United States
Environmental Protection
Agency

Office of Air Quality
Planning and Standards
Research Triangle Park, NC 27711

EMB Report 85-FPE-~~02~~ 07
August 1986

Air

EPA

Hazardous Waste Treatment, Storage, and Disposal Facilities

Site-Specific Test Report U.S. Pollution Control, Inc. Toole, Utah

SITE-SPECIFIC TEST REPORT

U.S. POLLUTION CONTROL, INC.
GRASSY MOUNTAIN FACILITY
TOOLE, UTAH

ESED 85/12
EMB 85FPE07

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Contract No. 68-02-3852 and 68-02-4336
Work Assignment No. 3024 and No. 3501

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August 1986

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1.0 INTRODUCTION

On November 5 and 6, 1985, Entropy Environmentalists, Inc. collected soil samples from five treatment, storage, and disposal related processes at U.S. Pollution Control, Inc. (USPCI) Grassy Mountain Facility located in Toole, Utah. The purpose of this sampling program was to provide preliminary data on the magnitude of fugitive particulate emissions from various processes at treatment, storage, and disposal facilities (TSDF's) and the degree to which these emissions are contaminated. The U. S. Environmental Protection Agency (EPA) anticipates utilizing the analytical data from this program with emission models to estimate fugitive particulate emissions from TSDF's. The information generated by this study may ultimately be used by the Office of Air Quality Planning and Standards (OAQPS) of EPA to assess the adequacy of regulations governing fugitive particulate emissions from TSDF's.

To accomplish the overall goals of this study, soil samples were collected from representative processes at this plant and were submitted for the appropriate analyses in order to determine the following:

- The percent by weight of silt in the soil (i.e., material that passes through a 200 mesh screen and has a nominal diameter less than 75 um) and the percent by weight of moisture in the soil.
- The degree of contamination in the soil silt fraction of metals, semivolatile organics, and pesticides.
- The percent by weight of soil silt that is less than 20 um in diameter based on a sonic sieving technique.
- The particle size dependency of the degree of contamination (i.e., greater or lesser degree of contamination in particles with diameters not in excess of 20 um) by conducting separate analyses of different soil particle size fractions.

- The repeatability and reproducibility of the sampling and analytical procedures for the entire sampling program (only raw data are included in this report; a statistical summary will be presented for all sampling sites in a later report).

At USPCI, the five processes sampled were (1) a landfill cell, (2) the stabilization unit, (3) and (4) two sections of one of the land treatment areas, and (5) unpaved road segments at two locations within the facility. A pair of background samples along with samples to assess the repeatability and reproducibility of the method were also taken.

Samples taken were analyzed for silt content, PM_{10} content, metals, cyanide, and semivolatile organics as described in Chapter 4. Research Triangle Institute (RTI) conducted the analyses for metals and PEI Associates performed the analyses for the semivolatile organics. Additional cleanup of the semivolatile organic extracts was performed by Triangle Laboratories, Inc. The outside laboratory that performed the metals analysis on the reproducibility samples was PEI Associates. For a cost benefit, all the reproducibility samples for the entire study were analyzed at the same time. EPA decided not to have the reproducibility samples analyzed for semivolatile organics as a cost saving measure since few semivolatile organics were detected at two times the detection limits in the other process samples.

Field sampling was performed by Mr. Steve Plaisance and Mr. Kent Spears of Entropy Environmentalists. Mr. Phillip Englehart of Midwest Research Institute (MRI) directed Entropy personnel regarding specific processes to be sampled and the boundaries of the processes, and recorded the pertinent process and operating characteristics. Mr. Gene Riley (EPA Task Manager) of the Emission Measurement Branch (EMB) and Mr. Lee Beck (EPA Task Manager) of the Industrial Studies Branch (ISB) observed the sampling program. Mr. L. H. Shepherd, Facility Manager, served as the principal contact for U.S. Pollution Control, Inc.

This report is organized into several chapters that address various aspects of the sampling and analysis program. Immediately following this chapter is the "Summary and Discussion of Results" chapter which presents table summaries of data on silt and PM_{10} content and degree of contamination for each sample fraction analyzed. Following the "Summary and Discussion of Results" chapter is the "Process Description" chapter (supplied by MRI) which includes descriptions of each process sampled. The next chapter, "Sampling and Analysis," presents the plot plan and sampling grid for each process. The method of selecting the sampling grid and the sample collection procedures are outlined, including any deviations and problems encountered. This chapter also describes the sample preparation and analytical procedures used for each sample; any deviations from the normal procedures are addressed. The appendices present the Raw Field Data and Sampling Logs (Appendix A); Analytical Data (Appendix B); detailed Sampling and Analytical Procedures (Appendix C); Sampling Program Participants and Observers (Appendix D); and Process Operations Data (Appendix E).

2.0 SUMMARY AND DISCUSSION OF RESULTS

This chapter presents a summary of the sampling and analysis results and a brief discussion of significant deviations from the proposed sampling and analysis protocol for this program. Since the standard sampling and analytical procedures are not addressed in this chapter, it is recommended that those individuals who are not familiar with the sampling and analytical procedures used in this study review Chapter 4, "Sampling and Analysis," prior to reading this chapter.

Soil samples were collected from five processes at USPCI in Toole, Utah. The processes included: (1) Landfill Cell #1; (2) the Stabilization Unit; (3) Land Treatment Area II, Row Markers 118 to 121; (4) Land Treatment Area II, Row Markers R-32 to R-35; and (5) two unpaved access road segments. The sampling and analytical procedures used were those described in the Sampling and Analysis Protocol written specifically for this sampling program. The protocol was provided to the facility prior to the sample collection. The procedures described in this protocol are described again in detail in Chapter 4 and Appendix C of this report.

As described in the Sampling and Analysis Protocol, this site-specific report is intended to present the data relevant to the samples obtained at one site in this study and the procedures used to obtain these samples. Some statistical analyses will be performed on the data concerning this site; however, the majority of statistical analyses will involve the data collected over the entire study, including the repeatability and reproducibility and quality assurance data, and will be included in the summary report to be completed at the conclusion of the program. With the exception of the data from

the screening conducted to determine silt contents, there is not sufficient data to conduct meaningful statistical analyses on a site- or process-specific basis.

The sampling plan for USPCI is shown in Table 2.1. The sampling procedures were designed to obtain a representative sample of that portion of the contaminated soil with the potential to become airborne. The analyses of the collected samples were designed to measure the concentration of the most likely compounds or elements that could be soil contaminates (metals, cyanide, semivolatile organics, and pesticides). The sample collection techniques were generally as follows: (1) for undisturbed hard surfaces a sweeping technique was used to obtain surface samples only; (2) for moderately disturbed surfaces a scooping technique was used to obtain near surface samples; and (3) for surfaces that were mechanically disturbed to a specific depth, coring was used to sample to the depth of the disturbance. The number of samples collected within each process was a function of the variability expected in the degree of contamination and/or the amount of sample that was needed for the analyses.

According to the Sampling and Analysis Protocol, the collected samples were to be analyzed for metals, cyanide, semivolatile organics, and pesticides. The organics of interest were found on the Hazardous Substance Lists (HSL) in the EPA Contract Laboratory Program (CLP), Statement of Work. If significant quantities of cyanide, semivolatile organics, or pesticides were not expected to be present in a particular process, then analysis for those compounds was not performed. MRI decided that at this particular site, pesticides would not be present in significant quantities in any processes except the Landfill and the Stabilization Area and therefore, the pesticide analyses were deleted for all processes but these. All samples were analyzed for metals, cyanide, and

TABLE 2.1. SAMPLING PLAN FOR USPCI

Process Sampled	Process Designation	Number of Samples	Collection Method	Analyses
Landfill Cell #1	S	8 (9 R&R)	Scooping	Loss on Drying Silt and PM_{10} Content Metals and Cyanide Semivolatile Organics Pesticides
Stabilization (Unit Land Treatment Area I)	T	7	Scooping	Loss on Drying Silt and PM_{10} Content Metals and Cyanide Semivolatile Organics Pesticides
Land Treatment Area II (Row Markers 118 to 121)	U	8	Scooping	Loss on Drying Silt and PM_{10} Content Metals and Cyanide Semivolatile Organics Oil and Grease
Land Treatment Area II (Row Markers R-32 to R-35)	V	8	Scooping	Loss on Drying Silt and PM_{10} Content Metals and Cyanide Semivolatile Organics Oil and Grease
Unpaved Access Roads	W	2	Sweeping	Loss on Drying Silt and PM_{10} Content Metals Semivolatile Organics
Background Samples	BGD	2	Scooping	Loss on Drying Silt and PM_{10} Content Metals Semivolatile Organics Oil and Grease

semivolatile organics, except the reproducibility samples. They were analyzed only for metals and cyanide as a cost savings measure. Complete lists of compounds or elements for which analyses were conducted and their detection limits are presented in Chapter 4 (see Tables 4.2, 4.3, and 4.4).

The analytical results are discussed in the following subsections. Complete sampling data sheets are presented in Appendix A and all analytical data sheets are presented in Appendix B.

2.1 BACKGROUND SAMPLES

Because many compounds and elements are either naturally occuring in the soil or may be present as a result of factors other than those which may be attributed to USPCI'S activities, background samples were collected at a point not used for TSDF activities. The percent weight loss on drying (LOD) measured for samples BGD-609 and BGD-610 averaged 16.05 percent by weight. The samples were oven-dried at 105°C for 1 hour prior to being screened for silt content. The silt content of the two background samples (sample identification numbers BGD-609 and BGD-610) averaged 5.0 percent by weight (see Table 2.2). The composite silt material (sample identification number BGD-645) separated from the background samples was sonic sieved. Material passing through a 20 um sieve constituted the PM_{10} content. The PM_{10} content averaged 21.52 percent by weight of the silt material. The fraction of the silt material that did not pass through the 20 um sieve was referred to as the "greater than PM_{10} (> PM_{10}) fraction. The silt screening did not produce a sufficient amount of silt to allow for the production of the "greater than PM_{10}" (>PM_{10}) and PM_{10} fractions for chemical analyses.

TABLE 2.2.
ANALYTICAL RESULTS OF SILT SCREENING, WEIGHT LOSS ON DRYING, AND PM_{10} SIEVING
FUGITIVE PARTICULATE FROM TSDF (85/12)

Site and Process	Sample ID	Percent Silt	Percent Loss on Drying	Sample ID	Percent PM_{10}
USPCI, Toole, Utah Landfill, Cell #1 (Process S)	S-601	14.8	10.35		
	S-602	10.1	25.07		
	S-603	11.6	22.31		
	S-604	10.9	21.97		
	S-605	18.3	5.49		
	S-606	16.0	2.25		
	S-607	10.6	25.84	S-642	41.31
	S-608	9.6	19.68	S-642	39.84
	Average	12.7	16.62		40.58
	Std. Dev.	3.2	9.23		1.04
USPCI, Toole, Utah Background Samples	BGD-609		22.08		
	BGD-609	1.4	22.58		
	Average		22.33		
	Std. Dev.		0.35		
	BGD-610		9.37	BGD-645	21.56
	BGD-610	8.6	10.16	BGD-645	21.48
	Average		9.77		21.52
	Std. Dev.		0.56		0.06
USPCI, Toole, Utah Stabilization Area, #7 (Process T)	T-611	6.6	33.05		
	T-612	1.0 *	20.81		
	T-613	2.2 *	23.45		
	T-614	6.6	35.54		
	T-615	7.3	26.31		
	T-616	9.9	23.94	T-652	31.01
	T-617	8.7	33.33	T-652	34.89
	Average	6.0	28.06		32.95
	Std. Dev.	3.3	5.81		2.74
USPCI, Toole, Utah Land Treatment, 118-121 (Process U)	U-618	14.3	2.98		
	U-619	13.0	4.30		
	U-620	13.5	4.32		
	U-621	10.7	4.09		
	U-622	10.4	4.94		
	U-623	11.0	3.12		
	U-624	10.8	3.01	U-659	20.13
	U-625	18.6	3.47	U-659	20.67
	Average	12.8	3.78		20.40
	Std. Dev.	2.8	0.73		0.38

(continued)

TABLE 2.2. (continued)

Site and Process	Sample ID	Percent Silt	Percent Loss on Drying	Sample ID	Percent PM_{10}
USPCI, Toole, Utah Land Treatment, R32-R35 (Process V)	V-626	7.9	7.37		
	V-627	11.8	8.37		
	V-628	8.6	5.79		
	V-629	10.7	5.61		
	V-630	10.3	6.18		
	V-631	10.9	5.41		
	V-632	7.4	4.04	V-666	4.64
	V-633	10.5	6.16	V-666	4.59
	Average	9.76	6.12		4.62
	Std. Dev.	1.6	1.30		0.04
USPCI, Toole, Utah Roadways (Process W)	W-634	16.0	2.05		
				W-669	40.43
	W-635	7.9	1.20	W-669	40.69
				Average	40.56
				Std. Dev.	0.18
USPCI, Toole, Utah Landfill, Cell #1 Repeatability and Reproducibility	S-601-RR1	12.3	9.93		
	S-601-RR2	13.6	13.90		
	S-601-RR3	13.9	9.55		
	Average	13.3	11.1		
	Std. Dev.	0.9	2.4		
	S-602-RR1	21.1	22.32		
	S-602-RR2	16.1	22.75		
	S-602-RR3	14.1	22.71		
	Average	17.1	22.6		
	Std. Dev.	3.6	0.2		
	S-603-RR1	21.2	22.27		
	S-603-RR2	15.6	21.86		
	S-603-RR3	16.7	20.93		
	Average	17.8	21.7		
	Std. Dev.	3.0	0.7		

*These samples were screened with a full stack of sieves.

Results of the analyses for metals are shown in Table 2.3 and those for the semivolatile organics are shown in Table 2.4. The analytical results for the metals and cyanide in the background silt sample (sample ID BGD-645) are in terms of micrograms of the metal per gram of silt sample (dry basis). These results reflect the nominal concentrations of these materials present in the soil which are not a result of USPCI'S activities. The results for the background samples have not been subtracted from the results for the other samples since the risk assessments use the inclusive value of the degree of contamination. It should be understood, however, that the actual outside contribution to the degree of contamination of the soil is that portion of the contaminate concentration which exceeds the nominal background level.

For the analysis of the semivolatile organic compounds, the background samples were extracted as low-level samples following the U.S. EPA Contract Laboratory Program, Statement of Work for Organic Analysis, 7/85 Revision (refered to as the CLP in this report). The extract was concentrated and subjected to an adsorption chromatography cleanup procedure instead of the CLP gel permeation chromatography (GPC) cleanup procedure specified in the CLP. The adsorption chromatography procedure was developed to remove more aliphatic compounds from the extract than possible with the GPC procedure. The presence of excessive amounts of aliphatic material would have required dilution of the extracts prior to the gas chromatograph/mass spectrometer (GC/MS) analysis and a corresponding increase in the sample detection limit. The dilution would have been necessary to protect the GC/MS from the samples having large amounts of aliphatic compounds (particularly the land treatment samples which contain considerable amounts of oil and grease).

