48 (0–0.5)	1/24	
	Barium	110 – 1,570	P1P48 (0–0.5)	6/24	
	Beryllium	1.1 – 1.2	1345 (unknown) & P1P51 (0–0.5)	3/24	
	Cadmium	2.9 – 6.7	P1P66 (0–0.5)	24/24	
	Copper	20.6 – 45.5	P1P51 (0–0.5)	6/24	
	Lead	23 – 73.5	P1P48 (0–0.5)	13/24	
	Mercury	0.16 – 0.2	P1P61 (0–0.5)	2/24	
	Nickel	30.4 – 49.1	P1P46 (0–0.5)	7/24	
	Thallium	2.1	P1P45 (0–0.5)	1/24	
Landfill	Barium	160	1888 (0–1.5)	1/4	
	Beryllium	1.6	1888 (0–1.5)	1/4	
	Cadmium	4.8 – 6.5	1888 (0–1.5)	4/4	
	Chromium	51.8	1888 (0–1.5)	1/4	
	Thallium	12.5	1889 (15.5–17.5)	1/4	
	Vanadium	57.3	1888 (0–1.5)	1/4	
Plants 2/3	Cadmium	4.1 – 5.2	1183 (0.5–1)	3/4	
	Chromium	75.5	1183 (0–0.5)	1/4	
	Copper	38.5 – 161	1412 (5.5–6)	2/4	
	Lead	334 – 440	1183 (0.5–1)	2/4	
	Nickel	38 – 50	1183 (0–0.5)	3/4	
Plant 8	Cadmium	1.4 – 3.8	1797 (0–0.5)	2/3	
	Chromium	30	1796 (0–0.5)	1/3	
	Copper	34.8	1796 (0–0.5)	1/3	
Laboratory	Barium	561 – 587	1266 (0–0.5)	2/2	
	Beryllium	1.2	1266 (0–0.5) 1266 (0.5–1)	1/2	
	Cadmium	3.5 – 4.9	1266 (0.5–1)	2/2	
	Copper	69.4	1266 (0.5–1)	1/2	
	Lead	42.3	1266 (0.5–1)	1/2	
	Mercury	0.34	1266 (0–0.5)	1/2	
	Nickel	35.1 – 48.1	1266 (0.5–1)	2/2	
Pilot Plant	Barium	317 – 3,610	1411 (10–10.5)	3/13	
	Beryllium	1.2 – 1.7	1250 (0–0.5)	4/13	
	Cadmium	2.1 – 7.9	1674 (13.5–14)	13/13	

PRELIMINARY SUMMARY OF METAL CONCENTRATIONS IN SOIL SIGNIFICANTLY EXCEEDING BACKGROUND, mg/kg (1) AND CORRESPONDING ACTION LEVELS, mg/kg
OPERABLE UNIT #5
FERMCO
CINCINNATI, OHIO

SOURCE	PARAMETER	RANGE OF CONCENTRATIONS SIGNIFICANTLY EXCEEDING BACKGROUND (1)	LOCATION OF MAXIMUM CONCENTRATION (Depth Interval, Feet)	NUMBER OF CONCENTRATIONS SIGNIFICANTLY EXCEEDING BACKGROUND / TOTAL NO. SAMPLES (2)	ACTION LEVEL
Pilot Plant (Continued)	Chromium	19.4 – 32.9	1674 (13.5–14)	3/13	
	Copper	24 – 27.1	1250 (0–0.5)	2/13	
	Lead	30.3 – 117	1260 (0–0.5)	2/13	
	Mercury	0.27 – 1.1	1260 (0.5–1)	2/13	
	Nickel	39.8 – 41.9	1250 (0.5–1)	3/13	
Plants 2/3	Arsenic	26.5	1412 (5.5–6)	1/1	
	Beryllium	1.0	1412 (5.5–6)	1/1	
	Cadmium	4.1	1412 (5.5–6)	1/1	
	Chromium	30.5	1412 (5.5–6)	1/1	
	Lead	161	1412 (5.5–6)	1/1	
Grit Blast Storage (West Tower)	Beryllium	1.0 – 1.1	1665 (0.5–1)	2/8	
	Cadmium	3.6 – 6.2	1667 (0.5–1)	7/8	
	Chromium	27.7	1412 (5.5–6)	1/8	
	Copper	28 – 38	1665 (0.5–1)	2/8	
	Nickel	35.7	1665 (0.5–1)	1/8	
Waste Pit Runoff Area	Beryllium	1.0	WPA 38 (0–0.5) & WPA 24 (0–0.5)	2/45	
	Cadmium	1.7 – 7.7	WPA 3 (0–0.5)	45/45	
	Chromium	30.3	WPA 33 (0–0.5)	1/45	
	Nickel	35.1 – 50.2	WPA 38 (0–0.5)	4/45	
Building 66	Barium	165	1346 (1.5–2)	1/3	
	Beryllium	1 – 1.5	1346 (1.5–2)	3/3	
	Cadmium	3.9 – 4.5	1346 (?)	3/3	
	Mercury	1.9	1346 (?)	1/3	
	Nickel	38.6 – 39.7	1346 (?)	2/3	
	Thallium	0.84	1346 (1.5–2)	1/3	

