

MOUND



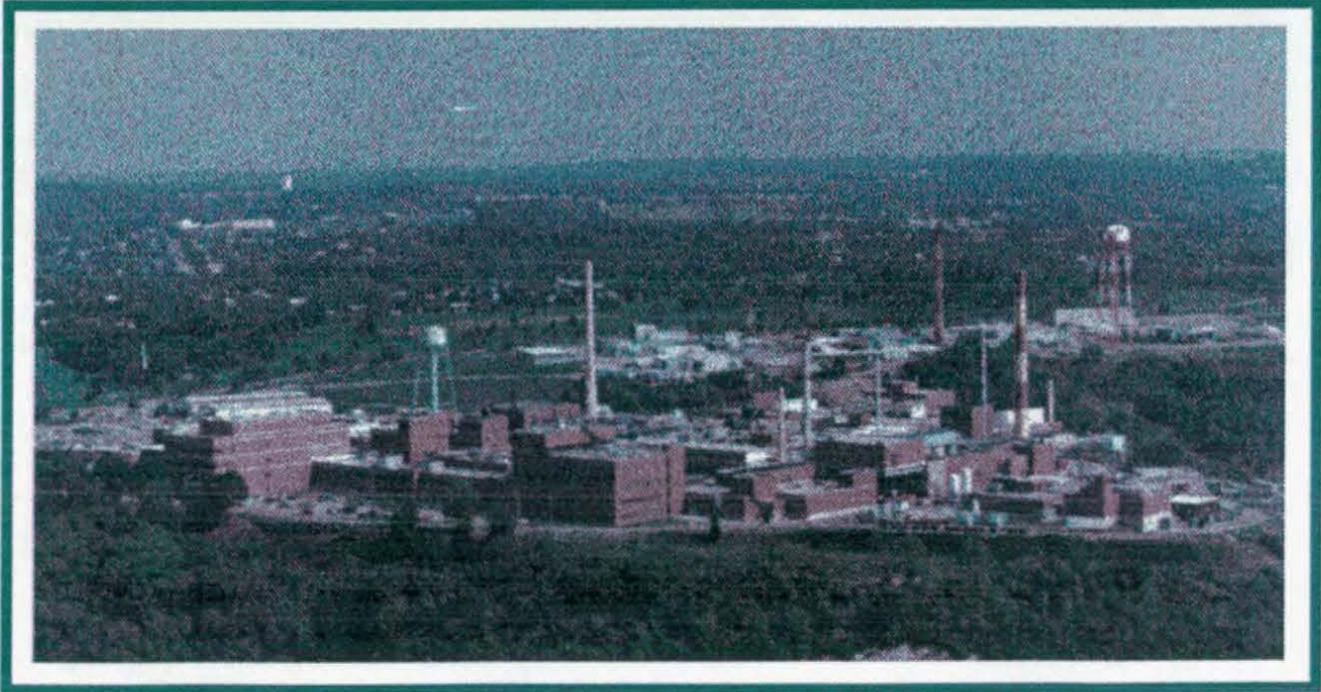
Environmental
Restoration
Program



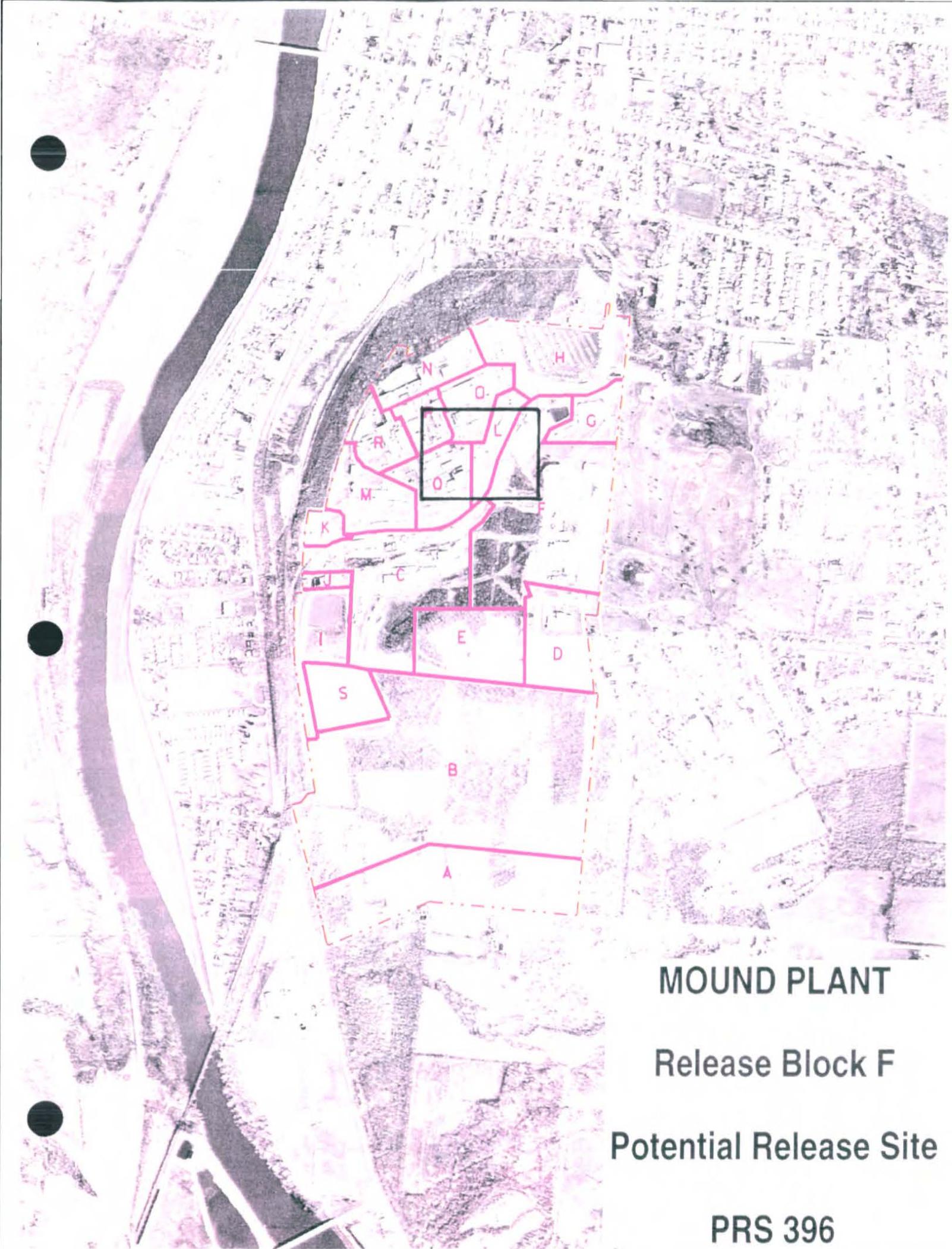
MOUND PLANT

Potential Release Site Package

PRS # 396



REV	DESCRIPTION	DATE
0 PUBLIC RELEASE	Available for comment.	Dec. 29, 1996
1 FINAL		