TABLE 2.3. ANALYTICAL RESULTS FOR METALS

FUGITIVE PARTICULATE FROM TSDF (85/12)

Metals Analysis	Landfill Cell #1			Stabilization Area #7			Land Treatment 118-121			R32-R35 Roadway		Background
Sample Identity	Silt S-637	PM10 S-639	>PM10 S-641	Silt T-647	PM10 T-649	>PM10 T-651	Silt U-654	PM10 U-656	>PM10 U-657	Silt V-661	Silt W-668	Silt BGD-644
Element	(ug/g)	(ug/g)	(ug/g)	(ug/g)	(ug/g)	(ug/g)	(ug/g)					
Aluminum (Al)	11,500	11,800	11,400	11,100	11,700	11,900	10,600	13,900	11,000	10,300	13,300	12,500
Antimony (Sb)	17.1	11.6	16.7	4.0	4.4	4.2	0.9	0.8	0.5	0.7	1.4	<0.5
Arsenic (As)	21.3	24.3	22.3	14.8	14.6	16.1	7.9	12.5	7.4	10.7	10.1	8.3
Barium (Ba)	888	361	264	202	235	214	276	344	266	280	253	374
Beryllium (Be)	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Cadmium (Cd)	150	170	149	18.8	20.5	19.4	<1	<1	<1	<1	18.4	<1
Chromium (Cr)	447	465	429	337	432	337	90.6	206	74.7	93.1	109	19.2
Cobalt (Co)	12.2	12.2	8.4	6.0	6.2	6.0	4.2	8.4	4.1	4.2	5.2	6.2
Copper (Cu)	951	1,060	956	232	262	243	59.0	92.8	52.0	80.8	196	28.5
Iron (Fe)	63,200	63,500	63,400	13,500	14,700	14,600	9,500	12,700	9,200	9,500	14,800	9,700
Lead (Pb)	6,870	7,746	6,870	866	1,012	926	33.0	45.7	22.2	36.7	630	30.7
Manganese (Mn)	6,480	6,690	6,340	789	928	819	265	356	257	256	671	276
Mercury (Hg)	1.23	1.50	1.21	0.11	0.30	0.16	0.85	2.02	0.59	1.09	0.28	<0.1
Molybdenum (Mo)	82.3	92.0	86.7	127	141	139	<2	<2	2.1	<2	6.6	<2
Nickel (Ni)	85.6	86.2	83.6	30.4	39.2	30.3	8.3	19.8	13.8	13.9	23.7	9.36
Osmium (Os)	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Selenium (Se)	4.8	5.4	5.4	1.7	1.2	1.4	1.0	<0.5	<0.5	0.5	0.8	<0.5
Silver (Ag)	18.1	26.9	17.0	11.5	14.7	10.3	<2	<2	<2	<2	<2	<2
Thallium (Tl)	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Vanadium (V)	61.9	59.5	55.2	25.6	24.9	27.6	33.9	45.4	33.3	29.2	43.5	31.8
Zinc (Zn)	41,800	47,700	42,900	4,800	5,100	5,200	104	193	99.3	454	3,590	55.5
cyanide	1.23	1.93	0.57	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	-

TABLE 2.4. ANALYTICAL RESULTS FOR SEMIVOLATILE ORGANICS
FUGITIVE PARTICULATE FROM TSDF (85/12)

Organic Analysis	Landfill Cell #1			Stabilization Area #7		Land Treatment Cells 118-121		R32-R35	Roadway	Background
Sample Identity	Silt S-636	PM10 S-638	>PM10 S-640	Silt T-646	PM10 T-648	Silt U-653	PM10 U-656	Silt V-660	Silt W-667	Silt BGD-643
Semivolatile Compound	(ug/g)	(ug/g)	(ug/g)	(ug/g)	(ug/g)	(ug/g)	(ug/g)	(ug/g)	(ug/g)	(ug/g)
Acenapthene	N.D.	N.D.	N.D.	21.0	25.0	N.D.	N.D.	N.D.	1.2 J	N.D.
Anthracene	32.0 J	32.0	26.0 J	20.0	29.0	N.D.	N.D.	7.2	1.1 J	N.D.
Benzo(a)anthracene	N.D.	13.0 J	N.D.	3.1 J	4.5	N.D.	N.D.	N.D.	1.1 J	N.D.
Benzo(a)pyrene	N.D.	4.4 J	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Benzo(b)fluoranthene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	1.3 J	N.D.
Benzo(k)fluoranthene	N.D.	N.D.	N.D.	1.3 J	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Bis(2-ethylhexyl)phthalate	N.D.	6.4 J	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Chrysene	12.0 J	18.0 J	11.0 J	3.9 J	5.7	6.4 J	14.0 J	1.5 J	3.3 J	N.D.
Dibenzofuran	25.0 J	18.0 J	N.D.	14.0	N.D.	N.D.	N.D.	0.44 J	1.7 J	N.D.
Fluoranthene	54.0 J	62.0	39.0 J	23.0	23.0	N.D.	N.D.	N.D.	12.0	N.D.
Fluorene	N.D.	N.D.	N.D.	5.3 J	14.0	N.D.	N.D.	N.D.	2.4 J	N.D.
2-Methylnapthalene	120	62.0	89.0	30.0	31.0	3.2 J	5.6 J	18.0	1.4 J	N.D.
2-Methylphenol	N.D.	N.D.	N.D.	0.7 J	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
4-Methylphenol	N.D.	N.D.	N.D.	2.3 J	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Napthalene	31.0 J	9.4 J	17.0 J	27.0	14.0	N.D.	N.D.	2.0 J	N.D.	N.D.
Phenanthrene	150	140	120	50.0	36.0	22.0 J	46.0	N.D.	22.0	N.D.
Phenol	60.0 J	30.0	43.0	N.D.	3.0 J	N.D.	N.D.	N.D.	N.D.	N.D.
Pyrene	44.0 J	59.0	34.0 J	18.0	21.0	8.5 J	18.0 J	1.9 J	7.7	N.D.
Sample Detection Limit	62.1	19.6	39.6	5.0	3.8	26.4	46.2	4.0	3.3	0.33

N.D. = Less than the sample's quantifiable detection limit
J. = Estimated value where the compound meets the spectral criteria but the result is less than the quantifiable limit.

For the background sample no dilution (as determined by GC/flame ionization detection) was required prior to the GC/MS analysis. None of the CLP Hazardous Substance List (HSL) semivolatile compounds were detected in the background sample (see Table 2.4). Determinations of the oil and grease content were conducted on aliquots of two samples (numbers BGD-670 and BGD-671). The oil and grease content of these two samples averaged <0.05 percent expressed on a dry weight basis (see Table 2.5).

With the exception of the use of the adsorption chromatography cleanup procedure, all procedures followed the Sampling and Analysis Protocol.

2.2 LANDFILL CELL #1 (PROCESS S)

Cell #1 in the Landfill (Process S) was sampled using the scooping technique. A sampling grid was laid out and eight randomly selected cells were sampled. The weight loss on drying determined on aliquots of each sample averaged 16.62 percent by weight (see Table 2.2). Following drying by desiccation for 24 hours, the eight samples were screened for silt content which averaged 12.7 percent by weight.

The silt separated from the samples was sonic sieved for PM_{10} content which averaged 40.58 percent by weight of the silt. Portions of each of the three fractions (silt, $>PM_{10}$, and PM_{10}) produced from the combined silt sample from the landfill were analyzed for metals and cyanide by RTI and semivolatile organics and pesticides by PEI. All three fractions were analyzed to determine if the degree of contamination was less or greater in the PM_{10} fraction (particle size dependent).

The analytical results for metals and semivolatile organics are shown in Tables 2.3 and 2.4, respectively. The concentrations measured for the

TABLE 2.5. SUMMARY OF OIL AND GREASE ANALYSIS
FUGITIVE PARTICULATE FROM TSDF (85/12)

Process ID	Process Description	Site	Oil and Grease
U	Land Treatment, 118-121	USPCI, Toole, Utah	1.11%
V	Land Treatment, R32-35	USPCI, Toole, Utah	3.71%
BGD	Background Sample	USPCI, Toole, Utah	<0.05%

QUALITY ASSURANCE SUMMARY FOR OIL AND GREASE ANALYSIS

Process ID	Sample Description	Site		Oil and Grease
Total Repeatability				
O	Oil&Grease O-rr1 Comp			6.94%
O	Oil&Grease O-rr1 Comp			7.91%
				==========
			Mean	7.43%
			RPD	0.48%
Analytical Repeatability				
O	Oil&Grease O-rr1 Comp			7.91%
O	Oil&Grease O-rr1 Comp			7.30%
				==========
			RPD	0.30%
Sampling Reproducibility				
O	Oil&Grease O-rr4 Comp			8.12%
O	Mean of O-rr1 Comp			7.43%
				==========
			RPD	0.35%

Performance Audit

		Expected	Found	Recovery
BGD	Spiked with 34 mg of paraffin oil	0.39%	0.36%	92.3%

background sample were not subtracted from the sample results. Like the background silt sample, the Landfill Cell #1 samples were extracted by the low-level method. The extracts were concentrated and cleaned using the LH-20 adsorption chromatography procedure. The silt sample extract was diluted a total of 188-fold before the GC/MS analysis. Nine semivolatile organic compounds were detected in the silt sample. Seven of these compounds met the spectral criteria, but were below the quantifiable detection limit of 62.1 ug/gand the values reported are only an estimate. Phenathrene and 2-methylnapthalene were detected at levels above the quantifiable detection limit.

In the PM_{10} fraction extract, which had been diluted a total of 59.9-fold, twelve semivolatile organic compounds were detected. Anthracene, flouranthene, 2-methylnapthalene, phenathrene, phenol, and pyrene were found at levels above the quantifiable detection limit of 19.6 ug/g. In the $>PM_{10}$ fraction after a 120-fold dilution, eight semivolatile organics were detected with three (2-methylnapthalene, phenathrene, and phenol) above the quantifiable detection limit of 39.6 ug/g. No pesticides were detected in any of the samples.

With the exception of using the adsorption chromatography cleanup procedure and diluting the extracts prior to the GC/MS analysis, all procedures followed the Sampling and Analysis Protocol.

2.3 STABILIZATION UNIT (PROCESS T)

The Stabilization Unit (Process T) was sampled using a grid layout. Seven samples were collected within this grid in a random manner as described in Chapter 4. The scoop sampling technique was employed. The average of the LOD

measured for aliquots of each of the Stabilization Area samples was 28.06 percent (see Table 2.2). All the samples were dried by desiccating for 36 hours followed by oven-drying for 1 hour at 105°C. Each of the seven samples (identification numbers T-611 through T-617) was screened for silt content which averaged 6.0 percent silt by weight (see Table 2.2). The silt (sample T-652) resulting from screening the Stabilization Unit samples was then sonic sieved for PM_{10} content which averaged 32.95 percent by weight.

Portions of the three fractions (silt, $>PM_{10}$, and PM_{10}) produced from the composite silt sample were anlayzed for metals and cyanide by RTI and semivolatile organics and pesticides by PEI. All three fractions were analyzed to determine if the degree of contamination was less or greater in the PM_{10} fraction (particle size dependent). The results of these analyses are presented in Tables 2.3 and 2.4. The results are expressed in micrograms of the metal or compound per gram of sample on a dry basis. The concentrations measured for the background sample were not subtracted from the sample results.

As a cost saving measure, only the silt and PM_{10} fractions were analyzed for semivolatile organics and pesticides to determine the particle size dependency of the degree of contamination. Like the background silt sample, Stabilization Unit silt and PM_{10} fractions were extracted by the low-level CLP procedure. The extracts were concentrated and subjected to the adsorption chromatography cleanup procedure. Prior to the GC/MS analysis, the silt extract was diluted 15-fold and the PM_{10} extract was diluted 11.5-fold. Fourteen semivolatile organic compounds were detected in the silt fraction. Eight of these (acenapthene, anthracene, dibenzofuran, flouranthene, 2-methylnapthene, napthalene, phenathrene, and pyrene) were detected at concentrations above the quantifiable detection limit of 5.0 ug/g. The other

six compounds met the spectral criteria, but the concentration values reported are estimates only. In the PM_{10} fraction, eleven semivolatile HSL compounds were detected. Acenapthene, anthracene, benzo(a)anthracene, chrysene, flouranthene, flourene, 2-methylnapthene, napthalene, phenathrene, and pyrene were all found at concentrations above the quantifiable detection limit of 3.8 ug/g. No pesticides were detected in either of the fractions.

With the exception of using the adsorption chromatography cleanup procedure and diluting the extracts prior to the GC/MS analysis, all procedures followed the Sampling and Analysis Protocol.

2.4 LAND TREATMENT AREA, ROW MARKERS 118 to 121 (PROCESS U)

The area between row markers 118 and 121 in the Land Treatment Area (Process U) was sampled using the scooping technique. A sampling grid was laid out and eight randomly selected cells were sampled. The determination of the oil and grease content was conducted on sample U-658 taken from Process U. The oil and grease content of the sample was 1.11 percent expressed on a dry weight basis (see Table 2.5). The average LOD measured for sample aliquots from this process was 3.78 percent (see Table 2.2). All samples (U-618 through U-625) were desiccated for 72 hours prior to screening. The resulting dried samples were screened for silt content which averaged 12.8 percent by weight. The composite silt sample separated from the samples (sample ID number U-659) was sonic sieved for PM_{10} content which averaged 20.40 percent by weight of the silt.

Three fractions (silt, PM_{10}, and $>PM_{10}$) were produced from the combined silt sample from Process U. Portions of each were sent to RTI for metals and cyanide analyses. The three fractions were analyzed to determine

the particle size dependency of the degree of contamination. As a cost saving measure, only the silt and PM_{10} fractions were analyzed for semivolatile organics to determine the particle size dependency of the degree of contamination. The results for the anlayses for metals and cyanide and semivolatile organics are presented in Tables 2.3. and 2.4, respectively. The analytical results for the background samples were not subtracted from the sample results.

The silt and PM_{10} fractions were prepared for organic analysis like the background sample. The extracts were diluted 80- and 140-fold, respectively, prior to the GC/MS analysis. All four of the compounds detected in the silt fraction were below the quantifiable detection limit of 26.4 ug/g, which means that the reported compounds were identified, but the magnitude of the results are only an estimate. Of the four HSL compounds detected in the PM_{10} fraction, three were below and one (phenanthrene) was above the quantifiable detection limit of 46.2 ug/g.

With the exception of using the adsorption chromatography cleanup procedure and diluting the extracts prior to the GC/MS analysis, all procedures followed the Sampling and Analysis Protocol.

2.5 LAND TREATMENT AREA, ROW MARKERS R-32 TO R-35 (PROCESS V)

The area between row markers R-32 and R-35 in the Land Treatment Area (Process V) was sampled using the scooping technique. A sampling grid was laid out and eight randomly selected cells were sampled. The determination of the oil and grease content was conducted on sample V-665 from Process V. The oil and grease content measured was 3.71 percent expressed on a dry weight basis (see Table 2.5). The average LOD measured for sample aliquots from this

process was 6.12 percent (see Table 2.2). All samples (V-626 through V-633) were dried prior to screening for silt content using desiccation for 36 hours followed using oven drying at 105°C for 1 hour. The resulting dried samples averaged 9.76 percent silt content by weight. The composite silt sample separated from these samples (V-666) was sonic sieved for PM_{10} content which averaged 4.62 percent by weight.

Since the silt and PM_{10} contents for this process were low and as a cost saving measure, the decision was made not to produce PM_{10} and $>PM_{10}$ fractions for the chemical analyses. Portions of the silt fraction were sent to RTI for metals and cyanide analysis and PEI for semivolatile organics analysis. The results are presented in Tables 2.3 and 2.4. The analytical results for the background samples were not subtracted from the values shown.

The silt fraction was prepared for the organics analysis like the background sample. The extract was diluted 12-fold prior to the GC/MS analysis. Of the six HSL semivolatile organic compounds detected in the silt fraction sample, two (anthracene and 2-methynapthalene) were found at concentrations above the quantifiable detection limit of 4.0 ug/g and four were below the quantifiable detection limit (reported values are estimates only).

With the exception of using the adsorption chromatography cleanup procedure and diluting the extracts prior to GC/MS analysis, all procedures followed the Sampling and Analysis Protocol.

2.6 UNPAVED ACCESS ROADS (PROCESS W)

Two segments of unpaved access roads at USPCI were sampled. These segments were located (see Figure 4.1) (1) on the road leading from the office to the

Landfill (sample W-634) and (2) on the access road to Landfill Cells #1 and #2 (sample M-635). Both segments were sampled using the sweeping technique.

A brush was used to sweep loose particulate from a 8-foot strip across the road for a distance of 2 feet. Two sample jars were filled with each sample. The average LOD measured for the two samples was 1.63 percent (see Table 2.2). Both samples were oven-dried for 1 hour at 105°C. After drying, the samples were screened for silt content which averaged 16.0 and 7.9 percent by weight for sample numbers W-634 and W-635, respectively (see Table 2.2). The silt sample obtained from these samples was sonic sieved for PM_{10} content which averaged 40.56 percent by weight. Since a sufficient quantity of silt was not obtained from the silt screening, PM_{10} and $>PM_{10}$ fractions were not produced for the analysis of the metals and semivolatile organics.