Notes:
(1) Concentrations exceeding site–specific background levels by approximately 50% or more.
(2) Represents frequency of concentrations exceeding site–specific background levels (over all depth intervals sampled) in all soil samples collected and analyzed.

FERNALD
ORGANIC CONTAMINANT PROFILE IN SOILS

Well/ Boring No.	Depth (feet)	Total VOCs	ug/Kg	Predominant VOC	ug/Kg	Total BNAs	ug/Kg	Predominant BNA	ug/Kg	Total P/Ps	ug/Kg	Predominant P/P	ug/Kg	Dioxins/ Furans	ug/Kg
PLANT 6 AREA															
1611	4-5	TVOCs	51	1,1-DCE	25	TBNAs	660	BEHP	380						
1612	4-5	TVOCs	1348	1,1-DCA	870										
1148	4.5-5	TVOCs	265	TCE	200										
1609	4-5	TVOCs	2			TBNAs	ND			TP/P	59	B-BHC	38		
1607	4-5	TVOCs	49	1,2-DCE	34	TBNAs	ND								
1608	4-5	TVOCs	18	2butanone	13	TBNAs	ND								
1778	4-5	TVOCs	9	Toluene	7	TBNAs	ND								
1613	4-5	TVOCs	ND			TBNAs	ND								
PLANT 9 AREA															
1565	1-1.5	TVOCs	112	TCE	370	TBNAs	ND			TP/P	26				
	3-3.5	TVOCs	128	TCE	99										
	5.5-6	TVOCs	ND												
1568	1.5-2	TVOCs	30	Acetone	24										
	5.5-6	TVOCs	143	Chloroform	130										
	10.5-11	TVOCs	11	Acetone	11										
1569	1.5-2	TVOCs	ND												
	Deep	TVOCs	ND												
1570	1.5-2	TVOCs	22	Acetone	20										
	2.5-3	TVOCs	8	Acetone	6										
	10.5-11	TVOCs	2	CS2	2										
1566	1.5-2	TVOCs	16	4Met2Pent	12										
	2.5-3	TVOCs	50	4Met2Pent	44										
	3.5-4	TVOCs	128	4Met2Pent	120										
	5.5-6	TVOCs	3	4Met2Pent	1										
	10.5-11	TVOCs	10	4Met2Pent	7										
	15.5-16	TVOCs	357	4Met2Pent	340										
1567	1.5-2	TVOCs	1												
	2.5-3	TVOCs	9												
	3.5-4	TVOCs	4												
	5.5-6	TVOCs	11												
	10.5-11	TVOCs	5												
	15-16	TVOCs	4												
1324	4.5-5	TVOCs	10308	TCE	10000	TBNAs	ND			TP/P	ND				