MOUND PLANT

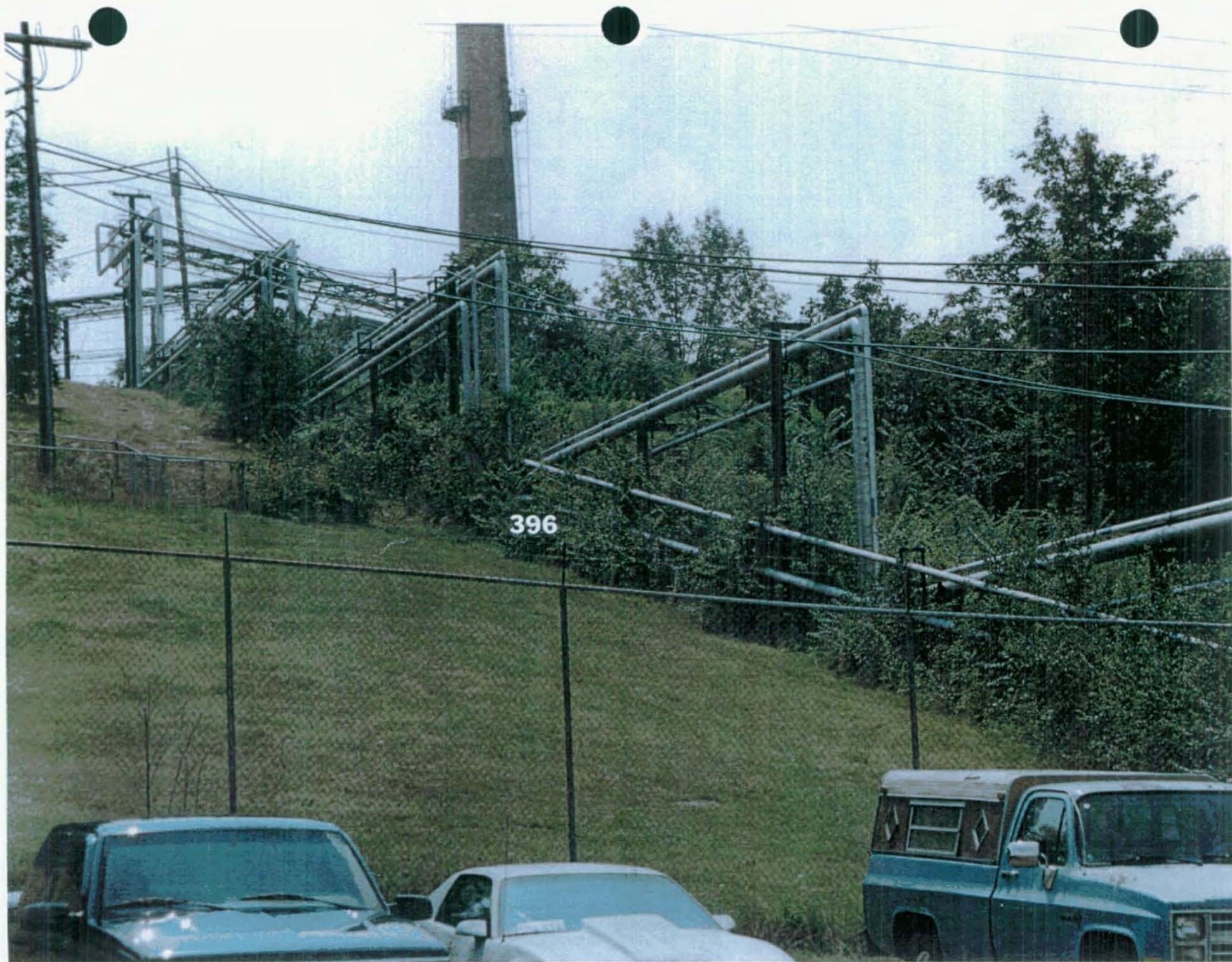
Release Block F

Potential Release Site

PRS 396



396



396

PRS 396

PRS HISTORY:

This area was identified as a potential release site in June 1994 as part of the Operable Unit 5, Operational Area Phase I Investigation Non-AOC Field Report.¹ The limited historical data suggests that no radioactive or hazardous processes are known to have occurred at this location and there are no buildings located in the immediate area.

CONTAMINATION:

The Site Survey analytical data collected from soil samples (PETREX) indicated elevated levels of "Total Halogenated Hydrocarbons". On a relative basis, the contamination level exceeded 1,300,000 ion counts, which was the highest recorded value of all samples taken for "Total Halogenated Hydrocarbons". Sample results corresponding to PRS 396 are listed according to sample number (890) and coordinates (18N8), within the reference material attached. The Pu-238 level was below the D&D ALARA guideline of 25 pCi/g and the Th-232 level was less than background of 1.4 pCi/g at PRS 396. Previous radiological site data confirms these low levels.²

READING ROOM REFERENCES:

- 1) OU5, Operational Area Phase I Investigation Non-AOC Field Report. (pages 6-14)
- 2) OU9 Site Scoping Report, Vol. 3, Radiological Site Survey Report. (pages 15-23)

PREPARED BY:

Gerald F. Maul, Member of EG&G Technical Staff

**PRS 396
(SUPPLEMENTAL DATA)**

HISTORY:

In 1996, the quantitative *Soil Gas Confirmation Sampling*³ investigation sampled the PETREX soil gas locations with the highest PETREX ion counts in the northern sector of the Mound plant. This included the soil gas confirmation sampling location number 4 which closely (within fifty feet) corresponds with the PETREX location 890 (i.e. PRS 396).

CONTAMINATION:

The Soil Gas Confirmation Sampling program analyzed for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), PCBs, pesticides, explosives, metals, and radionuclides. The analysis of sample No. 4 showed that no analyte exceeded the ALARA, regulatory, or the 10^{-6} Risk Based Guideline Criteria.

OTHER REFERENCES:

3) Soil Gas Confirmation Sampling, (Revision 0), May 1996. (pages 24-34)

PREPARED BY:

Dean A. Buckner, Member of EG&G Technical Staff

**MOUND PLANT
PRS 396
SOIL CONTAMINATION**

RECOMMENDATION:

This area was identified as a potential release site in June 1994 due to qualitative PETREX soil gas results during the Operable Unit 5, Operational Area Phase I Investigation. The historical data suggests that no radioactive or hazardous processes are known to have occurred at this location and there are no buildings located in the immediate area. A subsequent quantitative *Soil Gas Confirmation Investigation* within 50 feet of PRS 396 showed that all concentrations of volatile, semivolatile, PCBs, pesticides, metals, radionuclides, and explosives in the soils were below their respective ALARA, regulatory or 10^{-6} Risk Based Guideline Criteria. Therefore, NO FURTHER ASSESSMENT is recommended for PRS 396.

CONCURRENCE:

DOE/MEMP:

Arthur W. Kleinrath 12/18/96
Arthur W. Kleinrath, Remedial Project Manager (date)

USEPA:

Timothy J. Fischer 12/18/96
Timothy J. Fischer, Remedial Project Manager (date)

OEPA:

Brian K. Nickel 12/18/96
Brian K. Nickel, Project Manager (date)

SUMMARY OF COMMENTS AND RESPONSES:

Comment period from _____ to _____

- No comments were received during the comment period.
- Comment responses can be found on page _____ of this package.

REFERENCE MATERIAL
PRS 396

Environmental Restoration Program

**OPERABLE UNIT 5
OPERATIONAL AREA PHASE I INVESTIGATION
NON-AOC FIELD REPORT**

**MOUND PLANT
MIAMISBURG, OHIO**

VOLUME I - TEXT

June 1995

Final (Revision 0)

**U.S. Department of Energy
Ohio Field Office**



EG&G Mound Applied Technologies

A FIDLER was used to monitor placement of all samplers and timers. Soil samples were collected from each of the locations for analysis of radiological contamination at the Mound Plant Soil Screening Facility. Results of the soil screening analyses are summarized in Section 2.1.4.2 and presented in their entirety in Appendix D.

2.2.1.1. Non-AOC South

Soil Gas Sampler Installation

Three sets of timers and 131 data samplers were installed on 10 days between June 14 and July 7, 1994. Locations of the timers and data samplers are shown in Appendix E, Plate 1.

Soil Gas Sampler Retrieval

On June 21, 1994, one timer from each of the three timer sets was retrieved, wiped (checked for radiological contamination), and sent to Northeast Research Institute LLC (NERI) for analysis. The analysis of the timers indicated the following: high response levels of petroleum hydrocarbons at 1N2; low to medium response levels of TCE at 1N18; and trace response levels of hydrocarbons at 7N23. Based on these responses, NERI recommended an exposure time of approximately seven to 14 days per data sampler.

Samplers were extracted on seven days between June 28 and July 21, 1994. The samplers were wiped and prepared for shipment. On July 27, 1994, all of the Non-AOC south samplers were sent as a batch to NERI for analysis. In general, samplers were shipped as a batch for each Non-AOC section for quality control purposes.

2.2.1.2. Non-AOC North

Soil Gas Sampler Installation

Two sets of timers and 92 data samplers were installed on eight days between August 17 and September 14, 1994. Locations of the timers and data samplers are shown in Appendix E, Plate 1.

Soil Gas Sampler Retrieval

On August 23, 1994, one timer from each of the two timer sets was retrieved, wiped, and sent to NERI for analysis. The analysis of the timer at grid coordinate 23N2 indicated low to moderate response levels of light weight hydrocarbons and the analysis of the timer at grid coordinate 26N5 indicated moderate to high response levels of light weight hydrocarbons and trace response levels of tetrachloroethene (PCE). Based on these responses, NERI recommended an exposure time of approximately 12 days per data sampler.