The results of metal and semivolatile organic analyses for the composite silt sample are presented in Tables 2.3 and 2.4. The concentrations measured for the background sample were not subtracted from the results for the unpaved road silt sample. The silt sample was prepared for organic analysis like the background sample and diluted 10-fold prior to GC/MS analysis. Four of the semivolatile organic compounds (chrysene, flouranthene, phenathrene, and pyrene) found in the silt sample were above the quantifiable detection limit of 3.3 ug/g. Seven HSL compounds were below the quantifiable detection limit (i.e., the mass spectral criteria for these compounds were met for identifying the compound, but the actual magnitude reported is only an estimated value).

With the exception of using the adsorption chromatography cleanup procedure and diluting the extracts prior to GC/MS analysis, all procedures followed the Sampling and Analysis Protocol.

2.7 REPEATABILITY AND REPRODUCIBILITY

As discussed in more detail in Chapter 4 and Appendix C, additional samples were collected in three of the sampled grid cells in Cell #1 of the Landfill (Process S) for use in measuring the sampling and analysis repeatability and reproducibility. The silt contents of these samples are presented in Table 2.2.

The results of the metals analysis for these samples are presented in Table 2.6. The values for sample S-924 appear to be out of line with the values for the rest of the samples; since they are all 10 to 100 times less, it is possible that the sample was not fully digested prior to analysis. Repeatability results for semivolatile organics and pesticides are presented in Table 2.7. As a cost saving measure and because few compounds were detected in the Process S samples at two times the quantifiable detection limit, analysis for semivolatile organics and pesticides were not conducted on the reproducibility samples. A summary report presenting the repeatability and reproducibility results over the entire study will be completed at the end of the study.

2.8 CONCLUSIONS

No major problems were encountered during sample collection. It was felt that the sampling program was successful in obtaining representative samples.

In the analyses of the samples, no problems were encountered in obtaining silt content or determining PM_{10} content. The results of the metals and cyanide analyses are also believed to be accurate.

The only significant problem encountered during the analyses was the fact that the samples contained a significant amount of organics not found on the Hazardous Substances List. This prevented the semivolatile organics analyses from being conducted at the level described in the CLP analytical protocol.

TABLE 2.6. ANALYTICAL RESULTS FOR REPEATABILITY AND REPRODUCIBILITY SAMPLES - METALS
FUGITIVE PARTICULATE FROM TSDF (85/12)

Sample Identity	Grid No. 7					Grid No. 23					Grid No. 24				
	RTI S-902	PEI S-904	RTI S-908	RTI S-909	PEI S-910	RTI S-912	PEI S-914	RTI S-918	RTI S-919	PEI S-920	RTI S-922	PEI S-924	RTI S-928	RTI S-929	PEI S-930
Element	(ug/g)	(ug/g)	(ug/g)	(ug/g)	(ug/g)	(ug/g)	(ug/g)	(ug/g)	(ug/g)	(ug/g)	(ug/g)	(ug/g)	(ug/g)	(ug/g)	(ug/g)
Aluminum (Al)	16,500	13,420	17,100	17,400	13,010	10,300	10,030	11,600	11,200	10,290	10,100	2,800	11,300	10,900	8,320
Arsenic (As)	16.0	14.3	15.3	13.9	13.5	14.9	12.6	14.5	13.8	13.6	14.5	1.4	15.0	14.7	13.2
Barium (Ba)	385	401	356	357	313	195	204	257	228	223	193	3.1	194	192	161
Beryllium (Be)	<1	0.28	<1	<1	0.18	<1	<0.1	<1	<1	<0.1	<1	<0.1	<1	<1	<0.1
Cadmium (Cd)	28.8	45.7	37.2	37.9	32.4	123	63.5	71.3	71.5	67.0	84.1	0.6	90.1	88.0	68.5
Chromium (Cr)	181	255	196	207	141	325	696	937	933	870	255	8.0	289	285	216
Cobalt (Co)	10.4	20.5	25.9	13.7	17.7	7.1	19.4	6.5	7.2	20.4	6.3	<2	5.8	5.0	18.9
Copper (Cu)	326	778	431	435	344	681	470	705	710	654	455	7.9	465	463	347
Iron (Fe)	29,600	31,380	30,800	31,900	22,540	48,800	22,540	36,100	36,200	33,000	39,100	1,002	40,600	40,000	32,960
Lead (Pb)	1,690	2,598	2,140	2,124	1,600	5,230	2,770	3,490	3,480	2,902	3,900	6.0	4,210	4,140	3,180
Manganese (Mn)	1,150	1,587	1,400	1,380	1,130	4,380	2,270	2,740	2,700	2,510	2,920	<110	3,130	3,070	2,620
Mercury (Hg)	0.8	1.1	0.9	0.9	1.0	0.8	0.8	1.0	1.0	0.9	0.7	0.6	0.7	0.8	0.7
Nickel (Ni)	54.7	60.1	54.2	55.6	45.3	62.4	47.6	61.9	63.2	54.8	45.5	4.8	53.0	49.0	36.8
Selenium (Se)	2.3	0.4	1.4	1.5	<0.3	6.4	2.3	4.4	4.8	1.8	5.4	<0.3	5.4	5.7	2.2
Silver (Ag)	<2	5.3	<2	<2	2.3	<2	3.5	16.0	<2	4.7	<2	<0.7	<2	<2	7.0
Vanadium (V)	62.7	38.3	56.5	58.6	33.7	39.3	26.2	44.1	44.5	27.0	38.0	<0.7	42.1	39.7	21.8
Zinc (Zn)	7,760	13,680	8,947	7,010	8,060	38,400	26,570	24,830	24,800	25,880	29,700	172	31,700	31,000	29,540
cyanide	<0.5	3.78	<0.5	0.72	2.77	0.97	3.37	<0.5	1.50	2.82	0.86	1.56	<0.5	<0.5	2.02

TABLE 2.7. ANALYTICAL RESULTS FOR REPEATABILITY SAMPLES - SEMIVOLATILE ORGANICS AND PESTICIDES FUGITIVE PARTICULATE FROM TSDF (85/12)

Organic Analysis	Grid Cell # 7			Grid Cell # 8			Grid Cell # 24		
Sample Identity	S-901 Silt	S-905 Silt	S-906 Silt	S-911 Silt	S-915 Silt	S-916 Silt	S-921 Silt	S-925 Silt	S-926 Silt
Semivolatile Compound	(ug/g)	(ug/g)	(ug/g)	(ug/g)	(ug/g)	(ug/g)	(ug/g)	(ug/g)	(ug/g)
Acenapthene	27.0 J	12.0 J	N.D.	38.0	27.0	22.0	28.0	21.0	30.0
Anthracene	N.D.	3.1 J	N.D.	36.0	22.0	35.0	37.0	16.0	30.0
Benzo(a)anthracene	N.D.	2.2 J	N.D.	7.7 J	5.3	5.9	7.6	5.2	N.D.
Benzoic Acid	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	1.6 J	N.D.
Benzo(a)pyrene	N.D.	N.D.	N.D.	N.D.	1.3 J	1.5 J	2.2 J	1.5 J	N.D.
Benzo(b)fluoranthene	N.D.	N.D.	N.D.	4.4 J	N.D.	N.D.	4.5	3.2	N.D.
Benzo(k)fluoranthene	N.D.	N.D.	N.D.	N.D.	3.0	3.6 J	N.D.	N.D.	N.D.
Bis(2-ethylhexyl)phthalate	N.D.	N.D.	N.D.	N.D.	N.D.	6.4	N.D.	N.D.	N.D.
Chrysene	4.1 J	N.D.	N.D.	12.0 J	7.8	9.0	11.0	8.0	8.7
Dibenzofuran	20.0 J	7.0 J	9.8 J	27.0	23.0	21.0	29.0	18.0	19.0
Fluoranthene	10.0 J	3.5 J	4.7 J	48.0	18.0	25.0	19.0	15.0	37.0
Fluorene	28.0 J	16.0 J	N.D.	19.0	9.9	13.0	15.0	11.0	13.0
2-Methylnapthalene	310.0	170.0	240.0	83.0	120.0	130.0	100.0	62.0	67.0
2-Methylphenol	N.D.	N.D.	N.D.	N.D.	2.1 J	2.8 J	3.6	3.0	N.D.
4-Methylphenol	N.D.	N.D.	N.D.	14.0 J	8.6	10.0	13.0	9.8	N.D.
N-nitrosodiphenylamine	28.0 J	14.0 J	18.0 J	5.7 J	N.D.	N.D.	18.0	7.1	6.7
Napthalene	59.0	30.0	38.0	39.0	35.0	47.0	25.0	18.0	26.0
Phenanthrene	120.0	66.0	76.0	113.0	N.D.	110.0	55.0	16.0	100.0
Phenol	N.D.	N.D.	N.D.	56.0	74.0	96.0	370.0	140.0	160.0
Pyrene	12.0 J	4.6 J	6.6 J	4.0	16.0	23.0	18.0	13.0	33.0
1,2,4-Trichlorobenzene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	1.1 J	N.D.	N.D.
Sample Detection Limit	(ug/g)	(ug/g)	(ug/g)	(ug/g)	(ug/g)	(ug/g)	(ug/g)	(ug/g)	(ug/g)
Benzoic Acid	152.3	89.0	151.7	88.0	12.0	18.2	12.2	8.0	120.0
Other compounds listed	31.4	18.3	31.3	18.2	2.5	3.8	2.5	1.7	24.8
Pesticides	(ug/g)	(ug/g)	(ug/g)	(ug/g)	(ug/g)	(ug/g)	(ug/g)	(ug/g)	(ug/g)
4,4'-DDD	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.21 J	N.D.
4,4'-DDT	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	3.60	N.D.
Aroclor-1254	N.D.	5.28	9.09	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Sample Detection Limit	(ug/g)	(ug/g)	(ug/g)	(ug/g)	(ug/g)	(ug/g)	(ug/g)	(ug/g)	(ug/g)
4,4'-DDD and 4,4'-DDT	0.87	0.32	0.87	0.53	0.74	1.12	0.74	0.48	0.69
Aroclor-1254	8.73	3.20	8.73	5.33	7.38	11.16	7.38	4.80	6.86

N.D. = Less than the sample's quantifiable detection limit

J. = Estimated value where the compound meets the spectral criteria but the result is lee than the quantifiable limit.

Because of the high concentrations of organics, an alternative sample cleanup procedure was used on the samples to remove these organics. The cleanup procedure used on the semivolatile organic sample extracts appeared to have little effect on the samples from this site. However, the detection limits for these samples were believed to be the lowest levels practical for the analysis of HSL semivolatile compounds by GC/MS.

3.0 PROCESS DESCRIPTION

At this facility sampling was undertaken for five processes. The term "process" refers to a likely source of potentially contaminated fugitive particulate emissions within a facility. The processes sampled included:

a. Landfill cell No. 1;

b. Stabilization unit;

c. Land treatment area No. 2 (two sets of samples); and

d. Unpaved road segments at two locations within the facility.

The following process descriptions are based upon the information provided by the facility as well as observations made during the course of the survey/sampling effort.

3.1 LANDFILL (CELL NO. 1)

The facility has been in operation for about 3.5 years. Two landfill cells (cell Nos. 1 and 2) are currently used for disposal of hazardous wastes; a third cell (cell X) is under construction and will be used for disposal of wastes containing PCBs. At the time of survey, disposal in cell No. 1 was approaching design capacity with the active surface at or slightly above the height of the retaining berms. In cell No. 2 ≦ 5% of the design capacity (100,000 cubic yards) had been used.

Principal wastes and approximate quantities placed into landfill cell No. 1 during the period January through August 1985, are shown below.

EPA Hazardous Waste No.	Quantity (tons)	Description
F006	212	Wastewater treatment (WWT) sludge from electroplating operations
K048	133	Dissolved air flotation (DAF) float
K049	1,594	Slop oil emulsion solids
K050	25	Heat exchanger bundle sludge
K001	5,790	Sludge from WWT in wood preserving processes that use creosote or pentachlorophenol (PCP)

EPA Hazardous Waste No.	Quantity (tons)	Description
K051	520	API separator sludge
K052	130	Tank bottoms (leaded)
K061	813	Electric arc furnace (EAF) dust
U051	6,980	Cresote

The principal equipment types, functions, and approximate level of activity for the landfill operation are summarized below.

Equipment (commercial designation if available)	Function	Activity Units
Bulldozer (John Deere 750)	Used to spread material in landfill cells.	Plant estimate--4 hr/day.
Track loader (Cat 977)	Used to move material in landfill cells.	Equipment working in cell No. 2 during survey. Plant estimate--4 hr/day. Bucket capacity--5 yd^3.
Front-end loaders (John Deere 644C)	As above. Also used to transfer drums from drum dock to landfill.	Bucket capacity--3.5 yd^3.
Skip loader (Sperry New Holland) (Melroe Bobcat)	Used to unload palletized drums or boxes. Also used to transfer drums.	No estimates of activity available.

Note that the loaders are not dedicated for exclusive use in the landfill.

3.2 STABILIZATION UNIT

At the time of survey, the stabilization unit was located directly adjacent to landfill cell No. 1. This unit consists of a single oil field mix bin with dimensions 7 x 40 x 5 ft. Fly ash is used as the primary stabilizing agent. The material has 30 to 40% available lime.

During the site visit the stabilization unit received liquid wastes in containers (55 gal. drums); according to facility personnel tank trucks also are used to place liquid wastes directly into the mix bin. As "typical" figures, the process handles about 4,000 gal/day. The liquid wastes is

mixed on a 1:1 basis (presumably wt/wt) with the fly ash material. The stabilization process produces about 25 tons/day of stabilized material.

The principal equipment types, functions, and approximate level of activity for the stabilization unit are summarized below.

Equipment (commercial designation if available)	Function	Activity Units
Excavator (Mitsubishi)	Dual functions include mixing of material in bin and load-out of material into temporary piles.	Bucket capacity--5/8 yd^3.
Front-end loaders (John Deere 644C)	Dual functions include drum transfer and load-in of stabilizing agent.	No activity estimate available.
Skip loaders (Sperry New Holland) (Melroe Bobcat)	Drum transfer	No estimate available.

As an intermediate step in the stabilization process, bulk liquid wastes may be placed in one of five storage tanks (individual capacity--16,000 gal.), and later transferred to the stabilization unit for processing. Principal wastes and approximate quantities placed in the storage tanks during the period January through August 1985, are shown below. Two points should be noted:

1. It was not determined whether these figures are exclusive to those provided for ultimate treatment and disposal units (i.e., landfill or land treatment); and

2. Roughly 30% of the material in the tanks eventually is directed to the stabilization process.

EPA Hazardous Waste No.	Quantity (gal.)	Description
F006	13,707	WWT sludge from electroplating operations.
K001	8,944	WWT sludge in wood preserving processes that use creosote or PCP.
K048	116,167	DAF float.

EPA Hazardous Waste No.	Quantity (gal.)	Description
K049	36,667	Slop oil emulsion solids.
K051	120,662	API separator sludge.

3.3 LAND TREATMENT (CELL NO. 2)

The facility has 206 acres dedicated for land treatment; the area is divided into four distinct cells as follows:

Cell No.	Area (acres)	Description
1	33.5	First cell used, over-tilling may have damaged soil structure.
2	60	Cell currently used for hazardous waste.
3	60	Designated for treatment of non-listed wastestreams.
4	33.5	During survey observed application of nonlisted wastes to this area.

The land treatment unit is managed with reference to individual rows within a given treatment cell. Each row has nominal width of 15 to 17 ft. All sampling was performed in cell No. 2 where row length is ≧ 1,300 ft.

The principal equipment types, functions, and approximate level of activity for the land treatment unit are summarized below.

Equipment (commercial designation if available)	Function	Activity Units
Two farm tractors (CASE 2090, Ford 7700) with implements: 1. 2 liquid manure spreaders 2. rototiller (12 ft) 3. disc harrow (12 ft)	Manure spreaders used to apply high liquid content oily wastes to treatment unit. Rototiller and harrow used for incorporation and subsequent cultivation.	Manure spreader--2,000 gal. capacity. Application, cultivation schedules variable. Range appears to be 1-5 months. Typically, 1 pass for initial incorporation. Attempt to minimize subsequent cultivation to retain soil structure, however, do break-up noticeable surface crusts.