FERNALD
ORGANIC CONTAMINANT PROFILE IN SOILS

Well/ Boring No.	Depth (feet)	Total VOCs	ug/Kg	Predominant VOC	ug/Kg	Total BNAs	ug/Kg	Predominant BNA	ug/Kg	Total P/Ps	ug/Kg	Predominant P/P	ug/Kg	Dioxins/ Furans	ug/Kg
MAINTENANCE BUILDING 12															
1605	0.5-1	TVOCs	28			TBNAs	ND			TP/P	ND				
	2-2.5	TVOCs	ND			TBNAs	ND			TP/P	ND				
1601	0.5-1	TVOCs	3			TBNAs	5024	PAH	4983	TP/P	170	PCB	170		
	2-2.5	TVOCs	296	Bnzicacid	150					TP/P	ND				
	4-4.5	TVOCs	75			TBNAs	ND			TP/P	ND				
1603	?	TVOCs				TBNAs	NA			TP/P	ND				
	2-2.5	TVOCs	344	111TCA	320	TBNAs	240	DEP	240	TP/P	ND				
1604	?	TVOCs	48			TBNAs	ND			TP/P	ND				
1602	0.5-1	TVOCs	11							TP/P	ND				
	4-4.5	TVOCs	7			TBNAs	NA			TP/P	ND				
1317	?	TVOCs	2			TBNAs	38								
1308	0.0-0.5	TVOCs	22			TBNAs	227260	PAH	227260	TP/P	ND				
	0.5-1	TVOCs	207	Phenol	200	TBNAs	36530	PAH	36530	TP/P	3800	PCB	3800		
1596	0.5-1	TVOCs	3			TBNAs	126			TP/P	1600	PCB	1600		
	2-2.5	TVOCs	ND			TBNAs	ND			TP/P	26				
	4-4.5	TVOCs	54			TBNAs	40			TP/P	ND				
	9.5-10	TVOCs	43			TBNAs	ND			TP/P	ND				
1594	9.5-10	TVOCs	272	TCE	240										
1595	9.5-10	TVOCs	167	1,2-DCE	130					TP/P	500				
1599	1.5-2	TVOCs	479	PCE	370	TBNAs	7								
1589	0.5-1	TVOCs	3			TBNAs	ND			TP/P	ND				
	2-2.5	TVOCs	14			TBNAs	ND			TP/P	ND				
1593	0.5-1	TVOCs	11			TBNAs	247	PAH	247	TP/P	1500				
	2-2.5	TVOCs	133	111TCA	81	TBNAs	2800	BEHP	2800	TP/P	ND				
	4-4.5	TVOCs	375	Clrethane	210	TBNAs	7900	BEHP	1300	TP/P	ND				
	9.5-10	TVOCs	6			TBNAs	3600	BEHP	6600	TP/P	43				
1588	2-2.5	TVOCs	3			TBNAs	ND			TP/P	ND				
	4-4.5	TVOCs	ND			TBNAs	ND			TP/P	ND				
	7.5-10	TVOCs	10			TBNAs	ND			TP/P	ND				
1316	2-2.5	TVOCs	21							TP/P	200				

FERNALD
ORGANIC CONTAMINANT PROFILE IN SOILS

Well/ Boring No.	Depth (feet)	Total VOCs	ug/Kg	Predominant VOC	ug/Kg	Total BNAs	ug/Kg	Predominant BNA	ug/Kg	Total P/Ps	ug/Kg	Predominant P/P	ug/Kg	Dioxins/ Furans	ug/Kg
COAL PILE RUNOFF, MAINTENANCE BLDG, PLANT 9															
1591	0.5-1	TVOCs	3			TBNAs	ND			TP/P	ND				
1597	0.5-1	TVOCs	30			TBNAs	46			TP/P	120				
	2-2.5	TVOCs	5			TBNAs	82	BEHP	82	TP/P	240				
	4-4.5	TVOCs	21			TBNAs	78			TP/P	18				
	9.5-10	TVOCs	120	CS2	120	TBNAs	ND			TP/P	ND				
1590	0.5-1	TVOCs	2			TBNAs	ND			TPCB	ND				
	2-2.5	TVOCs	75	TCA	75	TBNAs	ND			TPCB	ND				
	4-4.5	TVOCs	100	TCA	95	TBNAs	ND			TPCB	ND				
	9.5-10	TVOCs	23			TBNAs	40			TPCB	ND				
1587	2-2.5	TVOCs	ND			TBNAs	ND			TP/P	ND				
	4-4.5	TVOCs	8			TBNAs	ND			TP/P	110				
	9.5-10	TVOCs	95	CS2	93	TBNAs	547			TP/P	ND				
1592	0.5-1	TVOCs	28			TBNAs	ND			TP/P	ND				
	2-2.5	TVOCs	49			TBNAs	41			TP/P	ND				
	4-4.5	TVOCs	567	TCA	550	TBNAs	100			TP/P	ND				
	9.5-10	TVOCs	ND			TBNAs	ND			TP/P	ND				
1307	0.0-0.5	TVOCs	92510	TCE	89000	TBNAs	8550			TP/P	8600				
	0.5-1	TVOCs	58110	TCE	56000	TBNAs	ND			TP/P	1200				
	?	TVOCs	150310	TCE	150000										
1586	0.5-1	TVOCs	2	111TCA	2					TP/P	59				
	2-2.5	TVOCs	86	111TCA	28					TP/P	ND				
	4-4.5	TVOCs	186	111TCA	160					TP/P	ND				
	9.5-10	TVOCs	30							TP/P	ND				
1585	0.5-1	TVOCs	ND							TP/P	63				
	2-2.5	TVOCs	31							TP/P	ND				
	4-4.5	TVOCs	ND							TP/P	ND				
	9.5-10	TVOCs	31							TP/P	ND				
1583	0.5-1	TVOCs	5			TBNAs	1609	PAH	1509	TP/P	420				