Samplers were extracted on five days between August 29 and September 27, 1994. One sampler, located at grid coordinate 15N9, was not retrieved due to a broken tube. The remaining samplers were wiped and prepared for shipment. On September 27, 1994, the samplers were sent as a batch to NERI for analysis.

2.2.1.3. Non-AOC West

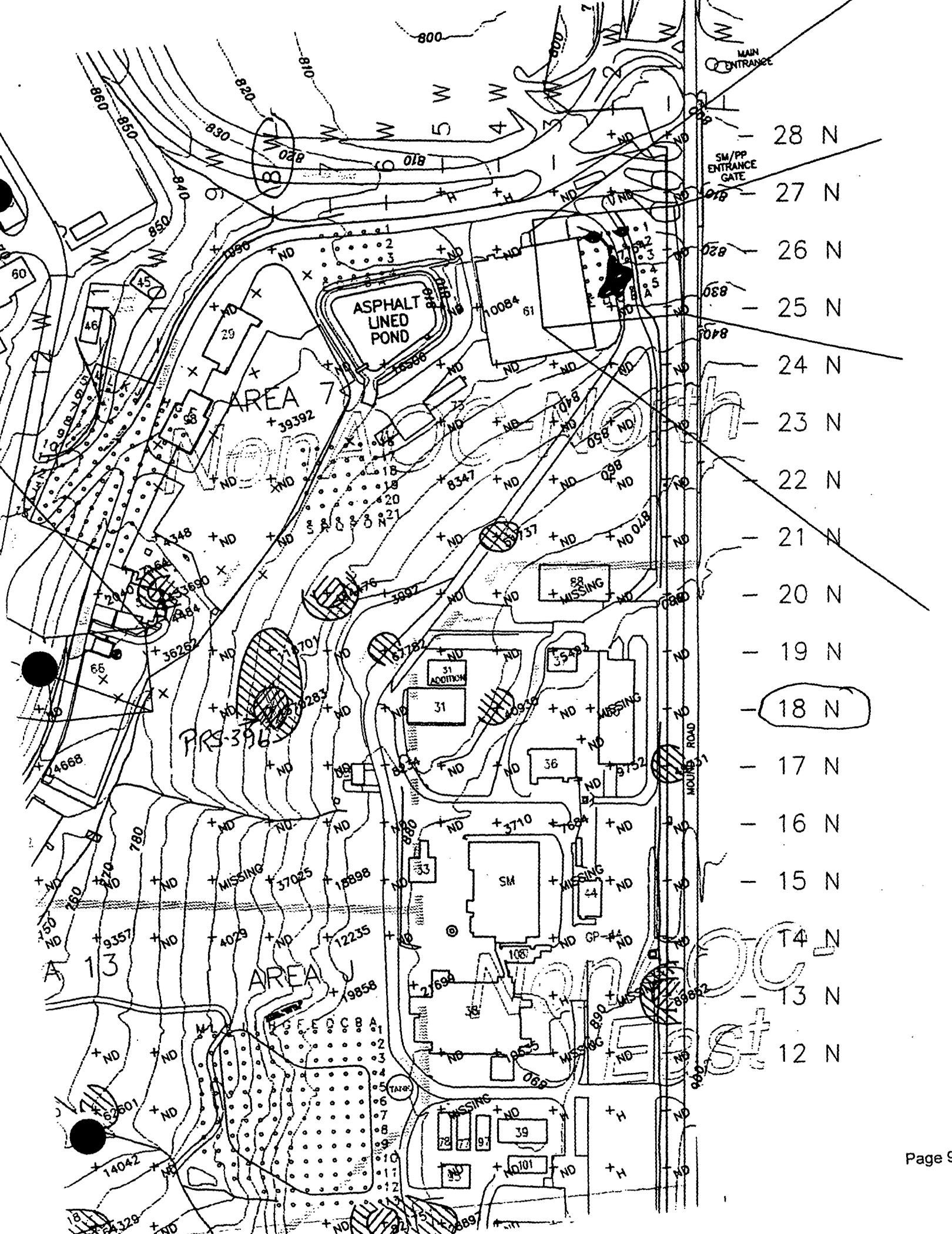
Soil Gas Sampler Installation

Two sets of timers and 85 data samplers were installed on 10 days between August 29 and September 6, 1994. Locations of the timers and data samplers are shown in Appendix E, Plate 1.

Soil Gas Sampler Retrieval

On September 6, 1994, one timer from each of the two timer sets was retrieved, wiped, and sent to NERI for analysis. The analysis of the timers at grid coordinates 9N10 and 8N27 indicated that little to no hydrocarbons were detected. NERI requested that the second timer from each timer set be retrieved after three weeks. The second timers were retrieved and sent to NERI on September 22, 1994, for analysis. The analysis of these timers indicated low levels of hydrocarbons, including some benzene at grid coordinate 9N10 and moderate levels of hydrocarbons, including benzene, toluene, ethylbenzene, and xylene (BTEX), TCE, and PCE at grid coordinate 8N27. Based on these responses, NERI recommended an exposure time of approximately 28 days per sampler.

Samplers were extracted on three days between September 27 and October 1, 1994. Two samplers, 14N25 and 9N15, broke during retrieval. Sample wires were transferred immediately to clean tubes. All



28 N

27 N

26 N

25 N

24 N

23 N

22 N

21 N

20 N

19 N

18 N

17 N

16 N

15 N

14 N

13 N

12 N

TASK TEAM ACTIVITY LOG SHEET

SOIL GAS

PROJECT NAME: EG&G MOUND 05 OPERATIONAL AREA PHASE 1

TASK NO. 34896

Date (mm/dd/yy): 9/7/94 TIME: NA PAGE 3 OF 3

Task Team Members:

J.H.

pg. 170

P.P.

~~JPH
9/7/94~~

Narrative (include time and location):

0930 Pull C6/829

0932 Pull C5/828

Completed Area 13. Moving to Non-AOC North to

pull samplers

0945 Pull 15N13/900 - in parking lot (asphalt)

0948 Pull 15N12/901 - in grass

0958 Pull 19N9/899 - in grass, weeds

1005 Pull 19N8/889

→ 1008 Pull 18N8/890 ←

1013 Pull 26N9/904

1017 Pull 15N6/897. Drop Area 13 tubes to HP to scan.

1025 Pull 16N8/894

1037 Pull 16N7/895. Hiking, rock climbing to 15N9

1054 Pull 15N9/903 - attempted. "Guy wire" broke.

1100 Pull 15N10/902.

1110 15N9/903 Sacrificed - unable to locate tube. ^{9/7/94}

Return to HP to pick up Area 61 tubes - OK to ship

1115 Return to sample trailer. Packing up Area 61 for

shipment. Airbill # 1558921195. Waiting for Area 13 from HP

LAST ENTRY

Daily Weather Conditions: A.M. NA

P.M. NA

Recorded By

Joetta Humpert

QA Checked By

JPH

PETREX DATA (RELATIVE)

Table 4 (cont'd)

Sample #	Total Aromatic Hydrocarbons (a)	Total Semivolatile Hydrocarbons (b)	Total C5 to C11 Petroleum Hydrocarbons (c)	Total Halogenated Hydrocarbons (d)
858	17,751	ND	38,321	ND
859	63,289	ND	112,992	ND
860	4,469	ND	14,983	ND
861	3,241	ND	8,519	ND
862	81,929	ND	268,425	8,347
3862 (e)	119,259	ND	435,287	13,451
863	211,830	48,446	488,411	ND
864	31,827	ND	60,770	ND
865	278,591	ND	680,193	ND
866	332,054	11,447	724,350	16,508
3866 (e)	272,440	6,951	555,885	11,448
867	323,265	761	1,054,664	ND
868	22,328	ND	43,566	51,737
869	413,808	6,035	1,229,747	ND
870	105,485	12,156	272,168	ND
871	262,537	13,383	709,554	39,392
3871 (e)	117,156	4,180	350,827	18,146
872	179,121	2,716	518,546	ND
873	215,400	ND	383,982	ND
874	997,234	9,698	2,035,141	ND
875	93,866	15,159	216,791	ND
876	91,518	ND	160,738	4,348
877	997,444	49,913	2,306,808	2,040
879	619,446	35,834	1,230,011	ND
886	294,275	482	574,432	3,992
887 (f)	600,046	4,035	1,054,346	484,476
888	5,315,457	36,969	9,565,092	67,782
889	3,540,952	4,865	8,657,091	118,701
890 (f)	36,315	6,488	151,227	1,370,283
3890 (e)(f)	18,704	4,258	115,026	1,199,030
891	250,039	ND	472,369	8,234
892	T	ND	T	ND