General operating procedures for the treatment unit involve:

a. initial application of wastes by the manure spreader; spray pattern has nominal 8 to 10 ft width;

b. incorporation of waste into the surface to a depth of 6 to 8 in. within 1 to 2 days of the application; and

c. subsequent tillage at a frequency which will maintain aerated conditions yet not damage the soil structure.

Principal wastes and approximate quantities directed to land treatment cell No. 2 for the period January through August 1985, are shown below.

EPA Hazardous Waste No.	Quantity (gal.)	Description
K048	67,467	DAF float.
K049	436,496	Slop oil emulsion solids.
K051	72,747	API separator sludge.

Facility personnel indicated that roughly 70% of the liquid wastes placed in the storage tanks (previously cited) are eventually directed to the land treatment unit. In addition, a surface impoundment is also used for intermediate storage of liquid wastes that are eventually directed to the land treatment unit.

Because land is not a limiting factor for the facility's land treatment operation, it appears that the loadings on a per row basis are relatively light. Facility supplied figures indicate < 5% oil (wt/wt basis) per application. Application frequency appears to vary between 1 and 5 months. Land treatment activity does show some sensitivity to seasonal climate variations; specifically, activity tends to decrease in the winter due to frozen surface conditions.

As noted earlier, two sets of samples were taken from land treatment cell No. 2. The samples represent two different points in time after application. Samples from rows 32 to 34 represent conditions about 5 days after application; samples from rows 118 to 120 represent conditions about 30 days after application. In all cases, the application loading was 2,000 gal/row; K051 was the waste stream applied most recently to all samples.

3.4 UNPAVED ROADWAYS

In addition to samples from the landfill, stabilization, and land treatment processes, unpaved road samples were also collected from two points within the facility. One sample was collected from the major access

roadway which carries traffic to both landfill cells, the stabilization unit, as well as the storage tanks, surface impoundment and drum dock. As a gross estimate, traffic volume at the sample point probably exceeds 100 vehicles passes per day. The second sample was collected on the roadway which services landfill cell No. 1 and the stabilization unit. Estimated traffic volume on the roadway is on the order of 50 vehicle passes per day.

4.0 SAMPLING AND ANALYSIS

This chapter outlines the procedures used for (1) the sampling conducted at USPCI and (2) the analysis of the samples collected. Included are descriptions of the location of each process sampled and the sampling grid for sample collection. Sample handling, preparation, and/or analysis specific to this facility or any process therein are described in detail. Any deviations from the standard sampling and analysis procedures (see Appendix C) are discussed.

Five processes were sampled at USPCI: (1) Landfill Cell #1, (2) the Stabilization Unit; (3) Land Treatment Area II, Row Markers 118 to 121; (4) Land Treatment Area II, Row Markers R-32 to R-35; and (5) two segments of unpaved access roads within the facility. The samples from each of these processes were analyzed for weight loss on drying (LOD), silt and PM_{10} content, metals, cyanide, and semivolatile organics. The samples from the Landfill Cell #1 and the Stabilization Unit were also analyzed for pesticides and those from the land treatment area and the background samples were also analyzed for oil and grease content. A tabular presentation of the sampling plan for USPCI which specifies the number and types of samples and the locations at which they were collected can be found in Chapter 2 (see Table 2.1). The subsections that follow further describe the sampling locations, sampling grid schemes, and applicable sampling and analytical procedures.

4.1 SITE PLOT PLAN

Figure 4.1 shows the site plot plan for the waste disposal facilities at USPCI's Grassy Mountain Facility in Toole, Utah. The locations of the

USPCI GRASSY MOUNTAIN FACILITY

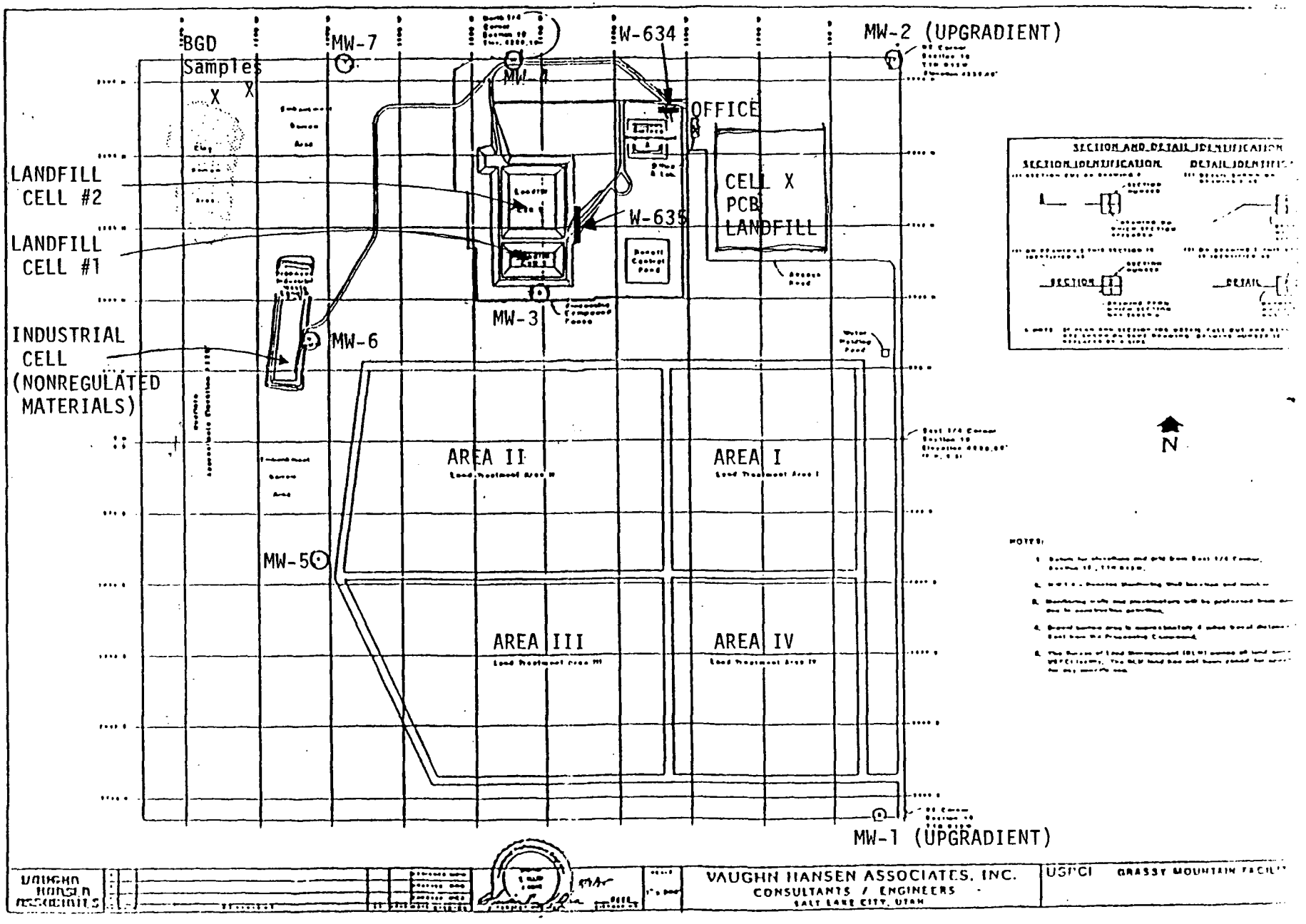


Figure 4.1. Site plot plan of USPCI in Toole, Utah showing locations of background and road samples taken.

landfill, land treatment areas, and unpaved road segments sampled are shown on this site plot plan. Pertinent topographical features, both natural and man-made, are also shown.

4.2 LANDFILL CELL #1 (PROCESS S)

Landfill Cell #1 (Process S) is located southwest of the USPCI facility office with Landfill Cell #2 (see Figure 4.1). The shape of Cell #1 was rectangular with dimensions of 225 by 325 feet.

Based on these dimensions, MRI designated that the sampling grid for Process S be a 225 x 325 foot rectangle having 25-foot square grid cells. The sampling grid was then laid out using surveyors stakes and tape. The grid cells were numbered starting in the northeast corner of Cell #1 as shown in Figure 4.2.

MRI directed that eight grid cells be sampled; a random number table was used to select the specific grid cells for sampling (see Appendix C). Four of the grid cells selected (#103, #71, #10, and #5) were rejected by MRI for various reasons (see Appendix C) and the next random numbers generated were used to substitute other cells in their place.

MRI determined that for the sample collection, the scooping technique would be used at this process. Within each cell, a sampling template was randomly tossed four times. The sample from each cell consisted of four soil aliquots taken inside the areas defined by the template. The eight samples taken were numbered S-601 through S-608. Figure 4.2 shows the grid layout and the cell from which each sample was taken.

Portions of each of the samples from this process were first analyzed for weight loss on drying (LOD) by drying for 12 to 16 hours in a 105°C oven.

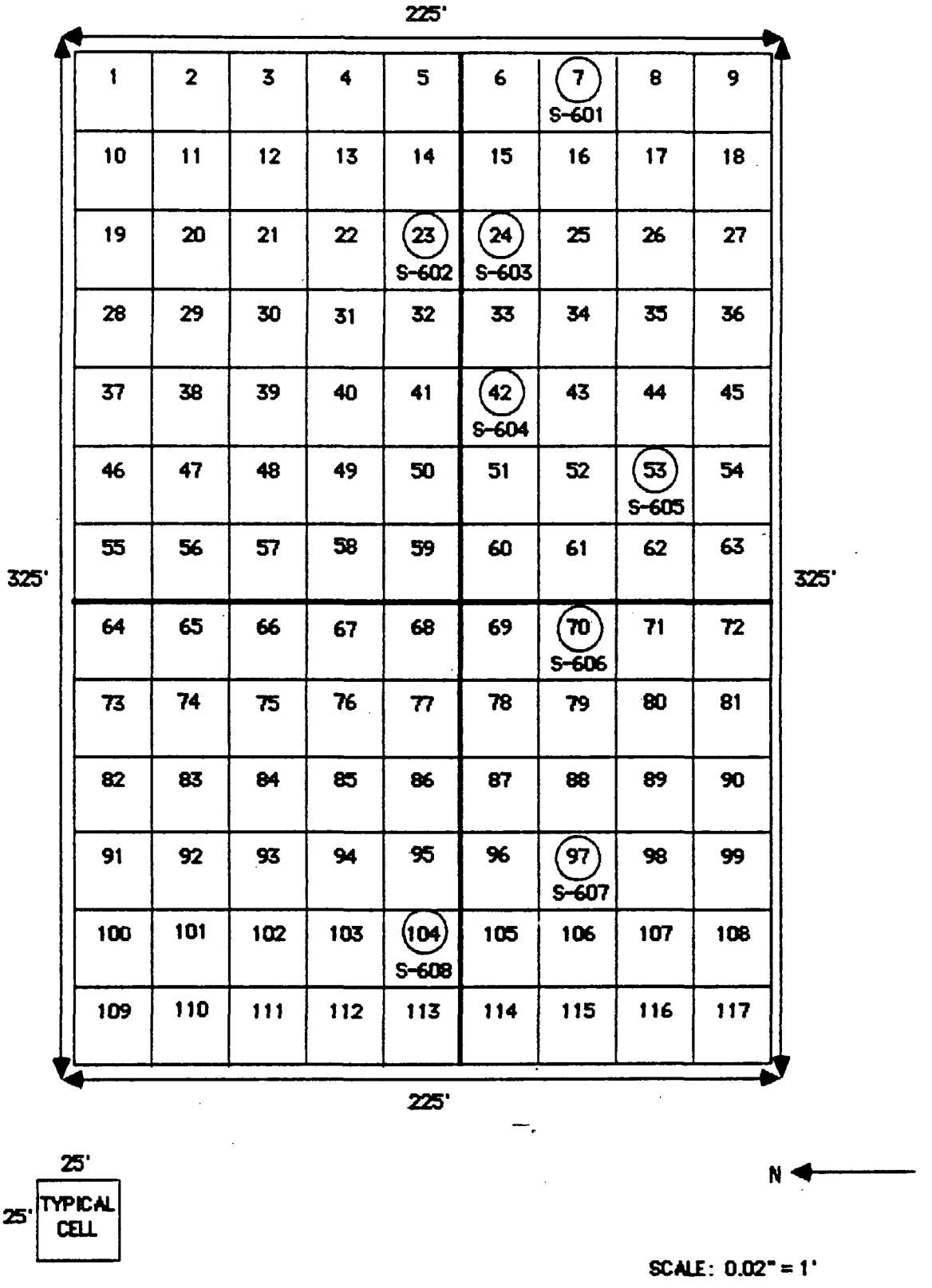


FIGURE 4.2. SAMPLING GRID, PROCESS DIMENSIONS, AND SAMPLE NUMBERS FOR LANDFILL CELL #1 AT USPCI (PROCESS S).

All samples from Process S were dried by desiccation for 24 hours (see Table 4.1). They were then screened for percent silt content (see Appendix C for a complete explanation of sample handling during these analyses).

TABLE 4.1. SAMPLE DRYING PROCEDURE SUMMARY

Sample ID	Process Description	Drying Procedure
S	Landfill, Cell #1	Desiccated for 24 hours
BGD	Background Samples	Oven dried at 105°C for 1 hour
T	Stabilization Area, #7	Desiccated for 36 hours followed by 1 hour of oven drying at 105°C
U	Land Treatment, 118-121	Desiccated for 72 hours
V	Land Treatment, R32-R35	Desiccated for 46 hours followed by 1 hour of oven drying at 105°C
W	Roadway	Oven dried at 105° for 1 hour
S-R&R	Landfill, Cell #1	Desiccated for 43 hours followed by 1 hour of oven drying at 105°C

The screening techniques described in Appendix C were used to make a composite sample of silt. The silt was then sonic sieved to measure PM_{10} content of the silt. Material passing through a 20 um sonic sieve constituted the PM_{10} fraction. The portion of the silt fraction that did not pass through this sieve was referred to as the "greater than PM_{10}" ($>PM_{10}$) fraction. The silt composite was used to produce silt, PM_{10}, and $>PM_{10}$ fractions for chemical analysis.

Portions of the three fractions (silt, PM_{10}, and $>PM_{10}$) from the samples collected from Process S were sent to RTI for metals and cyanide analysis. The procedures used for analysis of the metals followed the methods outlined in the EPA publication, "Testing Methods for Evaluating Solid Waste," SW-846. The metals measured and the detection limits for the analytical methods used

are shown in Table 4.2. Samples for analysis of all metals except mercury (Hg) were prepared by acid digestion using EPA Method 3050 (SW-846). Mercury samples were prepared and analyzed by the cold vapor atomic absorption procedure following EPA Method 7471 (SW-846). Two modifications were used in the final dilutions of the digestates. The samples for inductively-coupled argon plasmography (ICAP) determination by EPA Method 6010 and furnace atomic absorption determination of antimony (Sb) by EPA Method 7041 were diluted to achieve a final concentration of 5% HCl. The sample digestates for arsenic (As) determination by EPA Method 7060, for selenium (Se) determination by EPA Method 7740, and for thallium (Tl) determination were diluted to achieve a final concentration of 0.5% nitric acid.

Cyanide determinations were done by colormetric measurement following EPA Method 335.3 found in "Methods for the Evaluation of Water and Wastewater," EPA-600/4-79-020. The analyses for metals and cyanide were performed without any problems.