FERNALD
ORGANIC CONTAMINANT PROFILE IN SOILS

Well/ Boring No.	Depth (feet)	Total VOCs	ug/Kg	Predominant VOC	ug/Kg	Total BNAs	ug/Kg	Predominant BNA	ug/Kg	Total P/Ps	ug/Kg	Predominant P/P	ug/Kg	Dioxins/ Furans	ug/Kg
BUILDING 10 (CHEMICAL FEED SUMP)															
1584	0.5-1	TVOCs	ND			TBNAs	3282	PAH	3282	TP/P	3000	PCB	3000	F	140
	2-2.5	TVOCs	ND			TBNAs	60670	PAH	60670	TP/P	ND			F	120
	4-4.5	TVOCs	ND			TBNAs	254			TP/P	ND			F	ND
	9.5-10	TVOCs	2			TBNAs	39			TP/P	ND			F	ND
1582	0.5-1					TBNAs	217	PAH	168	TP/P	170	A 1254	170		
	2-2.5					TBNAs	40			TP/P	41	A 1254	41		
	4-4.5					TBNAs	ND			TP/P	51	A 1254	51		
	9.5-10					TBNAs	ND			TP/P	32	A 1254	32		
1676	0.5-1	TVOCs	28			TBNAs	ND			TP/P	36				
	2-2.5	TVOCs	29			TBNAs	ND			TP/P	ND				
	4-4.5	TVOCs	27			TBNAs	ND			TP/P	ND				
	9.5-10	TVOCs	ND			TBNAs	ND			TP/P	ND				
	?	TVOCs	13			TBNAs	ND			TP/P	ND				
GRAPHITE BURNER/OIL BURNER, BOILER PLANT AREA															
1363	?	TVOCs	19	PCE	6	TBNAs	310	BEHP	310	TP/P	150				
	?	TVOCs	14	PCE	5	TBNAs	299	PAH	190	TP/P	100	BBHC	100		
1576	0.5-1	TVOCs	33	PCE	15	TBNAs	1004	BEHP	760	TP/P	ND				
	2-2.5	TVOCs	ND			TBNAs	4200	BEHP	4200	TP/P	ND				
	4-4.5	TVOCs	3	PCE	1	TBNAs	3000	BEHP	3000	TP/P	ND				
1578	0.5-1	TVOCs	17984	PCE	15000	TBNAs	1700	BEHP	1700	TP/P	ND				
	2-2.5	TVOCs	979	PCE	420	TBNAs	230	BEHP	230	TP/P	ND				
	4-4.5	TVOCs	23180	PCE	13000	TBNAs	1755	BEHP	1755	TP/P	450				
1573	0.5-1	TVOCs	17			TBNAs	286	PAH	286	TP/P	200				
	2-2.5	TVOCs	13			TBNAs	217	PAH	217	TP/P	ND				
	4-4.5	TVOCs	23			TBNAs	ND			TP/P	ND				
1288	0.5-1	TVOCs	45			TBNAs	1019	PAH	1019	TP/P	230				
1577	4-4.5	TVOCs	ND			TBNAs	5100	BEHP	5100	TP/P	ND			F	ND
	2-2.5	TVOCs	3			TBNAs	2600	BEHP	2600	TP/P	ND			F	ND
	0.5-1	TVOCs	10			TBNAs	8863	BEHP	8863	TP/P	327			F	140
1572	0.5-1	TVOCs	12			TBNAs	1700	BEHP	1700	TP/P	173				
	2-2.5	TVOCs	226	TCA	220	TBNAs	14000	BEHP	14000	TP/P	ND				
	4-4.5	TVOCs	38	TCA	36	TBNAs	2600	BEHP	2600	TP/P	ND				
1574	0.5-1					TBNAs	3700	BEHP	3700	TP/P	167				
	2-2.5					TBNAs	6900	BEHP	6900	TP/P	ND				

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ORGANIC CONTAMINANT PROFILE IN SOILS