PETREX DATA (RELATIVE)

Table 4 (cont'd)

Sample #	Total Aromatic Hydrocarbons (a)	Total Semivolatile Hydrocarbons (b)	Total C5 to C11 Petroleum Hydrocarbons (c)	Total Halogenated Hydrocarbons (d)
1074	1,077,488	310,921	3,334,270	H
1075	5,024,929	190,818	8,157,950	ND
1076	98,846	ND	150,244	11,278
1077	179,495	637	313,677	253,075
1078	292,004	ND	384,717	27,102
1079	878,182	ND	1,047,284	ND
1080	476,919	ND	688,052	ND
1081	1,359,839	ND	1,737,634	ND
1082	2,366,016	ND	2,549,371	ND
1083	6,566,476	ND	7,262,620	ND
3083 (e)	5,727,584	ND	6,343,712	ND
1094	36,255	ND	65,413	14,484
1095	48,524	ND	79,645	27,164
8001 *	ND	ND	ND	ND
8002 *	ND	ND	ND	ND
8003 *	ND	ND	ND	ND

- Key:
- (a) Intensity of response to ions of atomic masses 78, 92, 106, 120, 134, 148, 162, 176, 190, and 204.
 - (b) Intensity of response to ions of atomic masses 128, 142, 153, 156, 178, 184, 198, 202, and 212.
 - (c) Intensity of response to ions of atomic masses 70, 72, 78, 84, 86, 92, 98, 100, 106, 110, 112, 114, 120, 124, 126, 128, 134, 138, 140, 142, 148, 152, 154, and 156.
 - (d) Intensity of response to ions of atomic masses 83, 101, 130, 146, 151, and 164.
 - (e) Duplicate of preceding sample.
 - (f) A pronounced level of chloroform was detected in this sample.

H High levels of petroleum hydrocarbons have interfered with the identification of halogenated hydrocarbons in this sample; see

T High levels of terpenes have interfered with the identification of petroleum hydrocarbons in this sample; see text.

ND The targeted compounds were not detected in this sample.

* Travel Blank

MOUND SOIL SCREEN DATA

APPENDIX D

RADIOLOGICAL DATA (FIDLER SURVEY MOUND SOIL SCREENING FACILITY DATA) FOR NON-AOC POINTS

SMPID	FIDLER SURVEY DATA					MOUND SOIL SCREENING FACILITY DATA			
	Contamination Criteria CH1	FIDLER Readings CH1	Contamination Criteria CH2	FIDLER Readings CH2	FIDLER Readings Out Channel	Plutonium - 238		Thorium - 232	
	Units: CPM	Units: CPM	Units: KCPM	Units: KCPM	Units: KCPM	Units: pCi/g		Units: pCi/g	
	RESULTS	RESULTS	RESULTS	RESULTS	RESULTS	RESULTS	Note:	RESULTS	Note:
17N06	130	100	6.5	5.0	NC	0	a	0.9	a
17N07	170.3	130	9.72	6.5	NC	21	a	1.2	a
17N08	170.3	130	9.72	8.0	NC	19	a	1.2	a
17N09	170.3	80	9.72	5.5	NC	NC		NC	
17N10	170.3	100	9.72	6.0	NC	NC		NC	
17N11	170.3	90	9.72	7.0	NC	NC		NC	
17N12	152.1	40	8.45	4.5	NC	6	a	0.6	a
18N01	253.5	185	12.48	9.0	NC	16	a	1.1	a
18N02	130	80	6.5	4.0	NC	WIPE	c	WIPE	c
18N03	130	75	6.5	5.0	NC	WIPE	c	WIPE	c
18N04	130	60	6.5	4.5	NC	6	a	0.8	a
18N06	130	90	6.5	6.5	NC	WIPE	c	WIPE	c
18N07	170.3	100	9.72	7.0	NC	13	a	0.7	a
18N08	170.3	170	9.72	11.0	NC	22	a	1.1	a
18N09	170.3	150	9.72	10.5	NC	NR		NR	
18N12	152.1	100	8.45	6.5	NC	0	a	0.3	a
19N01	253.5	155	12.48	9.5	NC	3	a	0.6	a
19N02	130	85	6.5	4.0	NC	NC		NC	
19N03	130	70	6.5	5.0	NC	4	a	0.8	a
19N04	130	60	6.5	4.0	NC	WIPE	c	WIPE	c
19N05	130	65	6.5	4.0	NC	WIPE	c	WIPE	c
19N06	130	60	6.5	5.0	NC	WIPE	c	WIPE	c
19N07	176.8	325	8.97	20.0	45	56	b	15.9	b
19N08	176.8	125	8.97	7	NC	25	b	2.4	b
						39	b	0.9	a
19N09	176.8	170	8.97	9.5	NC	10	a	1.1	a
19N10	176.8	70	8.97	3.5	NC	3	a	0.2	a
20N01	253.5	95	12.48	5.0	NC	16	a	0.6	a
20N02	130	105	6.5	6.5	NC	8	a	0.7	a

APPENDIX D

RADIOLOGICAL DATA (FIDLER SURVEY MOUND SOIL SCREENING FACILITY DATA) FOR NON-AOC POINTS

SMPID	FIDLER SURVEY DATA					MOUND SOIL SCREENING FACILITY DATA			
	Contamination Criteria CH1	FIDLER Readings CH1	Contamination Criteria CH2	FIDLER Readings CH2	FIDLER Readings Out Channel	Plutonium - 238		Thorium - 232	
	Units: CPM	Units: CPM	Units: KCPM	Units: KCPM	Units: KCPM	Units: pCi/g		Units: pCi/g	
RESULTS	RESULTS	RESULTS	RESULTS	RESULTS	RESULTS	Note:	RESULTS	Note:	

NR - Not recorded

NC - No sample/reading taken

NA - Reading not taken; contamination criteria not exceeded.

a - Mound Soil Screening Facility detection level not exceeded.

b - Concentration at or above the Mound Soil Screening Facility detection level.

c - Results of the wipe sample were less than 20 disintegrations per minute.

CPM - Counts per minute

KCPM - Counts per minute x 1000

pCi/g - Picocuries per gram

Environmental Restoration Program

**OPERABLE UNIT 9, SITE SCORING REPORT
VOLUME 3 - RADIOLOGICAL SITE SURVEY**

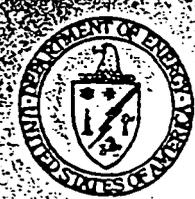
**MOUND PLANT
MIAMISBURG, OHIO**

June 1993

FINAL

**Department of Energy
Albuquerque Field Office**

Environmental Restoration Program
EG&G Mound Applied Technologies



The drilling and sampling were performed using an auger drill rig and a 2-ft, split-barrel sampler. As the split-barrel sampler was removed from the borehole, it was monitored for radioactivity contamination by Mound Plant health physics personnel using a FIDLER to detect radioactivity contamination that would pose a hazard to the workers present. After the soil was removed from the sampler and placed in sample containers, field team members wearing gloves brushed the remaining soil out of the sampler. The gloves were then monitored with an alpha scintillometer before the split-barrel sampler was used again. However, no standard decontamination was performed.

The core locations are shown in Plate 1. The core locations were surveyed by a licensed surveyor after drilling was completed. The available reports submitted to Mound Plant by the drilling subcontractors are presented in Appendix B.