Portions of the composite samples of the silt, PM_{10}, and $>PM_{10}$ fractions were sent to PEI; these were analyzed for the semivolatile organic compounds listed in Table 4.3 and the pesticides listed in Table 4.4. The fractions were prepared for analysis of semivolatile organics and pesticides following the low-level concentration extraction method detailed in the U.S. EPA Contract Laboratory Program, Statement of Work for Organic Analysis, 7/85 Revision (referred to as the CLP in this report). The extracts were screened by gas chromatography with a flame ionization detector (GC/FID) and found to contain over 20 ug/g of organic compounds. The extracts were then transfered to Triangle Laboratories for cleanup by an adsorption chromatography method which was developed to reduce the amount of sample dilution necessary to protect the gas chromatograph/mass spectrometer (GC/MS). The extracts were concentrated and 200 mg portions were removed. The 200 mg portions were redissolved

TABLE 4.2. METALS, MEASUREMENT METHODS, AND DETECTION LIMITS*

Element	Detection Limits (ug/g)* ICAP***	GFAA***	Cold Vapor AA***
Aluminum (Al)	75.0	-----	
Antimony (Sb)	-----	0.05	
Arsenic** (As)	-----	0.1	
Barium** (Ba)	0.3	-----	
Beryllium (Be)	0.1	-----	
Cadmium** (Cd)	0.1	-----	
Chromium** (Cr)	0.3	-----	
Cobalt (Co)	0.5	-----	
Copper (Cu)	2.0	-----	
Iron (Fe)	75.0	-----	
Lead** (Pb)	-----	0.3	
Manganese (Mn)	0.1	-----	
Mercury** (Hg)	-----	-----	0.01
Molybdenum (Mo)	0.2	-----	
Nickel (Ni)	1.2	-----	
Osmium (Os)	0.1	-----	
Selenium** (Se)	-----	0.05	
Silver** (Ag)	0.2	-----	
Thallium (Tl)	-----	0.2	
Vanadium (V)	0.8	-----	
Zinc (Zn)	0.1	-----	

*Detection limits were calculated as three times the standard deviation of the values measured for compounds at or near the suspected detection limit in the background sample. For compounds not detected in the background sample, the detection limits were calculated as three times the standard deviation of the background noise. Fe, Mg, and Al detection limits were determined using low level standards as three times the standard deviation of the values measured.

**Eight RCRA metals

***ICAP = Inductively-Coupled Argon Plasmography
GFAA = Graphite Furnace Atomic Absorption
AA = Atomic Absorption

TABLE 4.3. SEMIVOLATILE ORGANIC COMPOUNDS FOR ANALYSIS

ACENAPHTHENE
ACENAPHTHYLENE
ANTHRACENE
BENZO (a) ANTHRACENE
BENZOIC ACID
BENZO (a) PYRENE
BENZO (ghi) PERYLENE
BENZO (b) FLUORANTHENE
BENZO (k) FLUORANTHENE
BENZYL ALCOHOL
BIS (2-CHLOROETHOXY) METHANE
BIS (2-CHLOROETHYL) ETHER
BIS (2-CHLOROISOPROPYL) ETHER
BIS (2-ETHYHEXYL) PHTHALATE
4-BROMOPHENYL PHENYL ETHER
BUTYL BENZYL PHTHALATE
4-CHLOROANILINE
4-CHLORO-3-METHYLPHENOL
2-CHLORONAPHTHALENE
2-CHLOROPHENOL
4-CHLOROPHENYL PHENYL ETHER
CHRYSENE
DIBENZO (a,h) ANTHRACENE
DIBENZOFURAN
1,2 DICHLOROBENZENE
1,3 DICHLOROBENZENE
1,4 DICHLOROBENZENE
3,3'-DICHLOROBENZIDINE
2,4-DICHLOROPHENOL
DIETHYLPHTHALATE
2,4-DIMETHYLPHENOL
DIMETHYL PHTHALATE
DI-N-BUTYLPHTHALATE
2,4-DINITROPHENOL
2,4-DINITROTOLUENE
2,6-DINITROTOLUENE
DI-N-OCTYL PHTHALATE
FLUORANTHENE
FLUORENE
HEXACHLOROBENZENE
HEXACHLOROBUTADIENE
HEXACHLOROCYCLOPENTADIENE
HEXACHLOROETHANE
INDENO(1,2,3-cd) PYRENE
ISOPHORONE
2-METHYL-4,6-DINITROPHENOL
2-METHYLNAPHTHALENE
2-METHYLPHENOL
4-METHYLPHENOL
NAPHTHALENE
2-NITROANILINE
3-NITROANILINE
4-NITROANILINE
NITROBENZENE

(Continued)

TABLE 4.3. (continued)

2-NITROPHENOL
4-NITROPHENOL
N-NITROSO-DI-N-PROPYLAMINE
N-NITROSODIPHENYLAMINE
PENTACHLOROPHENOL
PHENANTHRENE
PHENOL
PYRENE
1,2,4-TRICHLOROBENZENE
2,4,5-TRICHLOROPHENOL
2,4,6-TRICHLOROPHENOL

in methanol/methylene chloride (1:1) and chromatographed on Sephadex LH-20. For the silt, PM_{10}, and $>PM_{10}$ fractions, the cleanup procedures used only 13, 17, and 8.5 percent of the original samples, respectively. These percentages resulted in 7.7-, 5.9-, and 11.7-fold dilutions, respectively.

The cleaned extracts were returned to PEI and screened again by GC/FID. Based on the results of the screening, the silt, PM_{10}, and $>PM_{10}$ samples were diluted another 25-, 10-, and 10-fold, respectively, to protect the gas chromatograph/mass spectrometer (GC/MS). The cumulative dilutions of 188-, 59.9-, and 120-fold raised the samples' quantifiable detection limits for semivolatile organics to 62.1, 19.6, and 39.6 ug/g, respectively. For the pesticides analysis, all the extracts (silt, PM_{10}, and $>PM_{10}$) were diluted 6-fold prior to GC/MS analysis resulting in cumulative dilutions of 46-, 35-, and 70-fold, respectively.

4.3 STABILIZATION UNIT (PROCESS T)

The Stabilization Unit (Process T) was located in Land Treatment Area I at USPCI (see Figure 4.1). The shape of the process approximated a rectangle with dimensions of 30 by 70 feet (see Figure 4.3).

TABLE 4.4. PESTICIDES FOR ANALYSIS

Number	Compounds
1	ALDRIN
2	Alpha - BHC
3	Beta - BHC
4	Delta - BHC
5	Gamma - BHC
6	CHLORDANE
7	4,4'-DDD
8	4,4'-DDE
9	4,4'-DDT
10	DIELDRIN
11	ENDOSULFAN I
12	ENDOSULFAN II
13	ENDOSULFAN SULFATE
14	ENDRIN
15	ENDRIN KETONE
16	HEPTACHLOR
17	HEPTACHLOR EPOXIDE
18	METHOXYCLOR
19	TOXAPHENE
20	PCB 1016
21	PCB 1221
22	PCB 1232
23	PCB 1242
24	PCB 1248
25	PCB 1254
26	PCB 1260

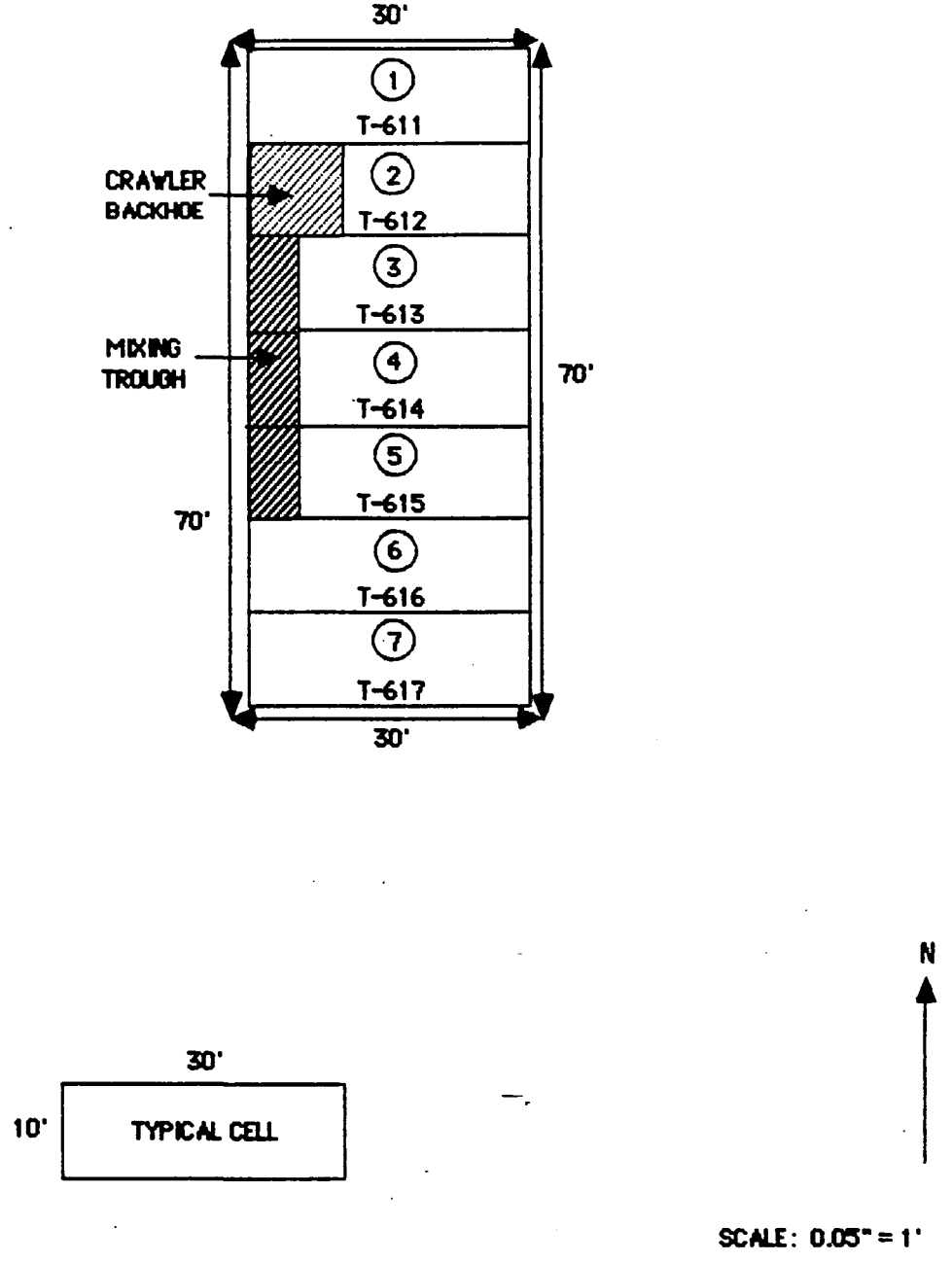


FIGURE 4.3. SAMPLING GRID, PROCESS DIMENSIONS, AND SAMPLE NUMBERS FOR STABILIZATION UNIT (LAND TREATMENT AREA I) AT USPCI (PROCESS T).

Based on these dimensions, MRI decided that the area was too small for random grid cell sampling, so the unit was divided into 7 equal rectangular grid cells (10' by 30') and all were sampled. The sampling grid cells were numbered from north to south (see Figure 4.3).

Because this process involved a disturbed surface, MRI decided that it would be sampled using the scooping technique (see Appendix C). As for Process S, the sampling template was randomly tossed four times within each cell sampled. The sample from each cell consisted of four soil aliquots taken inside the areas defined by the template. The seven samples taken were numbered T-611 through T-617. Figure 4.3 shows the grid layout and the cell from which each sample was taken. The mixing trough and the crawler backhoe areas were not sampled.

An aliquot of each of the samples was analyzed for weight loss on drying (LOD) by drying for 12 to 16 hours in an oven at 105°C. Later, all samples were desiccated for 36 hours and then dried in an oven at 105°C for 1 hour. Following drying, the samples were screened and sieved for percent silt content and percent PM_{10} content (see Appendix C for specifics of sample handling during each of these analyses).

Portions of the silt, PM_{10}, and $>PM_{10}$ fractions from this process were submitted to RTI for metals and cyanide analysis and portions of the silt and PM_{10} fractions only, were submitted to PEI for analysis of semivolatile organics and pesticides. As a cost saving measure, the $>PM_{10}$ fraction was not analyzed for semivolatile organics and pesticides since the particle size dependency of the degree of contamination will be determined using only the concentration values for the silt and PM_{10} fractions.

All fractions were analyzed for metals and prepared for semivolatile organics and pesticides analysis as described previously for the samples from

Process S. For the silt and PM_{10} extracts, the cleanup procedures resultedin dilutions of 15- and 11.5- fold, respectively. Based on the results of the GC/FID screening after the extracts were returned to PEI, the silt and PM_{10} samples did not require further dilution to protect the GC/MS. The cumulative dilutions of 15- and 11.5-fold raised the samples' quantifiable detection limits for the semivolatile organics to 5.0 and 3.8 ug/g, respectively. The silt and PM_{10} extracts for pesticides analysis were both diluted 6-fold prior to GC/MS analysis resulting in cumulative dilutions of 90- and 68-fold, respectively.

4.4 LAND TREATMENT AREA, ROW MARKERS 118 TO 121 (PROCESS U)

The portion of Land Treatment Area II designated Process U was a long, narrow strip between row markers 118 and 121 (see Figures 4.1 and 4.4). The Process U boundaries were a rectangle with dimensions of 45 by 1350 feet. Based on the process shape and dimensions, the sampling grid was laid out in a one grid wide strip with the typical grid cell being a 45 X 50 foot rectangle (see Figure 4.5). The twenty-seven grid cells were numbered from south to north.

MRI determined that eight grid cells would be sampled. A random number table was used to select the grid cells for sampling (Appendix C) and no selected cells were eliminated.

MRI determined that for the sample collection, the scooping technique would be used at this process (see Appendix C). Within each cell, the sampling template was randomly tossed four times. As for Process S, the sample from each cell consisted of the four soil aliquots (two scoops each) taken from inside the areas defined by the template. The eight samples were numbered U-618 through U-625. Figure 4.5 shows each sample and the corresponding grid cell from which it was taken.

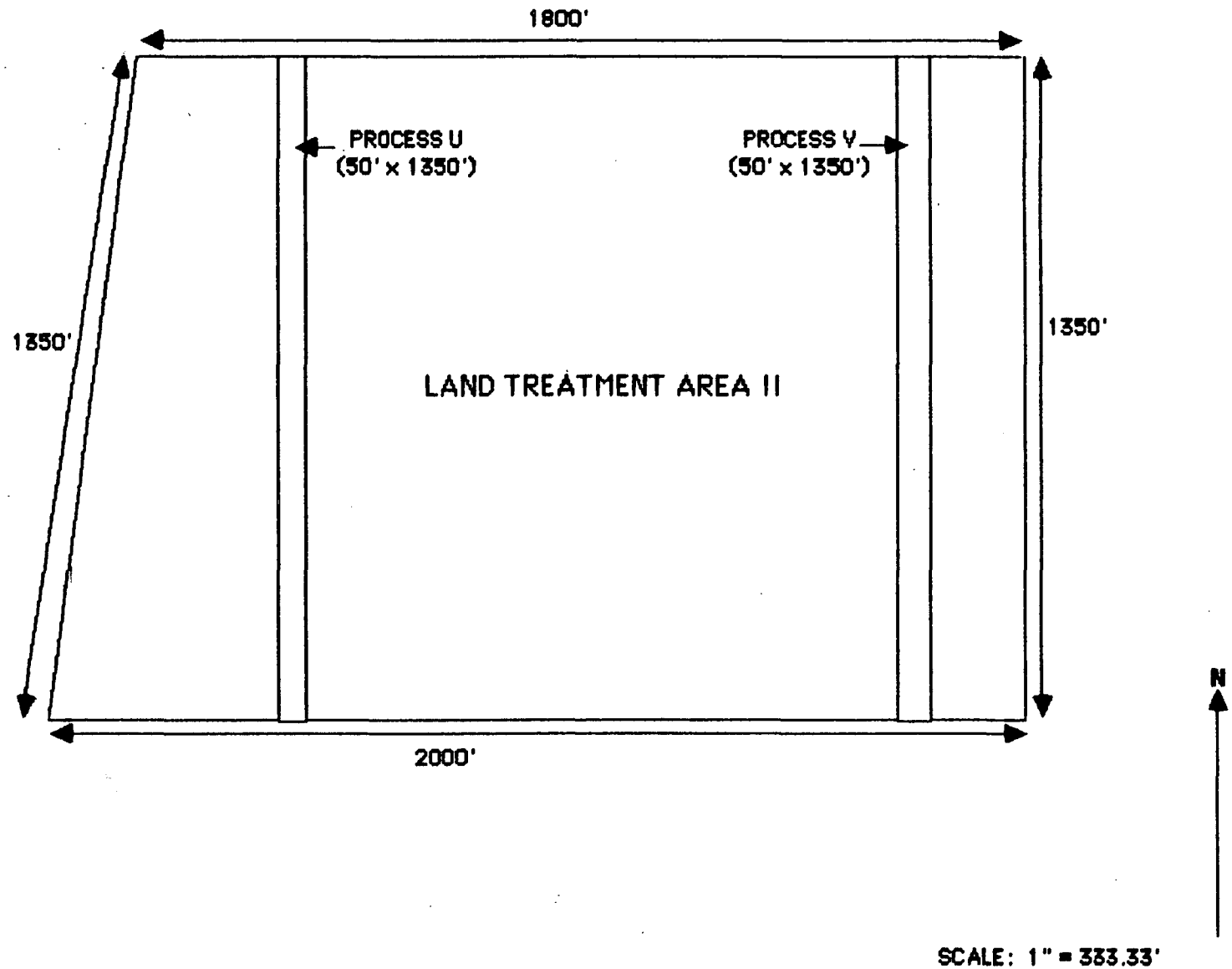


FIGURE 4.4. DIMENSIONS AND LOCATIONS OF PROCESSES U AND V IN LAND TREATMENT AREA II AT USPCI.