Well/ Boring No.	Depth (feet)	Total VOCs	ug/Kg	Predominant VOC	ug/Kg	Total BNAs	ug/Kg	Predominant BNA	ug/Kg	Total P/Ps	ug/Kg	Predominant P/P	ug/Kg	Dioxins/ Furans	ug/Kg
	3.5-4					TBNAs	6000	BEHP	6000	TP/P	ND				
1580	0.5-1	TVOCs	35	TCA	24	TBNAs	1178	PAH	1178	TP/P	506			F	84
	2-2.5	TVOCs	ND			TBNAs	ND			TP/P	ND			F	36
	4-4.5	TVOCs	438	DCA/DCE	120	TBNAs	ND			TP/P	ND			F	ND
1283	0-.5	TVOCs	26			TBNAs	830	PAH	590	TP/P	1760	PCB	1760		
	0.5-1	TVOCs	892	Toluene	160	TBNAs	1310	PAH	1310	TP/P	598	PCB	520		
1579	0.5-1	TVOCs	29	TCA	11	TBNAs	1855	PAH	1510	TP/P	960				
	2-2.5	TVOCs	98	1,2-DCE	29	TBNAs	ND			TP/P	ND				
	4-4.5	TVOCs	230	1,2-DCE	150	TBNAs	ND			TP/P	ND				
1287	0.0-0.5	TVOCs	50	PCE	12	TBNAs	862			TP/P	4000				
	0.5-1	TVOCs	3	PCE	10	TBNAs	ND			TP/P	85				
FIRE TRAINING AREA															
1515	2-2.5	TVOCs	2			TBNAs	ND			TP/P	ND				
1512	2-2.5									TP/P	2200	A 1254	2200		
1510	2-2.5	TVOCs	22												
1509	2-2.5	TVOCs	16							TPCB	ND				
1514	2-2.5	TVOCs	ND			TBNAs	ND			TPCB	ND				
1513	2-2.5	TVOCs	ND			TBNAs	ND			TPCB	ND				
	12-12.5	TVOCs	ND			TBNAs	ND			TP/P	ND				
1511	2-2.5	TVOCs	90	2Butanone	59					TP/P	ND				
1508	2-2.5	TVOCs	79	2Butanone	76					TP/P	240				
1673	0.0-0.5	TVOCs	101	PCE	99	TBNAs	1300	PAH	1300	TP/P	ND			D/F	ND
1672	0.0-0.5	TVOCs	32			TBNAs	39870	PAH	39300	TP/P	ND			D/F	ND
1670	0.0-0.5	TVOCs	13			TBNAs	120			TP/P	ND			D/F	
1671	0.0-0.5	TVOCs	2			TBNAs	ND			TP/P	ND			D/F	ND
1669	0.0-0.5	TVOCs	19							TP/P	45			D/F	ND
1668	0.0-0.5	TVOCs	58			TBNAs	862	PAH	490	TP/P	40			D/F	ND

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ORGANIC CONTAMINANT PROFILE IN SOILS

Well/ Boring No.	Depth (feet)	Total VOCs	ug/Kg	Predominant VOC	ug/Kg	Total BNAs	ug/Kg	Predominant BNA	ug/Kg	Total P/Ps	ug/Kg	Predominant P/P	ug/Kg	Dioxins/ Furans	ug/Kg
LAB AREA															
1266	0.0–0.5	TVOCs	ND			TBNAs	927								
	0.5–1	TVOCs	ND			TBNAs	1458								
PILOT PLANT: SUMPS, WASTEWATER TANKS, SOLVENT STORAGE TANKS															
1252	0.0–0.5	TVOCs	1			TBNAs	48800	PAH	48000	TP/P	2000	A 1254	1000		
	0.5–1	TVOCs	24			TBNAs	4682	PAH	4624	TP/P	440	A 1254	270		
1260	0.0–0.5	TVOCs	5			TBNAs	7761	PAH	7715	TP/P	740	A 1254	340		
	0.5–1	TVOCs	37			TBNAs	8774	PAH	8728	TP/P	220	BBHC	220		
1250	0.0–0.5	TVOCs	31			TBNAs	114			TP/P	ND				
	0.5–1	TVOCs	7			TBNAs	69			TP/P	NA				
1411	9.5–10	TVOCs	ND			TBNAs	2527	DNBP	1400	TP/P	830				
	10–10.5	TVOCs	32950	Toluene	31000	TBNAs	3170	DNBP	1400	TP/P	1100	PCB	1100		
1674	2.5–3	TVOCs	ND			TBNAs	ND			TP/P	143				
	3–3.5	TVOCs	458	TCA	310	TBNAs	ND			TP/P	ND				
	6–6.5	TVOCs	647	TCA	450	TBNAs	ND			TP/P	ND				
	6.5–7	TVOCs	488	TCA	340	TBNAs	ND			TP/P	ND				
	13.5–14	TVOCs	62	TCE	36	TBNAs	ND			TP/P	ND				
PLANT 8															
1797	0.0–0.5	TVOCs	3			TBNAs	43								
1796	0.0–0.5	TVOCs	6			TBNAs	39								