2.1.4. Sample Analyses

2.1.4.1. FIDLER Screening

In order to identify samples with concentrations of plutonium-238 exceeding 25 pCi/g and total thorium exceeding 2 pCi/g, all of the soil samples collected were pulverized and then screened using a Bicon® FIDLER at the Mound Plant Soil Screening Facility, known as trailer 15 at the time of the Site Survey Project. The Soil Screening Facility is now located in the H Building at Mound Plant (Plate 1). The minimum detectable activity at which plutonium-238 can be reliably detected at the Mound Plant screening facility is estimated to be 25 pCi/g (Draper 1986b). The detection of plutonium-238 at lesser concentrations (12-25 pCi/g) was unreliable and had an estimated error of ± 75 percent. The estimated error decreased with increasing sample activity; for samples with 25 to 100 pCi/g of plutonium-238, the estimated error was ± 35 percent, and for samples with > 100 pCi/g, the estimated error was ± 30 percent (Casella and Bishop 1984). The minimum detectable activity for thorium from FIDLER screening was estimated to be about 2 pCi/g (Stought et al. 1988). The Mound Plant procedure for screening soil samples is provided in Appendix A.

2.1.4.2. Radiochemical Analysis for Plutonium-238

Because of the high error (± 75 percent) involved in the FIDLER screening of samples containing less than 25 pCi/g of plutonium-238, all soil samples were radiochemically analyzed by Mound Plant for plutonium-238. The lower detection limit (LDL) for plutonium-238 by this method was estimated to be 0.01 pCi/g, with a relative precision (two standard deviations) of 25 percent. The overall precision of the plutonium-238 measurements was reported to be about 18 percent (DOE 1991b). The Mound

Plant procedure for the radiochemical analysis of soil samples for plutonium-238 is provided in Appendix A.

2.1.4.3. Radiochemical Analysis for Thorium

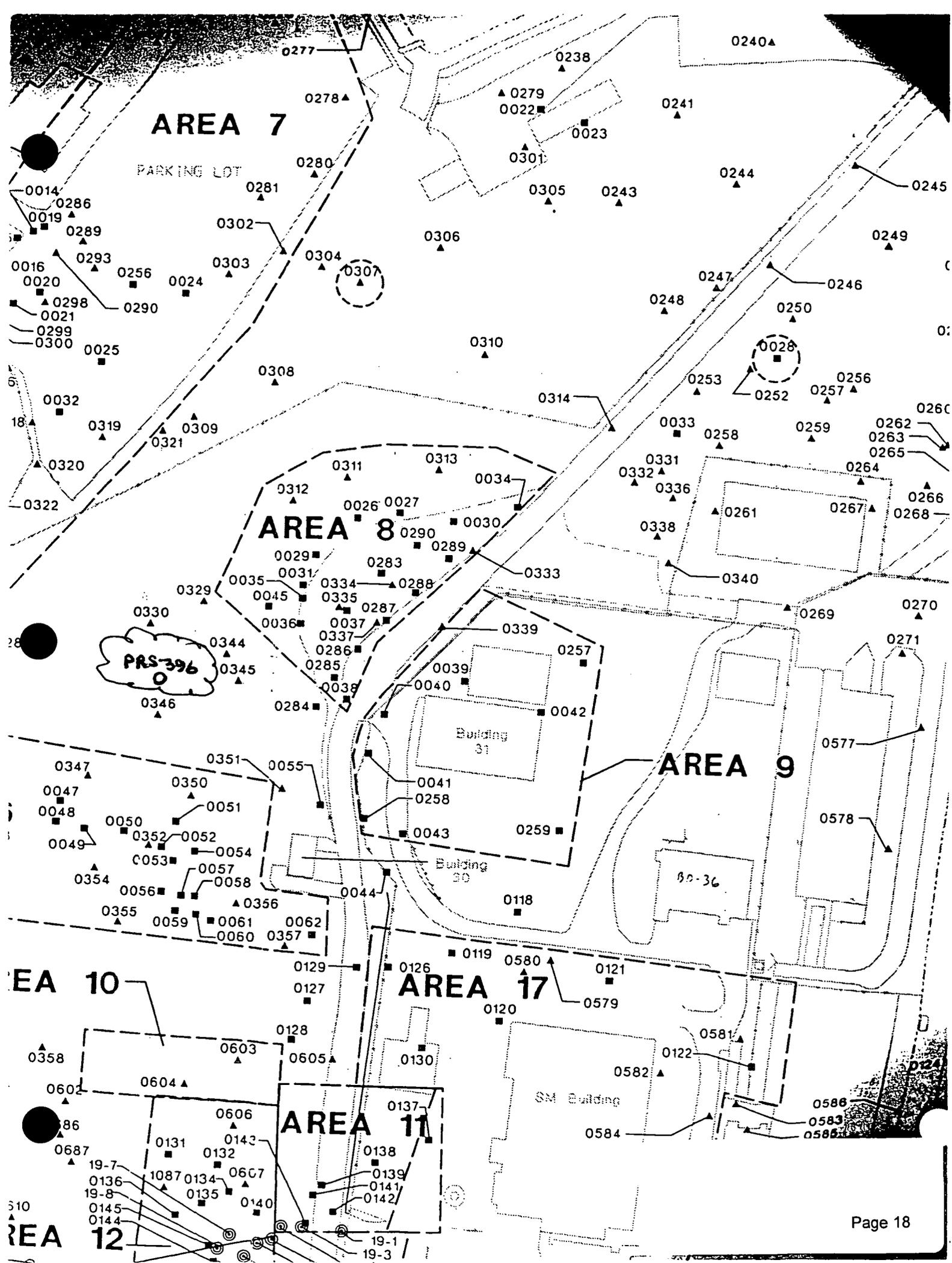
Samples with thorium concentrations in excess of 2 pCi/g by FIDLER screening were also radiochemically analyzed for thorium, resulting in the radiochemical analysis of about 12 percent of the samples. The LDLs for the thorium isotopes using radiochemical procedures were estimated to be

- 0.3 pCi/g for thorium-228, with a relative precision of 60 percent;
- 0.3 pCi/g for thorium-230, with a relative precision of 30 percent; and
- 0.1 pCi/g for thorium-232, with a relative precision of 70 percent.

The overall precision for the thorium measurement was reported to be about 25 percent. The thorium results were reported in pCi of total thorium per gram of soil, isotopes were not identified. The Mound Plant procedure for the radiochemical analysis of soil samples for thorium is provided in Appendix A.

2.1.4.4. Gamma Spectroscopy

Gamma spectroscopy was performed by Mound Plant on approximately 350 (18 percent) of the soil samples in order to verify the identity of the radionuclides present when screening indicated the presence of gamma-emitting radionuclides, but little excess plutonium or thorium was identified by radiochemical analysis. Gamma spectroscopy is capable of detecting a variety of gamma-emitting radionuclides; the radionuclides detected in samples collected during the Site Survey Project included cobalt-60, cesium-137, radium-226, actinium-227, and americium-241. No other gamma-emitting radionuclides with gamma energies below 1.5 millielectron volts (MeV) were detected, although the project report stated that subsequent sampling and analysis in some areas indicated bismuth-207 and bismuth 210m. No polonium-210 peaks were detected in the Site Survey Project samples, confirming that polonium-210, which was used at Mound Plant in the 1950s, is no longer present due to radioactive decay (half-life of 138.4 days). The LDLs for cesium-137, cobalt-60, and americium-241 were given with the original data, and were estimated to be 0.5 pCi/g for each. The LDLs for radium-226 and actinium-227 were estimated to be 1.0 pCi/g for both (Stought 1990). The Mound Plant procedure for gamma spectroscopy is provided in Appendix A.