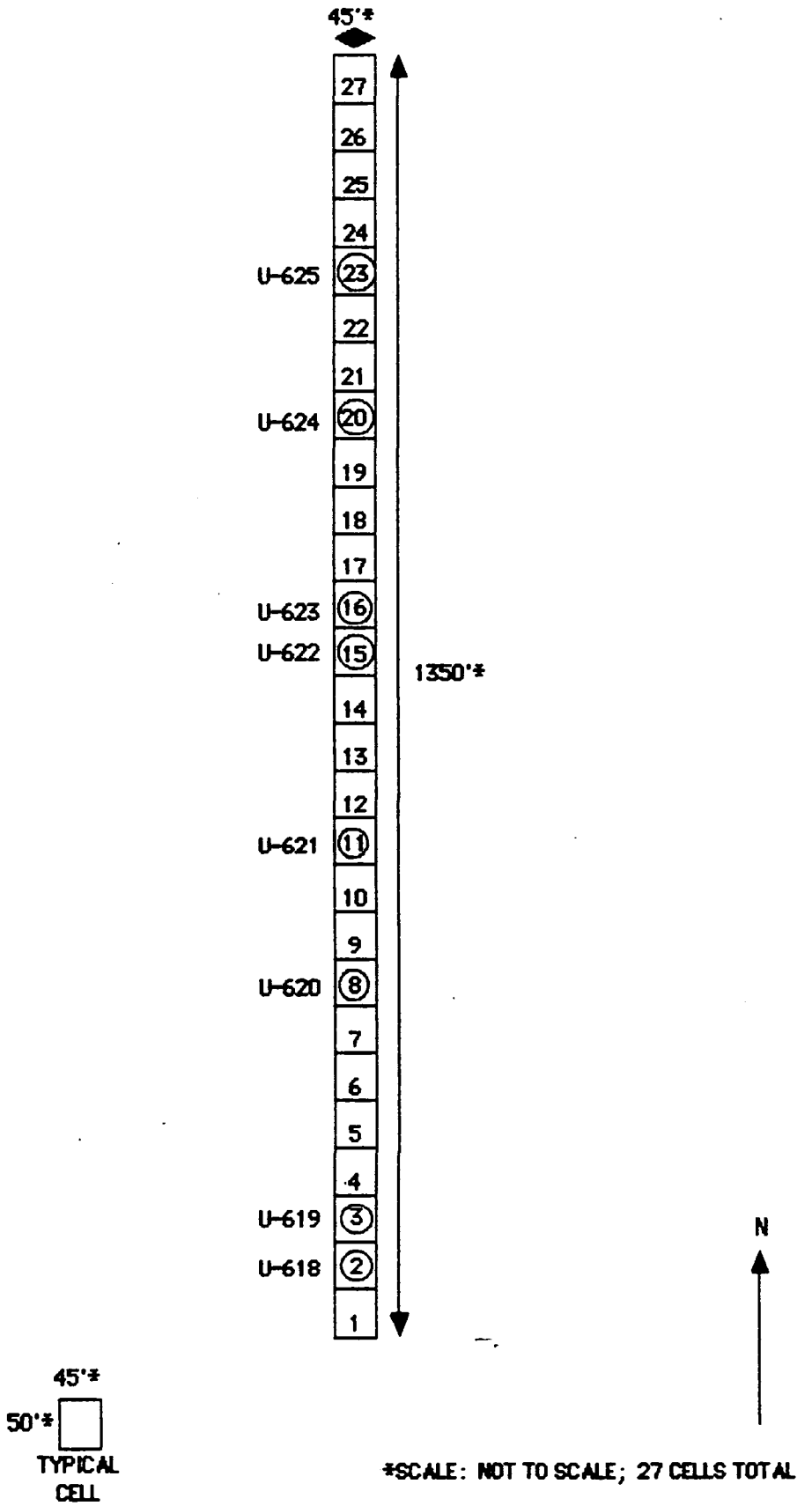


FIGURE 4.5. SAMPLING GRID, SAMPLING DIMENSIONS, AND SAMPLE NUMBERS FOR PROCESS U IN LAND TREATMENT AREA II (ROW MARKERS 118 TO 121) AT USPCI.

Oil and grease analysis was performed on a sample from Process U. The oil and grease analysis was performed following Method 503 D, Extraction Method for Sludge Samples, found in Standard Methods for Examination of Water and Waste Water, 1985, 16th Ed. The method involved acidifying the sample with concentrated HCl followed by drying the acidified sample by mixing the sample with an equal weight of anhydrous magnesium sulfate. The soil mixture was extracted with Freon TF, 1,1,2-trichloro- 1,2,2-trifluoroethane, in a Soxhlet extraction apparatus. The weight of the extracted residue was determined after distilling the solvent and drying the residue. The loss-on-drying (LOD) was determined on the soil composites to calculate the oil and grease as a percent of dry solids. The following formula was used for the calculation:

$$\% \text{ Oil and Grease} = \frac{\text{Weight of Residue}}{\text{Corrected Dry Weight of Soil Sample}} \times 100\ \%$$

The quality assurance (QA) for the oil and grease analysis used repeatability and reproducibility (R&R) samples. A soil composite was made from three R&R samples collected by the primary sampler at one site. Duplicate aliquots of the primary soil composite were analyzed separately for oil and grease. By comparison of the results from the duplicate oil and grease analysis, the degree of repeatability for the total system was determined.

A second soil composite was made from three of the R&R samples collected by the secondary sampler from the same site. An aliquot of the secondary soil composite was analyzed for oil and grease content. By comparing the average oil and grease value for the primary soil composite with the oil and grease value for the secondary soil composite, a measure of the sampling reproducibility was made.

A QA spike was conducted using the background sample from another site. A USEPA quality control sample for oil and grease analysis consisting of paraffin oil dissolved in Freon TF was used. The spike provided a concentration of 0.34% of oil and grease to the background sample. The spiked sample was then extracted and analyzed for oil and grease. The percent recovery of the spiked oil and grease mixture was calculated by the following formula:

$$\text{Percent Recovery} = \frac{\text{Spiked Sample \% - Background Sample \%}}{\text{Calculated Spiked Sample \%}} \times 100\ \%$$

Aliquots of each sample were analyzed for weight loss on drying (LOD) by drying for 12 to 16 hours in a 105°C oven. Later, all the samples from this process were dried by desiccation for 72 hours. They were then screened and sieved for percent silt content and percent PM_{10} content (see Appendix C for a complete explanation of sample handling during these analyses).

The same screening and sieving techniques were used to make composite samples of the silt, PM_{10}, and $>PM_{10}$ fractions from this process. Portions of each fraction were submitted to RTI for metals and cyanide analyses. As for the Process T samples, only the silt and PM_{10} fractions were submitted to PEI for semivolatile organic analysis. The fractions were analyzed for metals and cyanide and prepared for semivolatile organic analysis as described previously for the composite samples from Process S. For the silt and PM_{10} extracts, the cleanup procedures resulted in dilutions of 7.7- and 14-fold, respectively. Based on the GC/FID screening results, the extracts were both diluted another 10-fold to protect the GC/MS. The cumulative dilutions of 80- and 140-fold raised the quantifiable detection limits for semivolatile organic compounds to 26.4 and 46.2 ug/g, respectively.

4.5 LAND TREATMENT AREA II, ROW MARKERS R-32 TO R-35 (PROCESS V)

The portion of Land Treatment Area II designated Process V was a long strip parallel to Process U, but between row markers R-32 and R-35 (see Figure 4.4). Process V approximated a rectangle with dimensions of 45 by 1350 feet. Based again on the process shape and dimensions, the sampling grid was laid out in a one grid wide strip with a typical grid cell size of 45 by 50 feet (see Figure 4.6). The twenty-seven grid cells were numbered from south to north.

MRI directed that eight grid cells be sampled; a random number table was used to select the specific grid cells for sampling (see Appendix C). No grid cells were rejected. MRI determined that for the sample collection, the scooping technique should be used at this process. As previously described for Process S, a sampling template was randomly tossed four times within each cell sampled. The sample aliquots were taken from inside the areas defined by the template. The eight samples were numbered V-627 through V-633. Figure 4.6 shows each sample and the corresponding grid cell from which it was taken.

Sample V-665 was analyzed for oil and grease content as described previously for the Process U sample. The LOD determinations were conducted on aliquots taken from each Process V sample. To dry them, the samples were desiccated for 46 hours and then oven-dried at 105°C for 1 hour prior to silt screening. The silt resulting from screening each sample was mixed to form a silt composite and the PM_{10} content was determined on the silt composite by sonic sieving. Because the silt yield was low and the PM_{10} content of the silt was also low, the decision was made not to produce PM_{10} and $>PM_{10}$ fractions from the silt for the chemical analyses.

Portions of the silt fraction were submitted to RTI and PEI for metals and cyanide analysis and semivolatile organics analysis as described previously for

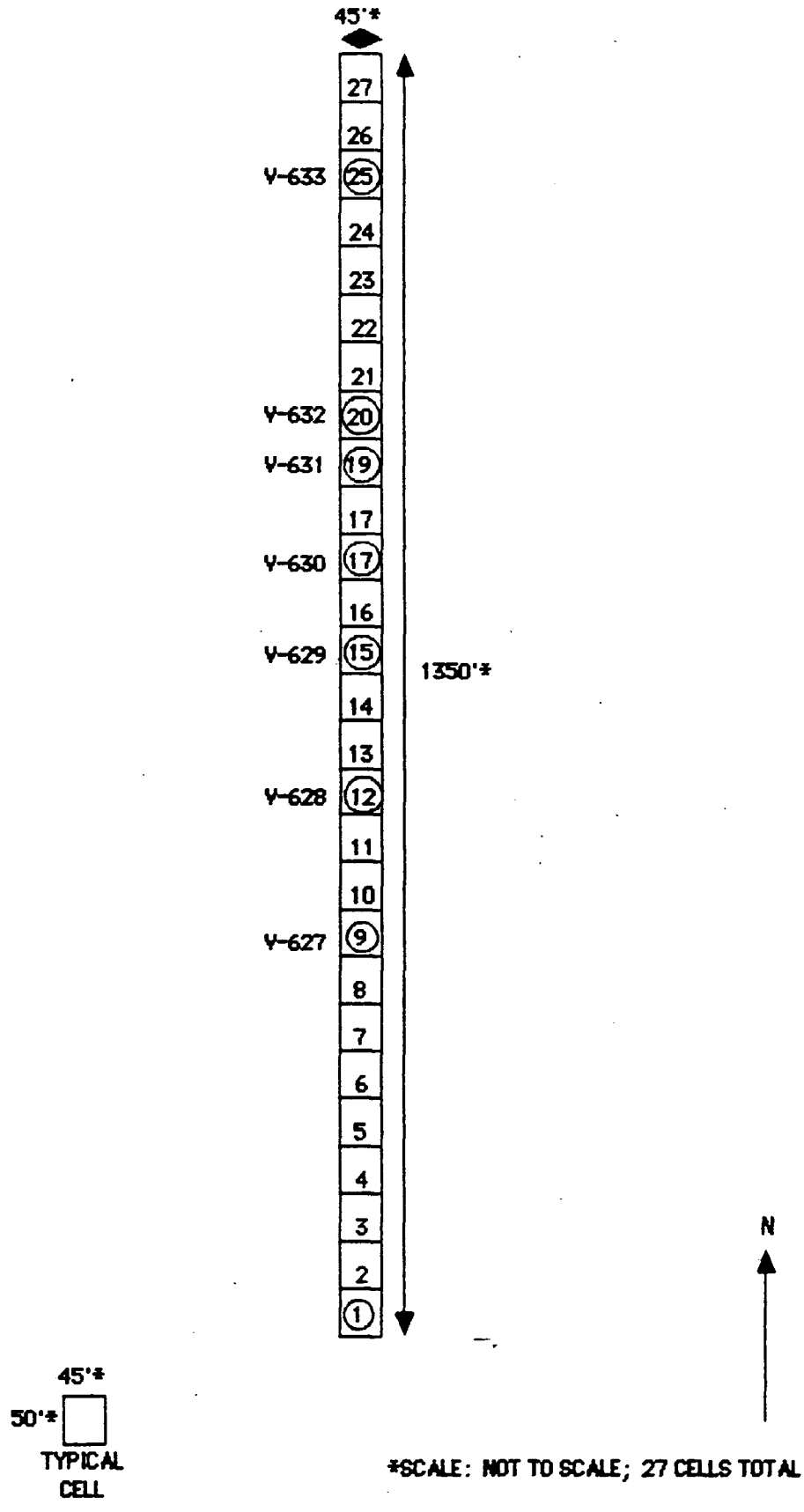


FIGURE 4.6. SAMPLING GRID, SAMPLING DIMENSIONS, AND SAMPLE NUMBERS FOR PROCESS V IN LAND TREATMENT AREA II (ROW MARKERS R-31 TO R-35) AT USPCI.

the composite samples from Process S. The LH-20 adsorption chromatography cleanup procedures resulted in a 12-fold dilution of the silt sample. Based on the results of the GC/FID screening, the sample required no further dilution prior to injection into the GC/MS. The dilution during the cleanup procedure raised the quantifiable detection limit for semivolatile organics to 4.0 ug/g.

4.6 UNPAVED ACCESS ROADS (PROCESS W)

Two separate segments of unpaved access roads (Process W) were sampled at the USPCI facility. As may be seen in Figure 4.1, the areas sampled were located:

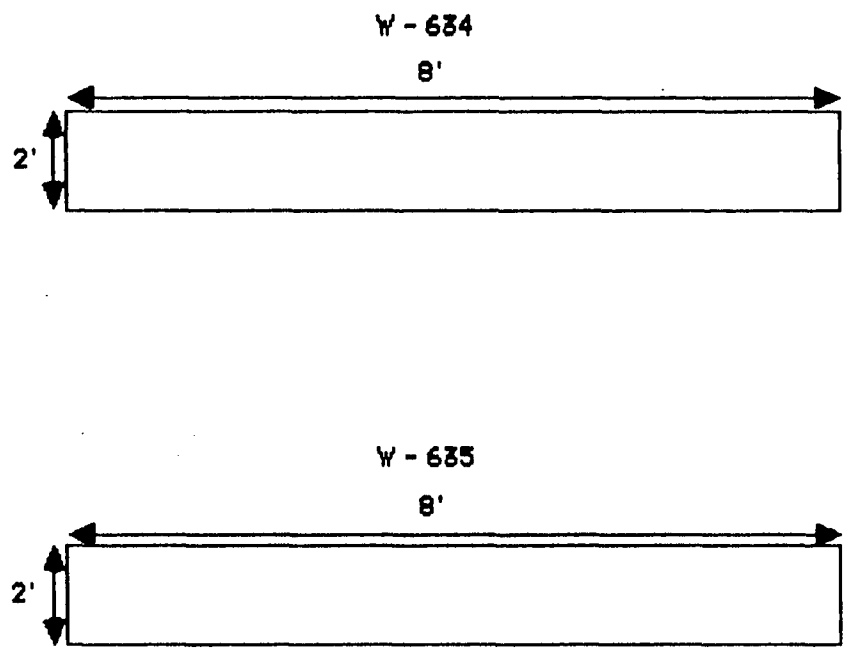
(1) near the office at the beginning of the access road to Landfill Cells #1 and #2, (sample number W-634) and

(2) on the access road to Landfill Cells #1 and #2 adjacent to the entrance to the cells (sample number W-635).