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ORGANIC CONTAMINANT PROFILE IN SOILS

Well/ Boring No.	Depth (feet)	Total VOCs	ug/Kg	Predominant VOC	ug/Kg	Total BNAs	ug/Kg	Predominant BNA	ug/Kg	Total P/Ps	ug/Kg	Predominant P/P	ug/Kg	Dioxins/ Furans	ug/Kg
PLANT 2/3															
1184	5-5.5	TVOCs	211	2Butanone	120										
1412	3.5-6	TVOCs	20			TBNAs	799	NNDNPA	630						
1183	0.0-0.5	TVOCs	28			TBNAs	280	BEHP	180	TP/P	360				
	0.5-1	TVOCs	104			TBNAs	130	NNDNPA	130	TP/P	NA				
BUILDING 66															
1346	?	TVOCs	13			TBNAs	ND			TP/P	ND				
1345	?	TVOCs	4/ND			TBNAs	72/ND			TPCB	ND/ND				
PLANT 1 PAD AREA															
45	0-0.5									TPCB:	170				
	1.5-2.0	TVOCs	ND												
46	0-0.5									TPCB:	960				
	1.5-2.0	TVOCs	ND			TBNAs	64								
47	0-0.5									TPCB:	140				
	1.5-2.0	TVOCs	ND			TBNAs	46	PAH	46						
48	0-0.5									TPCB:	33				
	1.5-2.0	TVOCs	ND			TBNAs	ND								
49	0-0.5									TPCB:	190				
	1.5-2.0	TVOCs	ND			TBNAs	ND								
50	0-0.5									TPCB:	130				
	1.5-2.0	TVOCs	ND			TBNAs	ND								
51	0-0.5									TPCB:	11				
	1.5-2.0	TVOCs	ND			TBNAs	388	BEHP	200						
52	?									TPCB:	15				
	1.5-2.0	TVOCs	ND			TBNAs	ND								
53	0-0.5									TPCB:	150				
	1.5-2.0	TVOCs	ND			TBNAs	ND								
54	0-0.5									TPCB:	10				
	1.5-2.0	TVOCs	ND			TBNAs	100	BEHP	100						
55	0-0.5									TPCB:	18				
	1.5-2.0	TVOCs	ND												
56	0-0.5									TPCB:	50				

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ORGANIC CONTAMINANT PROFILE IN SOILS

Well/ Boring No.	Depth (feet)	Total VOCs	ug/Kg	Predominant VOC	ug/Kg	Total BNAs	ug/Kg	Predominant BNA	ug/Kg	Total P/Ps	ug/Kg	Predominant P/P	ug/Kg	Dioxins/ Furans	ug/Kg
	1.5-2.0	TVOCs	ND			TBNAs	43								
57	0-0.5									TPCB:	700				
	1.5-2.0	TVOCs	ND			TBNAs	20535	PAH	20535						
58	0-0.5									TPCB:	19				
	1.5-2.0	TVOCs	ND												
59	0-0.5									TPCB:	29				
	1.5-2.0	TVOCs	1			TBNAs	156	PAH	156						
60	0-0.5									TPCB:	460	A 1254	460		
	1.5-2.0	TVOCs	ND			TBNAs	74	DEP	74						
61	0-0.5									TPCB:	740	A 1254	740		
	1.5-2.0	TVOCs	ND			TBNAs	8898	PAH	8690						
62	0-0.5									TPCB:	1500	A 1254	1500		
	1.5-2.0	TVOCs	ND			TBNAs	3627	PAH	3456						
63	0-0.5									TPCB:	65	A 1254	65		
	1.5-2.0	TVOCs	ND			TBNAs	1020	PAH	1020						
64	0-0.5									TPCB:	26.8	A 1254	15		
	1.5-2.0	TVOCs	ND			TBNAs	859	PAH	530						
65	0-0.5	TVOCs	ND							TPCB:	ND				
	1.5-2.0	TVOCs	ND			TBNAs	814	PAH	755						
66	0-0.5	TVOCs	ND							TPCB:	ND				
	1.5-2.0	TVOCs	ND			TBNAs	381	PAH	281						
1486	5 ft	TVOCs	36	Acetone	18										
1078	4.5-6.0	TVOCs	64	Xylene	46										