RADIOCHEMICAL ANALYSIS

Map Location ^a	Coordinates		MRC ID No.	Mo-Yr	Depth (inch)	Pu-238 (pCi/g)	Thorium ^b (pCi/g)	Tritium (pCi/mL)	Co-60 (pCi/g)	Cs-137 (pCi/g)	Ra-226 (pCi/g)	Am-241 (pCi/g)
	South	West										
S0323	2225	2540	5988	08-84	0	0.45 ^c	3.64 ^c					
S0324	2275	2540	6848	08-84	0	1.86	b					
S0325	2275	2490	6849	08-84	0	1.73	b					
S0326	2325	2590	4096	10-83	0	3.91	b					
S0327	2350	2515	6847	08-84	0	1.50	b					
→ S0328	2350	2465	4097	10-83	0	0.73	b		LDL	1.2	1.1	LDL
S0329	2375	2290	4098	10-83	0	15.88	b	1.39				
→ S0330	2375	2340	6846	08-84	0	2.02	b					
C0033	2400	1860	8349	11-84	36	0.11 ^c	42.38 ^c					
			8414	11-84	48	0.97 ^c	20.17 ^c					
C0034	2405	2010	1260	12-82	18	4.83 ^c	32.20 ^c					
			1261	12-82	72	0.48	9.12					
			1262	12-82	90	0.07	b					
			1263	12-82	108	0.03	b					
C0035	2405.8	2212.9	None ^d	07-84	0	NR	5.5					
			None ^d	07-84	12	NR	11					
			None ^d	07-84	24	NR	24					
			None ^d	07-84	36	NR	29					
			None ^d	07-84	48	NR	42					
			None ^d	07-84	60	NR	18					
			None ^d	07-84	72	NR	33					
			None ^d	07-84	84	NR	28					
			None ^d	07-84	96	NR	15					
			None ^d	07-84	108	NR	11					
			None ^d	07-84	120	NR	39					
			None ^d	07-84	132	NR	31					
			None ^d	07-84	144	NR	15					

GAMMA SPECTROSCOPY

RADIOCHEMICAL ANALYSIS

Map Location ^a	Coordinates		MRC ID No.	Mo-Yr	Depth (Inch)	Pu-238 (pCi/g)	Thorium ^b (pCi/g)	Tritium (pCi/mL)	Co-60 (pCi/g)	Cs-137 (pCi/g)	Ra-226 (pCi/g)	Am-241 (pCi/g)
	South	West										
			1238	12-82	54	2.24	b					
			1239	12-82	72	0.31	b					
			1240	12-82	90	0.64	b					
			1241	12-82	108	0.35	b					
C0039	2525	2110	1977	05-83	18	0.59 ^c	5.62 ^c					
			1978	05-83	36	0.04	b					
C0040	2525	2185	1979	05-83	18	0.82	b					
			1980	05-83	36	8.15	b					
			1981	05-83	54	0.82	b					
C0257	2550	2010	1976	05-83	18	0.47	b					
C0041	2550	2210	1982	05-83	18	2.30	b					
			1983	05-83	54	0.29	b					
C0042	2575	2060	1974	05-83	18	1.36	b					
			1975	05-83	24	0.07	b					
C0258	2600	2235	1985	05-83	36	0.04	b					
C0043	2625	2210	1971	05-83	18	0.65	6.22					
			1972	05-83	36	0.14	b					
C0044	2650	2235	1316	12-82	18	0.66	b					
			1317	12-82	36	0.20 ^c	b					
			1318	12-82	54	0.19	b					
C0259	2675	2085	1973	05-83	18	0.55	b					
C0045	2400	2240	8350	11-84	54	4.66 ^c	142.58 ^c					
			8351	11-84	80	0.51 ^c	254.30 ^c		LDL	LDL	3.3	LDL
→ S0344	2425	2290	6552	08-84	0	0.58 ^c	b					

GAMMA SPECTROSCOPY

Map Location ^a	Coordinates		MRC ID No.	Mo-Yr	Depth (inch)	Pu-238 (pCi/g)	Thorium ^b (pCi/g)	Tritium (pCi/mL)	Co-60 (pCi/g)	Cs-137 (pCi/g)	Ra-226 (pCi/g)	Am-241 (pCi/g)
	South	West										
C0046	2440	2550	10109	07-85	18	0.21	b					
			10110	07-85	42	1.42	b					
→ S0345	2450	2290	4102	10-83	0	1.37	b					
→ S0346	2450	2365	6551	08-84	0	0.93	b					
S0347	2475	2440	4103	10-83	0	1.65	b					
C0047	2485	2470	10106	07-85	18	29.10	b					
			10107	07-85	36	1.45	b					
			10108	07-85	54	0.02	b					
C0048	2500	2480	10103	07-85	18	0.23	b					
			10104	07-85	36	1.30	b					
			10105	07-85	54	0.06	b					
S0348	2500	2540	4104	10-83	0	2.78	b	0.35	LDL	LDL	0.8	LDL
S0349	2500	2565	6549	08-84	0	3.55	b		LDL	LDL	1.2	LDL
C0049	2515	2460	10100	07-85	18	2.30	b					
			10101	07-85	36	0.51	b					
			10102	07-85	54	0.17	b					
S0350	2525	2365	6770	08-84	0	23.60	b					
C0050	2530	2430	10097	07-85	18	0.39	b					
			10098	07-85	36	0.60	b					
			10099	07-85	54	0.11	b					
C0051	2540	2385	10111	07-85	18	0.99	b					
			10112	07-85	36	1.76	b					
			10113	07-85	54	0.16	b					
			10114	07-85	72	0.11	b					
			10115	07-85	90	0.40	b					
			10116	07-85	108	0.01	b					

GAMMA SPECTROSCOPY

RADIOCHEMICAL ANALYSIS

RADIOCHEMICAL ANALYSIS

Map Location ^a	Coordinates		MRC ID No.	Mo-Yr	Depth (inch)	Pu-238 (pCi/g)	Thorium ^b (pCi/g)	Tritium (pCi/mL)	Co-60 (pCi/g)	Cs-137 (pCi/g)	Ra-226 (pCi/g)	Am-241 (pCi/g)
	South	West										
C0289	2422.7	2081.0	None ^d	07-84	0	NR	0.6					
			None ^d	07-84	12	NR	1.1					
			None ^d	07-84	24	NR	0.5					
			None ^d	07-84	36	NR	0.8					
			None ^d	07-84	48	NR	1.0					
			None ^d	07-84	60	NR	0.8					
C0290	2401.5	2102.1	None ^d	07-84	0	NR	0.7					
			None ^d	07-84	12	NR	0.8					
			None ^d	07-84	24	NR	0.8					
			None ^d	07-84	36	NR	0.8					
			None ^d	07-84	48	NR	0.6					
			None ^d	07-84	60	NR	0.9					
			None ^d	07-84	72	NR	0.8					
C0291	2915.3	2490.3	None ^d	07-84	0	NR	0.6					
			None ^d	07-84	12	NR	0.4					
			None ^d	07-84	24	NR	0.5					
			None ^d	07-84	36	NR	0.4					
			None ^d	07-84	48	NR	0.4					
			None ^d	07-84	60	NR	0.3					
			None ^d	07-84	72	NR	0.5					
			None ^d	07-84	84	NR	0.4					
			None ^d	07-84	96	NR	0.7					
			None ^d	07-84	108	NR	0.6					
			None ^d	07-84	120	NR	0.3					
			None ^d	07-84	132	NR	0.3					
			S1092	2185	3362	8413	12-84	1	0.31	323.5 ^g		

^aC denotes core location and S denotes surface sample location on Plate 1.

^bThorium results of ≤ 2 pCi/g are listed as "b".

^cVerification sample analyzed for QA/QC.

^dNo MRC ID assigned because *in situ* gamma spectrometry was performed for thorium-232.

^eGamma results could not be confirmed using the gamma spectroscopy printout given in this appendix.

^fThe depth for this sample was given as "SS". For mapping purposes (Plates 1 and 5), this is assumed to be a surface sample.

^gSample results were given isotopically for this sample and included 0.99 pCi/g thorium-228; 321 pCi/g thorium-230; and 1.5 pCi/g thorium-232, for a total of 323.5 pCi/g.

LDL - The sample result was below the Lower Detection Limit, which was estimated to be 0.5 pCi/g for cesium-137, cobalt-60, and americium-241. The LDL for radium-226 or actinium-227 was estimated to be 1 pCi/g.

NR - No result provided. (Note: no samples were taken for plutonium-238 when *in situ* gamma spectrometry was performed.)