Each of the samples taken (see sample numbers above) was from a rectangular area and spanned the road (centered) for 8 feet and was 2 feet wide (see Figure 4.7).

Because unpaved roads consist of hard-crusted, undisturbed surfaces, MRI recommended sampling this process using the sweeping technique. A disposable brush was used to sweep the loose particulate from the surface of each road area into a disposable scoop, which was then used to deposit the particulate into the appropriate sample jars.

An aliquot of the sample from each road segment was first analyzed for weight loss on drying (LOD) by drying for 12 to 16 hours in a 105°C oven. Later both samples were oven-dried for 1 hour in a 105°C oven. They were screened and sieved for percent silt content and percent PM_{10} content (see Appendix C). Since a sufficient quantity of silt could not be obtained from the silt screening, PM_{10} and $>PM_{10}$ material was not produced for chemical analysis.



SCALE: 0.25" = 1'

FIGURE 4.7. PROCESS DIMENSIONS AND SAMPLE NUMBERS FOR ACCESS ROADS AT USPCI (PROCESS W).

Portions of the silt fraction of the samples were submitted to RTI and PEI for metals and semivolatile organics analysis, respectively. They were analyzed for metals and semivolatile organic compounds as described previously for the samples from Process S. The adsorpton chromatography cleanup procedures did not dilute the silt sample. The results of the GC/FID screening, however, required a 10-fold dilution prior to analysis using the GC/MS. This dilution increased the quantifiable detection limit for semivolatile organics to 3.3 ug/g.

4.6 REPEATABILITY, REPRODUCABILITY, AND PERFORMANCE AUDIT SAMPLES

As part of the sampling conducted within the Process S boundries at USPCI, samples were taken for measurement of repeatability (within laboratory precision) and reproducibility (between laboratory precision) and for performance audits. Three of the grid cells (numbers 7, 23, and 24) previously sampled were sampled for these purposes.

Within each of these cells, the primary sampler (in this case, Mr. Steve Plaisance) took two samples and the secondary sampler (Mr. Kent Spears) took one sample, all from the same template area. Samples taken by the primary sampler were used to measure both total* and analytical repeatability and analytical reproducibility. They were also spiked for the performance audits (see Chapter 5 and Appendix C). Samples taken by the secondary sampler were used to measure total reproducibility (see Appendix C). Sampling was conducted using the scooping technique.

Weight loss on drying determinations, drying, silt content, and PM_{10} content determinations for these samples were done as described for the samples from Process S. The other analyses for metals were done using the same methods

*Sampling and analytical.

previously discussed; Research Triangle Institute (RTI) (for within laboratory precision) and PEI (for between laboratory precision) conducted the metals analysis. The decision was made not to have the reproducibility samples analyzed for semivolatile organics because they were not found at two times the quantifiable detection limits in the Process S samples.

4.7 BACKGROUND SAMPLES

Two background samples (numbers BGD-690 and BGD-610) were taken at USPCI in the northwest corner near the clay burrow area (see Figures 4.1 and 4.8). The scooping technique was used for sample collection.

Sample BGD-671 was analyzed for oil and grease content as described previously for the Process U sample. Aliquots from both background samples were analyzed for weight loss on drying (LOD) and then the samples were dried in an oven at 105°C for 1 hour. They were also analyzed for percent silt and percent PM_{10} content (see Appendix C).

Portions of the silt fraction generated by sonic sieving were sent to RTI and PEI for metals and semivolatile organics analysis, respectively. They were analyzed for metals and semivolatile organic compounds as described previously for the samples from Process S. The low-level extraction and adsorption chromatography cleanup procedure (with no dilution) plus no dilution prior to the GC/MS analysis resulted in the a quantifiable detection limit of 0.33 ug/g.

DATE: 11/5/85 PROCESS LETTER: BGD

SITE NAME USPCI

LOCATION TOOLE, UTAH

SAMPLING TEAM S. PLAISANCE/K. SPEARS

PROCESS NAME BACKGROUND

SAMPLING TECHNIQUE SCOOPING

PROCESS LAYOUT (Indicate Cell #, Sampled Cell #, Sample #, and Dimensions)

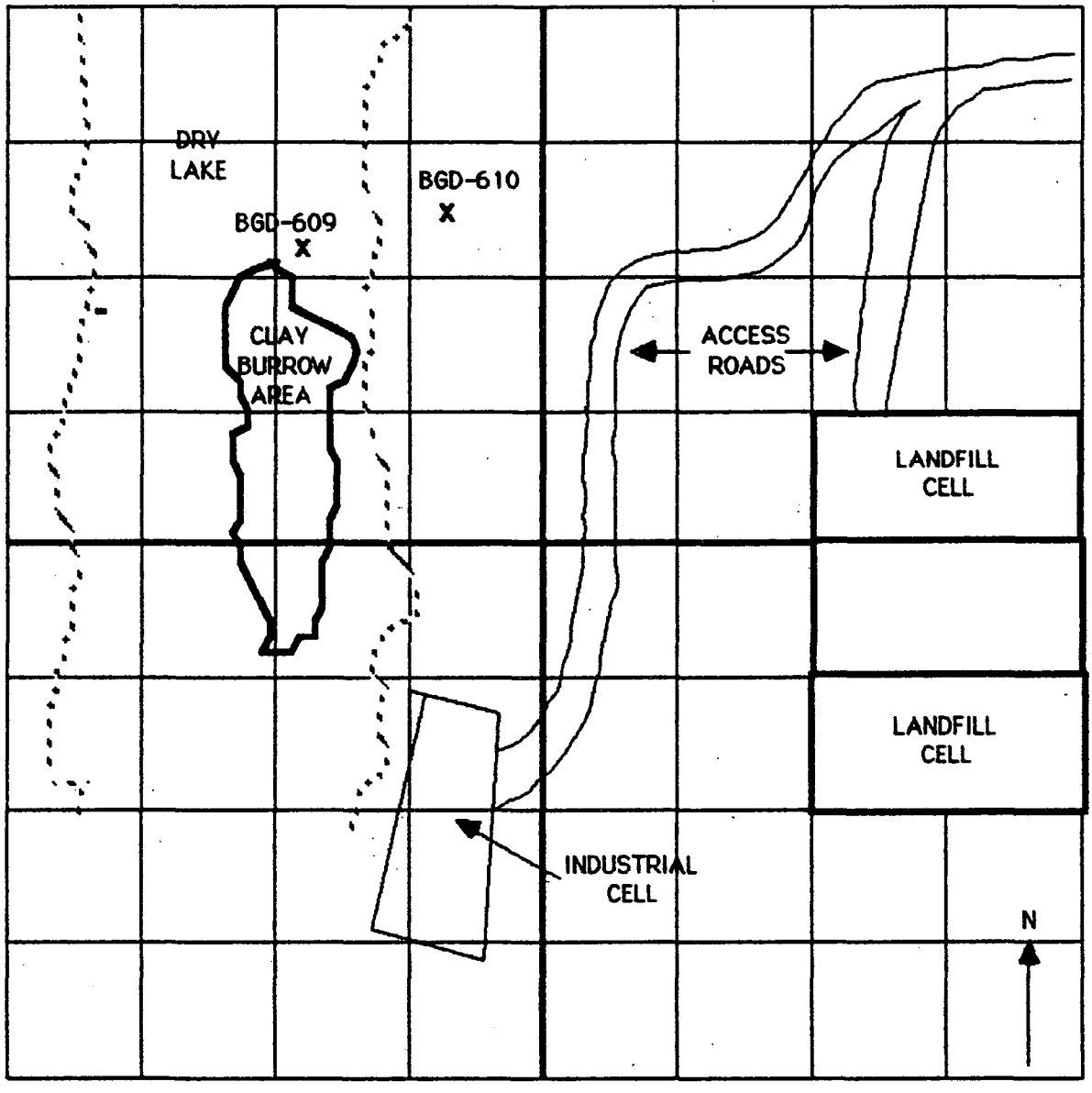


FIGURE 4.8. SKETCH SHOWING APPROXIMATE LOCATIONS WHERE BACKGROUND SAMPLES WERE TAKEN AT USPCI.

5.0 QUALITY ASSURANCE

The quality assurance (QA) measures for the chemical analyses were conducted internally by each laboratory. For the metals analysis, RTI used an EPA check sample to determine the accuracy of the instrumentation. A marine sediment reference material (MESS-1) acquired from the Marine Analytical Chemistry Standard Program of the National Research Council of Canada and a NBS fly ash sample (1633 A) were used as QA samples to check the overall accuracy of the digestion and analysis procedures. One process sample was spiked with sixteen elements and their percent recoveries were calculated to assess matrix effects. Another sample (S-637) was analyzed as duplicates to demonstrate analytical precision.

PEI also performed a series of QA checks for the analysis of metals in the reproducibility samples. PEI used either EPA or their own check samples to determine the accuracy of the instrumentation. PEI also spiked a sample with seventeen elements and their percent recoveries were calculated to assess matrix effects. Another sample (S-930) was analyzed in duplicate and a coefficient of variance calculated as an indication of precision. Results of both RTI's and PEI's checks are presented in Table 5.1.

For the QA on the analysis of the semivolatile organics and pesticides, PEI used samples V-660 and T-646 for matrix spikes (MS) and matrix spike duplicates (MSD). The percent recoveries were determined and the relative percent difference (RPD) for the duplicates calculated (see Table 5.2). The percent recovery for acenaphthene was within the QA limits for both MS and MSD samples. The recovery of 4-nitrophenol was within the QA limits for the MS

TABLE 5.1 QUALITY ASSURANCE RESULTS FOR METALS ANALYSIS

RTI AND PEI ANALYSES

RTI Sample Identity	EPA Check Sample		NBS Fly Ash 1633 A		NRC Sediment MESS-1		Matrix Spike			Duplicates	
	Expected	Found	Expected	Found	Expected	Found	Added	Recovered	Percent	S-637	S-637
Elements (ug/g)	(ug/g)	(ug/g)	(ug/g)	(ug/g)	(ug/g)	(ug/g)	(ug)	(ug)		(ug/g)	(ug/g)
Aluminum (Al)	-	-	140,000	17,000	58,000	18,000	-	-	-	-	-
Antimony (Sb)	8.2	9.0	7.0	2.6	-	<0.5	-	-	-	17.1	18.8
Arsenic (As)	43.0	43.6	145	129	10.6	7.9	10.0	8.9	89.0%	21.3	22.3
Barium (Ba)	-	-	1500	700	-	87.3	100.0	239.0	239%	3534	888
Beryllium (Be)	29.0	30.5	12.0	4.2	1.9	1.4	100.0	94.2	94.2%	<1	<1
Cadmium (Cd)	9.1	7.7	1.0	5.5	0.6	0.4	100.0	90.2	90.2%	150	146
Chromium (Cr)	7.1	6.8	196	35.4	71.0	40.1	100.0	97.1	97.1%	447	406
Cobalt (Co)	43.0	40.1	46.0	25.0	10.8	10.2	-	-	-	12.0	10.2
Copper (Cu)	8.9	12.3	118	38.5	25.1	22.3	100.0	96.5	96.5%	951	944
Iron (Fe)	-	-	94,000	22,200	36,500	25,000	-	-	-	-	-
Lead (Pb)	43.0	43.0	72.4	31.8	34.0	23.8	10.0	8.6	86.0%	6,870	6,900
Manganese (Mn)	13.0	12.9	190	27.9	513	344	100.0	102.0	102.0%	6,480	6,170
Mercury (Hg)	-	-	-	-	-	-	0.40	0.36	90.0%	-	-
Molybdenum (Mo)	-	-	29	-	-	-	100.0	91.5	91.5%	82.3	80.0
Nickel (Ni)	-	-	127	53.3	29.5	33.5	100.0	93.7	93.7%	85.6	81.1
Osmium (Os)	-	-	-	-	-	-	-	-	-	<1	<1
Selenium (Se)	7.6	6.9	10.3	7.7	0.4	<0.5	11.0	10.0	90.9%	4.8	3.8
Silver (Ag)	-	-	-	-	-	-	100.0	81.8	81.8%	-	-
Thallium (Tl)	25.2	26.7	5.7	3.3	0.7	<2	10.0	11.0	110.0%	<2	<2
Vanadium (V)	130	123	300	121	72.4	54.0	100.0	32.8	32.8%	61.9	55.0
Zinc (Zn)	10.0	10.0	200	69.2	191	171	100.0	94.4	94.4%	45,900	41,700
cyanide	-	-	-	-	-	-	-	-	-	-	-

PEI Sample Identity	Check Samples			Matrix Spike	Duplicates		Coefficient of Variance
	Source	Expected	Found	Percent Recovery	S-930	S-930	
Elements (ug/g)							
Aluminum (Al)	PEI	1.00	1.00	131.0%	8,320	10,470	0.162
Antimony (Sb)	-	-	-	-	-	-	-
Arsenic (As)	PEI	0.075	0.074	94.9%	13.2	14.4	0.061
Barium (Ba)	EPA	0.97	1.03	105.0%	161	188	0.109
Beryllium (Be)	EPA	0.96	0.96	99.8%	<0.1	<0.1	0
Cadmium (Cd)	EPA	0.94	0.93	97.6%	68.5	88.2	0.178
Chromium (Cr)	EPA	1.03	1.00	97.1%	216	273	0.165
Cobalt (Co)	EPA	1.00	0.99	74.4%	18.9	22.8	0.132
Copper (Cu)	EPA	1.01	1.02	100.0%	347	439	0.166
Iron (Fe)	EPA	1.02	0.97	79.0%	32,960	38,020	0.101
Lead (Pb)	EPA	1.01	1.02	98.5%	3,180	3,620	0.092
Manganese (Mn)	EPA	1.02	1.00	92.8%	2,620	3,010	0.098
Mercury (Hg)	EPA	0.01	0.01	99.0%	-	-	-
Molybdenum (Mo)	-	-	-	-	-	-	-
Nickel (Ni)	EPA	1.02	1.04	102.0%	36.8	47.4	0.178
Osmium (Os)	-	-	-	-	-	-	-
Selenium (Se)	EPA	0.050	0.048	53.6%	2.20	2.60	0.118
Silver (Ag)	EPA	0.99	0.92	88.4%	6.95	5.18	0.206
Thallium (Tl)	-	-	-	-	-	-	-
Vanadium (V)	EPA	1.01	0.92	103.0%	21.8	27.4	0.158
Zinc (Zn)	EPA	1.01	1.04	47.0%	29,540	34,200	0.103
cyanide	PEI	1.83	1.92	-	3.23	3.51	0.059

TABLE 5.2. QUALITY ASSURANCE RESULTS FOR SEMIVOLATILES AND PESTICIDES ANALYSIS

SOIL SURROGATE PERCENT RECOVERY SUMMARY

Sample Identity	Silt S-636	PM-10 S-638	>PM10 S-640	Silt BGD-643	Silt T-646	PM-10 T-648	Silt U-653	PM-10 U-655	Silt V-660	Silt W-667	Sample Blank	Matrix Spike	Matrix Spike Duplicate
Surrogate Compounds													
Nitrobenzene-d5	0%	0%	0%	8%	139%	63%	0%	0%	0%	34%	0%	0%	0%
2-Fluorobiphenyl	120%	126%	96%	39%	135%	124%	0%	0%	132%	75%	1%	14%	12%
Terphenyl-d14	180%	168%	0%	138%	166%	153%	128%	140%	180%	98%	109%	19%	20%
Phenol-d5	0%	0%	0%	36%	63%	19%	0%	0%	0%	0%	0%	0%	0%
2-Fluorophenol	0%	0%	0%	9%	0%	0%	0%	0%	0%	20%	0%	0%	0%
2,4,6-Tribromophenol	0%	0%	0%	85%	0%	0%	0%	0%	0%	43%	78%	0%	0%
Dibutylchlorendate	0%	44%	0%	-	0%	0%	-	-	-	121%	119%	44%	13%