Well/ Boring No.	Depth (feet)	Total VOCs	ug/Kg	Predominant VOC	ug/Kg	Total BNAs	ug/Kg	Predominant BNA	ug/Kg	Total P/Ps	ug/Kg	Predominant P/P	ug/Kg	Dioxins/ Furans	ug/Kg
WASTE PIT AREA															
1	0-0.5									TPCB:	ND				
	1.5-2.0	TVOCs	4			TBNAs	ND								
2	0-0.5									TPCB:	ND				
	1.5-2.0	TVOCs	4			TBNAs	760	BEHP	760						
3	0-0.5									TPCB:	ND				
	1.5-2.0	TVOCs	ND			TBNAs	ND								
4	0-0.5									TPCB:	13	A 1254	13		
	1.5-2.0	TVOCs	ND			TBNAs	686	BEHP	600						
5	0-0.5									TPCB:	37	A 1254	37		
	1.5-2.0	TVOCs	1			TBNAs	55	BEHP	55						
6	0-0.5									TPCB:	ND				
	1.5-2.0	TVOCs	ND			TBNAs	200	BEHP	200						
7	0-0.5									TPCB:	64	A 1254	64		
	1.5-2.0	TVOCs	ND			TBNAs	1100	BEHP	1100						
8	0-0.5									TPCB:	ND				
	1.5-2.0	TVOCs	ND			TBNAs	75	Phenol	52						
9	0-0.5									TPCB:	14	A 1254	14		
10	0-0.5									TPCB:	ND				
	1.5-2.0	TVOCs	ND			TBNAs	1000	BEHP	1000						
11	0-0.5									TPCB:	ND				
	1.5-2.0	TVOCs	ND			TBNAs	1100	BEHP	1100						
12	0-0.5									TPCB:	18	A 1254	18		
	1.5-2.0	TVOCs	3			TBNAs	64	BEHP	64						
13	0-0.5									TPCB:	ND				
	1.5-2.0	TVOCs	ND			TBNAs	1300	BEHP	1300						
14	0-0.5	TVOCs	1							TPCB:	ND				
	1.5-2.0					TBNAs	ND								
15	1.5-2.0	TVOCs	1			TBNAs	100	BEHP	100						
16	?									TPCB:	ND				
	1.5-2.0	TVOCs	ND			TBNAs	ND								
17	0-0.5									TPCB:	ND				
	1.5-2.0	TVOCs	ND			TBNAs	ND								
18	0-0.5	TVOCs	15	Acetone	15					TPCB:	ND				
	1.5-2.0					TBNAs	53080	PAH	53080						
19	0-0.5	TVOCs	ND							TPCB:	ND				
	1.5-2.0	TVOCs	4			TBNAs	520	PAH	445						
20	0-0.5									TPCB:	ND				

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ORGANIC CONTAMINANT PROFILE IN SOILS

Well/ Boring No.	Depth (feet)	Total VOCs ug/Kg	Predominant VOC ug/Kg	Total BNAs ug/Kg	Predominant BNA ug/Kg	Total P/Ps ug/Kg	Predominant P/P ug/Kg	Dioxins/ Furans ug/Kg
	1.5-2.0	TVOCs ?		TBNAs 95	PAH 95	TPCB: ND		
21	0-0.5					TPCB: ND		
	1.5-2.0	TVOCs 1		TBNAs ND				
22	0-0.5					TPCB: ND		
	1.5-2.0	TVOCs 61		TBNAs 1600	BEHP 1600			
23								
24	0-0.5					TPCB: ND		
	?	TVOCs 3		TBNAs 62	BEHP 62			
25	?	TVOCs ND		TBNAs 770	BEHP 770			
	?					TPCB: ND		
	?			TBNAs 79	BEHP 79			
26	?					TPCB: ND		
	?	TVOCs 13		TBNAs 121	BEHP 62			
27	?					TPCB: ND		
	?			TBNAs 1100	BEHP 1100			
28	?					TPCB: ND		
	?							
29	?	TVOCs ND		TBNAs 78	BEHP 78			
	?					TPCB: 38	1254 38	
30	0-0.5					TPCB: ND		
	1.5-2.0	TVOCs ND		TBNAs ND				
31	0-0.5					TPCB: 14	A 1254 14	
	1.5-2.0	TVOCs ND		TBNAs ND				
32	0-0.5					TPCB: ND		
	1.5-2.0	TVOCs 9		TBNAs 970	BEHP 970			
33	?					TPCB: 1200	A 1254 1200	
34	0-0.5					TPCB: ND		
	1.5-2.0	TVOCs ND		TBNAs ND				
35						TPCB: ND		
		TVOCs ND		TBNAs ND				
36						TPCB: ND		
		TVOCs ND		TBNAs 3600	BEHP 3600			
37						TPCB: 30	A 1254 30	
		TVOCs 2		TBNAs ND				
38						TPCB: 1300	A 1254 1300	
		TVOCs ND		TBNAs 613	BEHP 613			
39	0-0.5					TPCB: ND		
	1.5-2.0	TVOCs 46		TBNAs 1600	BEHP 1600			