MOUND



**Environmental
Restoration
Program**

Further Assessment

Soil Gas Confirmation Sampling

**Mound Plant
Miamisburg, Ohio**

May 1996

Revision 0

Department of Energy

EG&G Mound Applied Technologies

Table I.1 Soil Analyte List

Volatile Organic Compounds

Acetone	Dibromochloromethane	4-Methyl-2-Pentanone
Benzene	1,1-Dichloroethane	Styrene
Bromodichloromethane	1,2-Dichloroethane	1,1,2,2-Tetrachloroethane
Bromoform	1,1-Dichloroethene	Tetrachloroethene
Bromomethane	1,2-Dichloroethene (total)	1,1,1-Trichloroethane
2-Butanone	1,2-Dichloropropane	1,1,2-Trichloroethane
Carbon Disulfide	cis-1,3-Dichloropropene	Trichloroethene
Carbon Tetrachloride	trans-1,3-Dichloropropene	Toluene
Chlorobenzene	Ethylbenzene	Vinyl Acetate
Chloroethane	2-Hexanone	Vinyl Chloride
Chloroform	Methylene Chloride	Xylenes (total)
Chloromethane		

Semivolatile Organic Compounds

Acenaphthene	Chrysene	Hexachlorobenzene
Acenaphthylene	Dibenz(a,h)anthracene	Hexachlorobutadiene
Anthracene	Dibenzofuran	Hexachlorocyclopentadiene
Benzo(a)anthracene	1,2-Dichlorobenzene	Hexachloroethane
Benzo(a)pyrene	1,3-Dichlorobenzene	Indeno(1,2,3-cd)pyrene
Benzo(b)fluoranthene	1,4-Dichlorobenzene	Isophorone
Benzo(g,h,i)perylene	3,3-Dichlorobenzidine	2-Methylnaphthalene
Benzo(k)fluoranthene	2,4-Dichlorophenol	2-Methylphenol
bis(2-Chloroethoxy)methane	Diethylphthalate	4-Methylphenol
bis(2-Chloroethyl)ether	2,4-Dimethylphenol	Naphthalene
bis(2-Ethylhexyl)phthalate	Dimethylphthalate	2-Nitroaniline
4-Bromophenyl-phenylether	Di-n-butylphthalate	3-Nitroaniline
Butylbenzylphthalate	Di-n-octylphthalate	4-Nitroaniline
Carbazole	4,6-Dinitro-2-methylphenol	Nitrobenzene
4-Chloroaniline	2,4-Dinitrophenol	2-Nitrophenol
4-Chloro-3-methylphenol	2,4-Dinitrotoluene	4-Nitrophenol
2-Chloronaphthalene	2,6-Dinitrotoluene	N-Nitroso-di-n-propylamine
2-Chlorophenol	Fluoranthene	N-Nitroso-diphenylamine
4-Chlorophenyl-phenylether	Fluorene	2,2-oxybis(1-Chloropropane)
Pentachlorophenol	Pyrene	2,4,5-Trichlorobenzene
Phenanthrene	1,2,4-Trichlorobenzene	2,4,6-Trichlorobenzene
Phenol		

Table I.1 Soil Analyte List (Continued)

Pesticides/PCB's

Aroclor-1016	Delta-BHC	Endosulfan II
Aroclor-1221	Gamma-BHC	Endosulfan sulfate
Aroclor-1232	alpha-Chlordane	Endrin
Aroclor-1242	gamma-Chlordane	Endrin aldehyde
Aroclor-1248	4,4'-DDD	Endrin ketone
Aroclor-1254	4,4'-DDE	Heptachlor
Aroclor-1260	4,4'-DDT	Heptachlor epoxide
Aldrin	Dieldrin	Methoxychlor
Alpha-BHC	Endosulfan I	Toxaphene
Beta-BHC		

Inorganics

Aluminum	Copper	Potassium
Antimony	Cyanide	Selenium
Arsenic	Iron	Silver
Barium	Lead	Sodium
Beryllium	Lithium	Thallium
Bismuth	Magnesium	Tin
Cadmium	Manganese	Vanadium
Calcium	Mercury	Zinc
Chromium	Molybdenum	Nitrate/Nitrite
Cobalt	Nickel	Explosives (USATHAMA,PETN)

Radionuclides

Americium-241	Plutonium-238	Thorium-230
Bismuth-207	Plutonium-239/240	Thorium-232
Bismuth-210	Potassium-40	Uranium-234
Cesium-137	Radium-226	Uranium-235
Cobalt-60	Thorium-228	Uranium-238

Table I.2. Variance From 3-Foot Sampling Depth Specification

Location	Description of Variance
SGC-NAC-000001	Core sampler hit refusal at 2 feet.
SGC-NAC-000002	Relocated due to utilities.
SGC-NAC-000003	Core sampler hit refusal at 2 feet.
SGC-NAC-000004	Core sampler hit refusal at 18 inches.
SGC-NAC-000005	Drilled to 1 foot, hand-augered rest due to utilities.
SGC-NAC-000006	Drilled to 1 foot, hand-augered rest due to utilities.
SGC-NAC-000007	Core sampler hit refusal at 18 inches.
SGC-NAC-000008	Drilled to 2 feet due to utilities.
SGC-NAC-000010	Drilled to 1 foot; hand-augered rest due to utilities; flag against building, so sample taken 6 feet from flag.
SGC-NAC-000012	Drilled to 2 feet due to utilities.
SGC-SAN-000018	Core sampler hit refusal at 2 feet; relocated from inside clarifier.
SGC-NAC-000029	Core sampler hit refusal at 18 inches.
SGC-A61-000043	Sampled 1 foot from flag.
SGC-A61-000047	Drilled to 2 feet due to utilities.
SGC-A61-000048	Drilled to 2 feet due to utilities.
SGC-A61-000049	Relocated due to utilities.
SGC-A61-000051	Core sampler hit refusal at 18 inches.
SGC-A61-000052	Relocated due to utilities; core sampler hit refusal at 18 inches.
SGC-A61-000053	Core sampler hit refusal at 2 feet.
SGC-A13-000056	Core sampler hit refusal at 18 inches
SGC-A13-000058	Drilled to 1 foot, hand-augered rest due to utilities.
SGC-A13-000060	Core sampler hit refusal at 1 foot.
SGC-AOJ-000064	Core sampler hit refusal at 2 - 3 inches.
SGC-AOJ-000066	Core sampler hit refusal at 4 inches.
SGC-AOJ-000067	Core sampler hit refusal at 6 inches.
SGC-AOJ-000069	Core sampler hit refusal at 2 feet.
SGC-A03-000080	Core sampler hit refusal at 20 inches
SGC-A03-000081	Drilled to 2 feet due to utilities.
SGC-A03-000082	Drilled to 1 foot, hand-augered rest due to utilities.
SGC-A03-000083	Sampled 25 feet from original location due to storm sewer; core sampler hit refusal at 18 inches.
SGC-A03-000087	Core sampler hit refusal at 2 feet.
SGC-A21-000088	Core sampler hit refusal at 18 inches.
SGC-A21-000090	Core sampler hit refusal at 20 inches.
SGC-SDB-000097	Relocated due to utilities.
SGC-SDB-000098	Relocated from inside a building.
SGC-SDB-000101	Relocation of SGC-SDB-000099; first location surveyed incorrectly.
SGC-SDB-000102	Relocation of SGC-SDB-000100; first location surveyed incorrectly.

Table A.1. Soil Gas Confirmation Detected Volatile Organic Compounds

ANALYTE	SGC NAC 000002	SGC NAC 000003	SGC NAC 000004	SGC NAC 000005	SGC NAC 000006	SGC NAC 000007	Background	10 ⁶ Construction Worker Guidelines
VOLATILES (ug/Kg)								
Acetone	3						NA	105000000
1,2-Dichloroethene (total)							NA	21500000
2-Butanone	1						NA	46500000
Benzene	1						NA	8900
Carbon Disulfide			67				NA	1400000
Chloroform							NA	NA
Chloromethane							NA	NA
Ethylbenzene							NA	480
Methylene Chloride				7			NA	NA
Tetrachloroethene							NA	10500000
Toluene	1	1					NA	1250000
Trichloroethene							NA	41000
Xylene (total)							NA	215000000

J - Numerical value is an estimated quantity

NA - Value not available

D - Sample was diluted

C - Estimated due to error in calibration

ug/kg - micrograms per kilogram

B - detected below required limit of detection, but above instrument detection limit.