Sample Identity	Silt S-901	Silt S-905	Silt S-906	Silt S-911	Silt S-915	Silt S-916	Silt S-921	Silt S-925	Silt S-926	Silt S-931
Surrogate Compounds										
Nitrobenzene-d5	0%	0%	0%	10%	100%	115%	103%	843%	0%	0%
2-Fluorobiphenyl	171%	100%	142%	15%	131%	146%	206%	1240%	135%	0%
Terphenyl-d14	200%	111%	171%	16%	127%	180%	0%	1600%	180%	140%
Phenol-d5	0%	0%	0%	0%	227%	296%	114%	830%	101%	0%
2-Fluorophenol	0%	0%	0%	0%	21%	26%	20%	150%	0%	0%
2,4,6-Tribromophenol	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Dibutylchlorendate	0%	37%	30%	66%	49%	77%	62%	27%	34%	10%

SEMIVOLATILE ORGANIC SOIL MATRIX SPIKE/MATRIX SPIKE DUPLICATE RECOVERY SUMMARY

Sample Identity V-660	Spike Conc.	Unspiked Sample	Matrix Spike	Percent Recover	Matrix Spike Duplicate	Percent Recovery	RPD
Compound	(ug/g)	(ug/g)	(ug/g)		(ug/g)		
1,2,4-Trichlorobenzene	3.3	0.0	0.0	0%	0.0	0%	0%
Acenaphthene	3.3	0.0	2.4 J	72%	2.0 J	59%	20%
2,4-Dinitrotoluene	3.3	0.0	0.6	17%	0.0	0%	200%
Pyrene	3.3	1.9 J	2.5 J	18%	2.6 J	22%	5%
N-Nitrosodi-n-Propylamine	3.3	0.0	0.0	0%	0.0	0%	0%
1,4-Dichlorobenzene	3.3	0.0	0.0	0%	0.0	0%	0%
Pentachlorophenol	6.7	0.0	0.0	0%	0.0	0%	0%
Phenol	6.7	0.0	0.0	0%	0.0	0%	0%
2-Chlorophenol	6.7	0.0	0.0	0%	0.0	0%	0%
4-Chloro-3-methylphenol	6.7	0.0	0.0	0%	0.0	0%	0%
4-Nitrophenol	6.7	0.0	1.5 J	23%	0.6 J	9%	88%
Fluorene *	0.0	0.0	2.0 J	-	1.0 J	-	67%
N-nitrosodiphenylamine *	0.0	0.0	1.6 J	-	1.7 J	-	6%
Benzo(a)anthracene *	0.0	0.0	0.7 J	-	0.7 J	-	0%
Bis(2-ethylhexyl)phthalate *	0.0	0.0	0.3 J	-	0.0	-	200%
Sample Detection Limit (ug/g)		39.5	4.1		4.1		

* = Compound was not detected in the unspiked sample and was not spiked, but was detected in the matrix spike sample and/or matrix spike duplicate sample.

J = Estimated value where the compound meets the mass spectral or chromatographic criteria but is below the quantifiable limit

TABLE 5.2. (continued)

PESTICIDE SOIL MATRIX SPIKE/MATRIX SPIKE DUPLICATE RECOVERY SUMMARY

Sample Identity T-646 *	Spike Conc.	Unspiked Sample	Matrix Spike	Percent Recover	Matrix Spike Duplicate	Percent Recovery	RPD
Compound	(ug/g)	(ug/g)	(ug/g)		(ug/g)		
Lindane	0.027	0.0	0.0	0%	0.0	0%	0%
Heptachlor	0.027	0.0	0.0	0%	0.0	0%	0%
Aldrin	0.027	0.0	0.0	0%	0.0	0%	0%
Dieldrin	0.067	0.0	0.0	0%	0.0	0%	0%
Endrin	0.067	0.0	0.0	0%	0.0	0%	0%
4,4'-DDT	0.067	0.0	0.0	0%	0.0	0%	0%
Sample Detection Limit (ug/g)							
Lindane, Heptachlor, Aldrin		4.30	1.87		1.69		
Dieldrin, Endrin, 4,4'-DDT		8.60	3.74		3.39	-	

* = Due to sample matrix interferences and sample dilutions, spiked compounds were unable to be detected.

SUMMARY OF METHOD BLANK ANALYSIS

Blank ID	Compound Identity	Concentration
		(ug/g)
Sample Blank for Semivolatile Organics	None Detected	None Detected

sample, but below the QA limit for the MSD sample. All other spiked semivolatile compounds were recovered at levels below the QA limit.

Six compounds were detected below the quantifiable limit in the MS and/or MSD that were not detected in the unspiked sample. The dilution of the samples was probably the cause of the compounds not being found in the unspiked sample.

For sample T-646 which was spiked with pesticides, none of the spiked compounds were detected due to sample matrix interference and sample dilutions.

All the samples submitted for organic analysis as well as the laboratory blanks were spiked with surrogate compounds and the percent recoveries of these compounds were determined (see Table 5.2). The surrogate recovery of nitrobenzene-d_5 for samples T-648, W-667, S-915, S-916, and S-921 were within the QA limits. All other samples were below the QA recovery limits for nitrobenzene-d_5, except samples T-646 and S-925 which were above the limits. For the surrogate 2-fluorobiphenyl, the recoveries for samples S-640, BGD-643, W-667, and S-905 were within the QA limits. For samples S-636, S-638, T-646, T-648, V-660, S-901, S-906, S-915, S-916, S-921, S-925 and S-926, the recoveries of 2-fluorobiphenyl were above the QA limits; the recoveries for the rest of the samples were below the QA recovery limits. For the surrogate terphenyl-d_{14}, the recoveries for samples V-653, W-667, S-905, S-915, the sample blank, and the MS and MSD were within the QA limits. For samples S-636, S-638, BGD-643, T-646, T-648, V-655, V-660, S-901, S-906, S-916, S-925, S-926, and S-931, the recoveries of terphenyl-d_{14} were above the QA limits; the recoveries for the rest of the samples were below the QA limits. For the surrogate phenol-d_5, the recoveries for samples BGD-643, T-646, and S-926 were within the QA limits. For samples S-915, S-916, S-921, and S-925 the recoveries of phenol-d_5 were above the QA limits; and for the rest of the samples the recoveries were below the QA limits. For the surrogate

2-fluorophenol, all samples except S-916 were outside the QA recovery limits. For surrogate 2,4,6-tribromophenol, the recoveries for BGD-643, W-667, and the sample blank were within the QA limits; the surrogate was not detected in any of the other samples. For the pesticide surrogate dibutylchlorendate, the recoveries were within the QA limits for all samples spiked with the compound except for samples S-636, S-640, T-646, T-648, S-901, S-931, and the MSD.

Analysis was conducted on a blank sample consisting of a purified solid matrix spiked with surrogate compounds and carried through extraction and concentration (see Table 5.2). The CLP specifies limits for the blanks on the levels of common phthalate esters and Hazardous Substances List (HSL) compounds. In the blank sample, no phthalate esters or HSL compounds were detected at a quantifiable limit of 0.33 ug/g.

Entropy conducted a independent performance audit by spiking a silt sample from the repeatability and reproducibility sample set. Two aliquots of a silt composite were used for the metals spikes (samples S-932 and S-934). The elements and their concentractions in the spiking solution used for the metals spike are listed in Table C.10 of Appendix C. The metals spike was added to achieve approximately 225 ug/g concentration with the exact concentration depending on the actual sample weight. The exact concentration of the metals spike, the analyses of the unspiked silt samples and the spiked sample, and the percent recoveries for each element are presented in Table 5.3 for both the inside laboratory (RTI) and the outside laboratory (PEI).

One other aliquot from the same silt composite was spiked with the semivolatile compounds and pesticides listed in Tables C.6 through C.9. The exact concentrations of the spiked compounds, the analyses of the corresponding unspiked silt samples, and the percent recoveries for each spiked compound are presented in Table 5.4. The inability to detect all of the spiked compounds

TABLE 5.3. PERFORMANCE AUDIT FOR METALS ANALYSES

Sample Identity	Unspiked Samples S-908	S-909	Mean	Spike Amount	Found S-932	RTI Percent Recovery	Sample S-910	Spike Amount	Found S-934	PEI Percent Recovery
Element	(ug/g)	(ug/g)	(ug/g)	(ug/g)	(ug/g)		(ug/g)	(ug/g)	(ug/g)	
Aluminum (Al)	17,100	17,400	17,250	0	-	-	13,010	0	13,390	-
Antimony (Sb)	3.4	3.8	3.6	0	1.8	-	-	0	-	-
Arsenic (As)	15.3	13.9	14.6	279.8	245	82.4%	13.5	202.3	142.4	63.8%
Barium (Ba)	356	357	357	279.8	670	111.9%	313	202.3	130.0	-90.5%
Beryllium (Be)	<1	<1	<1	279.8	250	89.3%	0.2	202.3	159.4	78.7%
Cadmium (Cd)	37.2	37.9	37.6	279.8	286	88.7%	32.4	202.3	187.0	76.4%
Chromium (Cr)	196	207	202	0	179	-	141.0	0	191.4	-
Cobalt (Co)	25.9	13.7	19.8	0	127	-	17.7	0	16.4	-
Copper (Cu)	431	435	433	279.8	592	56.8%	344	202.3	797	223.9%
Iron (Fe)	30,800	31,900	31,350	0	0	-	22,540	0	24,314	-
Lead (Pb)	2,140	2,124	2,132	279.8	2,211	28.2%	1,600	202.3	1,772	84.9%
Manganese (Mn)	1,400	1,380	1,390	279.8	1,342	-17.2%	1,130	202.3	1,309	88.4%
Mercury (Hg)	0.9	0.9	0.9	0	0	-	1.00	0	-	-
Molybdenum (Mo)	22.5	25.5	24.0	0	41.3	-	-	0	-	-
Nickel (Ni)	54.2	55.6	54.9	0	165	-	45.3	0	45.2	-
Osmium (Os)	<4	<4	<4	0	0	-	-	0	-	-
Selenium (Se)	1.4	1.5	1.5	279.8	254	90.1%	<0.3	202.3	122.0	60.3%
Silver (Ag)	<10	<10	<10	279.8	158	56.4%	2.3	202.3	87.3	42.0%
Thallium (Tl)	<1	<1	<1	0	0	-	-	0	-	-
Vanadium (V)	56.5	58.6	57.6	0	64.6	-	33.7	0	31.7	-
Zinc (Zn)	8,947	7,010	7,979	0	8,632	-	8,060	0	11,351	-
cyanide	<0.5	0.7	0.4	0	-	-	2.8	0	-	-

TABLE 5.4. PERFORMANCE AUDIT FOR SEMIVOLATILE ORGANICS AND PESTICIDES ANALYSES

Fugitive Particulate from TSDF (85/12)
Organic Spike Recovery Results for USPCI, Tooele, UT

Sample Identity Semivolatile Organics	S-931	Avg. of S-905/906	Spike Amount	Percent Recovered
Spike Compound	(ug/g)	(ug/g)	(ug/g)	
,4,5-Trichlorophenol *	N.D.	0.0	86.2	0.0%
,4,6-Trichlorophenol	N.D.	0.0	86.2	0.0%
,4-Dichlorophenol	N.D.	0.0	86.2	0.0%
,4-Dimethylphenol	N.D.	0.0	86.2	0.0%
,4-Dinitrophenol	N.D.	0.0	86.2	0.0%
-Chlorophenol	N.D.	0.0	86.2	0.0%
-Methylphenol	N.D.	0.0	86.2	0.0%
-Nitrophenol	N.D.	0.0	86.2	0.0%
,6-Dinitro-2-methylphenol	N.D.	0.0	86.2	0.0%
-Methylphenol	N.D.	0.0	86.2	0.0%
-Nitrophenol *	N.D.	0.0	86.2	0.0%
-chloro-3-methylphenol	N.D.	0.0	86.2	0.0%
enzoic Acid *	N.D.	0.0	86.2	0.0%
entachlorophenol *	N.D.	0.0	86.2	0.0%
henol	32.0 J	0.0	86.2	37.1%
,2-Dichlorobenzene	N.D.	0.0	17.2	0.0%
,4,Dichlorobenzene	N.D.	0.0	17.2	0.0%
Acenapthene	30.0 J	12.0 J	17.2	104.4%
Anthracene	18.0 J	3.1 J	17.2	86.4%
Benzo(k)fluoranthene	N.D.	0.0	17.2	0.0%
Bis(2-ethylhexyl)phthalate	N.D.	0.0	17.2	0.0%
Dibenz(a,h)anthracene	N.D.	0.0	17.2	0.0%
Dibenzofuran	23.0 J	8.4 J	17.2	84.7%
Fluorene	35.0 J	16.0 J	17.2	110.2%
Hexachlorobenzene	9.3 J	0.0	17.2	53.9%
Hexachlorocyclopentadiene	N.D.	0.0	17.2	0.0%
Isophorone	8.5 J	0.0	17.2	49.3%
N-nitroso-di-propylamine	N.D.	16.0 J	17.2	0.0%
Nitrobenzene	N.D.	0.0	17.2	0.0%
Pyrene	21.0 J	5.6 J	17.2	89.3%
2-Chloronapthalene	N.D.	0.0	17.2	0.0%
4-Bromophenylphenylether	N.D.	0.0	17.2	0.0%
4-Chlorophenylphenylether	18.0 J	0.0	17.2	104.4%
Benzo(a)pyrene	14.0 J	0.0	17.2	81.2%
Benzo(g,h,i)perylene	N.D.	0.0	17.2	0.0%
Benzyl Alcohol	N.D.	0.0	17.2	0.0%
Chrysene	18.0 J	0.0	17.2	104.4%
Di-n-butylphthalate	N.D.	0.0	17.2	0.0%
Di-n-octylphthalate	N.D.	0.0	17.2	0.0%
Diethylphthalate	N.D.	0.0	17.2	0.0%
Dimethyl Phthalate	N.D.	0.0	17.2	0.0%
Hexachlorobutadiene	N.D.	0.0	17.2	0.0%
Hexachloroethane	N.D.	0.0	17.2	0.0%
Napthalene	48.0	34.0	17.2	81.2%
bis(2-chloroethyl)ether	N.D.	0.0	17.2	0.0%
Sample Detection Limit	(ug/g)	(ug/g)		
* Compounds	186.6	120.3		
All other compounds	38.5	24.8		

Pesticides	S-931	Avg. of S-905/906	Spike Amount	Percent Recovered
Compound	(ug/g)	(ug/g)	(ug/g)	
Alpha-BHC	9.50	N.D.	8.63	110%
Beta-BHC	N.D.	N.D.	8.63	0%
Delta-BHC	N.D.	N.D.	8.63	0%
Gamma-BHC(Lindane)	13.75	N.D.	8.63	159%
Heptachlor	6.63 J	N.D.	8.63	77%
Aldrin	10.50	N.D.	8.63	122%
Heptachlor Epoxide	9.38	N.D.	8.63	109%
Endosulfan I	1.08 J	N.D.	8.63	12%
Dieldrin	9.38 J	N.D.	8.63	109%
4,4'-DDE	8.75 J	N.D.	8.63	101%
Endrin	10.50 J	N.D.	8.63	122%
Endosulfan II	N.D.	N.D.	8.63	0%
4,4'-DDD	11.13 J	N.D.	8.63	129%
Endosulfan Sulfate	4.88 J	N.D.	8.63	57%
Methoxychlor	N.D.	N.D.	8.63	0%
Endrin Ketone	3.00 J	N.D.	8.63	35%
Sample Detection Limit	(ug/g)	(ug/g)		
Alpha-BHC	9.0	1.4		
Beta-BHC	9.0	1.4		
Delta-BHC	9.0	1.4		
Gamma-BHC(Lindane)	9.0	1.4		
Heptachlor	9.0	1.4		
Aldrin	9.0	1.4		
Heptachlor Epoxide	9.0	1.4		
Endosulfan I	9.0	1.4		
Dieldrin	18.0	2.8		
4,4'-DDE	18.0	2.8		
Endrin	18.0	2.8		
Endosulfan II	18.0	2.8		
4,4'-DDD	18.0	2.8		
Endosulfan Sulfate	18.0	2.8		
Methoxychlor	90.0	14.0		
Endrin Ketone	18.0	2.8		

may have been the result of the sample matrix and the sample dilutions necessary to facilitate the GC/MS analysis.

A performance audit for the oil and grease analysis was also conducted by spiking a background sample (from another site) with paraffin oil dissolved in Freon TF. The spiked sample was carried through the oil and grease analysis procedure. The recovery of the paraffin oil was calculated to be 94 percent (see Table 2.5).