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ORGANIC CONTAMINANT PROFILE IN SOILS

Well/ Boring No.	Depth (feet)	Total VOCs	ug/Kg	Predominant VOC	ug/Kg	Total BNAs	ug/Kg	Predominant BNA	ug/Kg	Total P/Ps	ug/Kg	Predominant P/P	ug/Kg	Dioxins/ Furans	ug/Kg
40	0-0.5									TPCB:	120	A 1254	120		
	1.5-2.0	TVOCs	ND			TBNAs	62	BEHP	62						
41	0-0.5									TPCB:	ND				
	1.5-2.0	TVOCs	ND			TBNAs	770	BEHP	770						
42	0-0.5									TPCB:	38	A 1254	38		
	1.5-2.0	TVOCs	ND			TBNAs	3500	BEHP	3500						
43	0-0.5									TPCB:	53	A 1254	53		
	1.5-2.0	TVOCs	1			TBNAs	ND								
44	0-0.5									TPCB:	16	A 1254	16		
	1.5-2.0	TVOCs	4			TBNAs	ND								
1838	2.5-3.0	TVOCs	ND												
	5.0-6.0	TVOCs	ND												
1479	10 ft	TVOCs	1715	TCE	1600										
1480	5 ft	TVOCs	2165	TCE	2100										
1481	15 ft	TVOCs	2262	TCE	2200										
1837	3-4	TVOCs	5												
	6-7	TVOCs	27												
1836	3-4	TVOCs	6												
	6-7	TVOCs	8												
1839	2-3	TVOCs	ND												
	5-6	TVOCs	ND												
K-65 SLURRY LINE															
1841	>6 ft	TVOCs	ND												
1842	>6 ft	TVOCs	5												
1843	>6 ft	TVOCs	2												
1844	>6 ft	TVOCs	ND												
	2.5-6	TVOCs	ND												
1656	2.5-6	TVOCs	ND												

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ORGANIC CONTAMINANT PROFILE IN SOILS

Well/ Boring No.	Depth (feet)	Total VOCs	ug/Kg	Predominant VOC	ug/Kg	Total BNAs	ug/Kg	Predominant BNA	ug/Kg	Total P/Ps	ug/Kg	Predominant P/P	ug/Kg	Dioxins/ Furans	ug/Kg
MISCELLANEOUS															
1084		TVOCs	ND			TBNAs	ND			TPCB:	ND				
1485	15 ft	TVOCs	13			TBNAs	ND			TPCB:	ND				
1888	0-1.5	TVOCs	2												
1038	0-1.5					TBNAs	ND			TPCB:	ND				
1476	15 ft	TVOCs	ND			TBNAs	ND			TPCB:	ND	OPP	ND		
1482	14 ft	TVOCs	21	TCE	18	TBNAs	ND			TPCB:	ND				
1729	0-0.5	TVOCs	ND			TBNAs	82	DNBP	82						
1735	0-0.5	TVOCs	18	4Met2Pent	14										
1736	0-0.5	TVOCs	13			TBNAs	100	Pyrene	100						
1739	0-0.5	TVOCs	ND			TBNAs	102								
1740	0-2.5	TVOCs	73							TP/P	ND				
1730	0-2.5	TVOCs	2			TBNAs	ND			TP/P	ND				
1732	0-2.5	TVOCs	ND			TBNAs	ND			TP/P	ND				
1734	0-2.5	TVOCs	ND			TBNAs	ND			TP/P	ND				