Table A.2. Soil Gas Confirmation Detected Semivolatile Organic Compounds

ANALYTE	SGC NAC 000001	SGC NAC 000002	SGC NAC 000003	SGC NAC 000004	SGC NAC 000005	SGC NAC 000006	Background	10 ⁹ Construction Worker Guidelines
SEMIVOLATILES (µg/Kg)								
Acenaphthene		190 J	63 J			42	NA	NA
Acenaphthylene		730					NA	NA
Anthracene		1300	66 J		25 J	55 J	NA	32000000
Benzo(a)anthracene		1300	180 J		160	300 J	NA	4100
Benzo(a)pyrene		1300	180 J		200 J	450	NA	410
Benzo(b)fluoranthene		1000	180 J		190	400	NA	4100
Benzo(g,h,i)perylene		550	110 J		100 J	260	NA	NA
Benzo(k)fluoranthene		1000	160 J		190 J	440	NA	41000
Bis(2-ethylhexyl)phthalate							NA	215000
Butylbenzylphthalate							NA	215000000
Carbazole		600	62 J			34 J	NA	NA
Chrysene		1500	220 J		240	400	NA	410000
Di-n-butyl phthalate	120 J			280 J			NA	105000000
Di-n-octyl phthalate							NA	21500000
Dibenz(a,h)anthracene		180 J	40 J		37 J	87	NA	410
Dibenzofuran		1100	23 J				NA	NA
Diethyl phthalate							NA	NA
Fluoranthene		3400 D	480		400 J	800	NA	42500000
Fluorene		1500	12 J				NA	NA
Indeno(1,2,3-cd)pyrene		690	12 J		130 J	320 J	NA	4100
2-Methylnaphthalene		970					NA	NA
Naphthalene		400 D	24 J				NA	NA
Phenanthrene		4700 D	380		150 J	200 J	NA	NA
Phenol							NA	650000000
Pyrene	24 J	2700 D	440		340 J	730	NA	32000000

Table A.3. Soil Gas Confirmation Detected Pesticides/PCB's

ANALYTE	SGC NAC 000008	SGC NAC 000010	SGC NAC 000031	SGC A66 000041	SGC A61 000044	SGC A13 000060	Background	10 ⁶ Construction Worker Guidelines
PESTICIDES/PCB (µg/kg)								
Aroclor-1248	48			110	98		ND	380
Aroclor-1254	43				55		ND	21500
Alpha-Chlordane							ND	NA
Gamma-Chlordane						3.7	ND	NA
4,4'-DDT							13000	9000
Dieldrin		4.4	5*				ND	185
Endosulfan I				3.4*	2.4*		ND	NA
Endosulfan II							NA	NA
Endrin			11*				ND	NA
Heptachlor						2.9	ND	NA

THERE WERE NO PESTICIDES/PCB'S
 DETECTED AT LOCATION #4.
 ANY DETECTIONS WOULD BE
 LISTED ON THIS PAGE OF
 REPORT

Table A.4. Soil Gas Confirmation - Detected TAL Inorganics

ANALYTE	SGC NAC 000001	SGC NAC 000002	SGC NAC 000003	SGC NAC 000004	SGC NAC 000005	SGC NAC 000006	Background	10 ⁶ Construction Worker Guidelines
INORGANICS (mg/kg)								
Aluminum	11000	4190	1910	11400	7970	7780	19000	NA
Antimony		0.23 B		0.24 B	0.41 B		NA	425
Arsenic	1.5 B	2.1 B	2.9 B	1.4 B	7	7.2	8.6	320
Barium	48.6	20.7 B	23.7 B	47.1 B	73.6	86.4	180	75000
Beryllium	0.56		0.17 B	0.65	0.88	0.28	1.3	0.7
Bismuth							NA	NA
Cadmium		0.25 B	0.19 B		0.36 B	0.5 B	2.1	1050
Calcium	162000	159000	95500	152000	13600	86200	310000	NA
Chromium	13.2	6.7	3.8	15.2	13	11.5	20	1050000
Cobalt	9.8 B	4.5 B	2.3 B	10.1 B	7.6 B	7.6 B	19	NA
Copper	16.2	11.9	9.9	17.1	14.5	15.2	26	NA
Cyanide							ND	21400
Iron	21300	10600	5680	21800	7200	17700	35000	NA
Lead	6.7	5.2	11.2	8.6	30.9	25.1	48	NA
Lithium	21 B	12.5 B	6.2 B	23 B	7.7 B	10.3 B	26	NA
Magnesium	6160	57500	27900	5670	5210	35600	40000	NA
Manganese	695	384	270	612	383	589	1400	135000
Mercury			0.13				NC	320
Molybdenum	0.43 B	1.2 B	0.77 B		1.7 B	1.5 B	27	NA
Nickel	18.4	9.9	6.4 B	20.6	11.1	16.1	32	21500
Potassium	1780	742 B	146 B	2080	574 B	744 B	1900	NA
Selenium							NA	NA
Silver			0.24 B				1700	5500000
Sodium	228 B	888 B	150 B	137 B	471 B	348 B	240	NA
Thallium							460	NA
Tin	1.1 B			1.4 B	11 B		20	NA
Vanadium	14.9	8.3	4.7	16.3	23.1	18.9	25	7500
Zinc	53.3	29.5		67	59	69.2	140	320000

Table A.5. Soil Gas Confirmation - Detected Nitrate-Nitrite

ANALYTE	SGC NAC 000001	SGC NAC 000002	SGC NAC 000003	SGC NAC 000004	SGC NAC 000005	SGC NAC 000006	Background	10 ⁻⁶ Construction Worker Guidelines
GENERAL ANALYTES								
% Solids (%)	83.9	93.8	88.5	83.3	78.4	75.0	NA	NA
Nitrate/Nitrite (MG-N/KG)	2.0	1.8	1.2	2.1	7.2	4.8	26	NA

ANALYTE	SGC NAC 000007	SGC NAC 000008	SGC NAC 000009	SGC NAC 000010	SGC NAC 000011	SGC NAC 000012	Background	10 ⁻⁶ Construction Worker Guidelines
GENERAL ANALYTES								
% Solids (%)	83.9	95.0	78.9	83.9	90.1	84.7	NA	NA
Nitrate/Nitrite (MG-N/KG)	1.6	26.5	2.2	5.9	5.3	1.8	26	NA

ANALYTE	SGC NAC 000013	SGC NAC 000014	SGC NAC 000015	SGC NAC 000016	SGC NAC 000017	SGC SAN 000018	Background	10 ⁻⁶ Construction Worker Guidelines
GENERAL ANALYTES								
% Solids (%)	81.7	80.9	74.0	85.3	72.8	84.2	NA	NA
Nitrate/Nitrite (MG-N/KG)	2.1	4.9	3.0	2.4	6.4	13.7	26	NA

ANALYTE	SGC NAC 000019	SGC NAC 000020	SGC NAC 000021	SGC NAC 000022	SGC NAC 000023	SGC NAC 000024	Background	10 ⁻⁶ Construction Worker Guidelines
GENERAL ANALYTES								
% Solids (%)	85.3	87.6	77.4	78.3	77.5	89.5	NA	NA
Nitrate/Nitrite (MG-N/KG)	6.5	2.1	6.1	2.2	11.6	2.2	26	NA

Table A.6. Soil Gas Confirmation Detected Radionuclides

ANALYTE	SGC NAC 000001	SGC NAC 000002	SGC NAC 000003	SGC NAC 000004	SGC NAC 000005	SGC NAC 000006	SGC NAC 000007	Background	10 ⁶ Construction Worker Guidelines
RADIONUCLIDES (pCi/g)									
Americium-241								ND	4.95
Bismuth-207								ND	0.175
Bismuth-210								ND	NA
Cesium-137						0.861		0.42	0.46
Cobalt-60								NC	0.1
Plutonium-238	1.42	0.0690	0.833	0.0870	0.543	4.32	0.537	0.13	5.5
Plutonium-239/240			0.0252					0.18	5.5
Potassium-40	21.7	2.95	6.53	27.4	15.1	14.3	10.8	37	NA
Radium-226	1.03	0.478	0.508	1.16	1.22	0.570	0.537	2	0.14
Thorium-228	1.52	0.277	0.370	1.24	1.05	1.06	0.431	1.5	0.85
Thorium-230	0.814	0.374	0.621	0.980	1.19	1.18	0.582	1.9	44
Thorium-232	1.30	0.184	0.315	1.17	0.950	1.18	0.328	1.4	50
Uranium-234	2.19	0.401	0.419	0.934	0.874	0.761	0.584	1.1	37.5
Uranium-235	0.0974		0.0400	0.0349	0.0328			0.11	3.35
Uranium-238	2.35	0.392	0.512	0.918	0.913	0.815	0.574	1.2	11