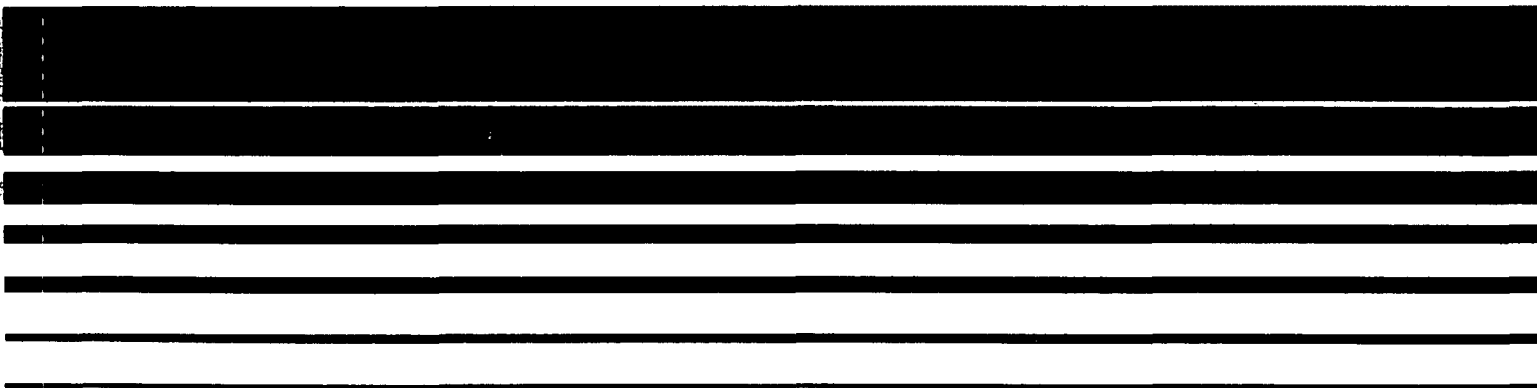


Air



# **Hazardous Waste Treatment, Storage, and Disposal Facilities**

## **Site-Specific Test Report Gulf Coast Waste Disposal Authority Texas City, Texas**



SITE-SPECIFIC TEST REPORT  
GULF COAST WASTE DISPOSAL AUTHORITY  
TEXAS CITY, TEXAS

ESED 85/12  
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## 1.0 INTRODUCTION

On October 30 and November 8, 1985, Entropy Environmentalists, Inc. collected soil samples from five treatment, storage, and disposal related processes at Gulf Coast Waste Disposal Authority's (GCWDA) facility at Texas City, Texas. 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 contaminated 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 contaminated fugitive particulate emissions from TSDF's.

To accomplish the overall goals of this study, soil samples were collected from representative processes at this facility 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 of the soil silt fraction with metals, cyanide, and semivolatile organics.
- 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  $\mu\text{m}$ ) 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 (not included in this report since no samples were collected for this purpose at GCWDA).

At GCWDA, the five processes sampled were (1) the active lift for landfill Cell A; (2) the active lift for landfill Cell C; (3) the active lift for landfill Cell Q; (4) a land treatment unit; and (5) an unpaved road segment from the landfill access road. A pair of background samples were also taken. Sampling was conducted on two separate dates (October 30 and November 8, 1985) because of heavy rains associated with a hurricane. The land treatment unit and the landfill access road were the processes sampled during the second visit.

All samples taken were analyzed for weight loss on drying (LOD), silt content, and  $\text{PM}_{10}$  content. The landfill samples were analyzed for metals, cyanide, pesticides, and semivolatile organics as described in Chapter 4. The land treatment samples were analyzed for metals, semivolatile organics, and oil and grease content. The landfill access road samples and the background samples were analyzed for metals and semivolatile organics only. Research Triangle Institute (RTI) conducted the analyses for metals, cyanide, and oil and grease content. PEI and Associates performed the analyses for the pesticides and semivolatile organics. Additional cleanup of semivolatile organic extracts was performed by Triangle Laboratories, Inc.

Field sampling was performed by Mr. Steve Plaisance and Mr. Bernie von Lehmden (first visit) and Mr. Steve Plaisance and Mr. Kent Spears (second visit) of Entropy Environmentalists. During both visits, 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) observed the sampling program. Mr. Bob Dyer, Facility Manager, and Mr. Bill Stullken, Operations Supervisor, served as the contacts for GCWDA.

This report is organized into several chapters addressing 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 GCWDA. The processes included: (1) the active lift for landfill Cell A; (2) the active lift for landfill Cell C; (3) the active lift for landfill Cell Q; (4) a land treatment unit; and (5) an unpaved road segment from the landfill access road. Sampling and analysis were conducted using the procedures described in the Sampling and Analysis Protocol which was 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 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 GCWDA 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 conducted to measure the concentration of the most likely compounds or elements that could be soil contaminants (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 the metals, cyanide, semivolatile organics, and pesticides. The organics of interest were taken from the Hazardous Substances List (HSL) in the EPA Contract Laboratory Program (CLP), Statement of Work. Land treatment samples were also to be analyzed for oil and grease content. If significant quantities of cyanide, semivolatile organics, or pesticides were not expected to be present in a particular process, the analysis of those corresponding compounds was not performed. MRI decided that cyanide and pesticides would not be present in significant quantities in the land treatment unit and the access road and therefore, cyanide and pesticides analyses were not performed on the samples from these processes. 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). Organic compounds in some samples caused the detection limits to be higher than desired for the pesticides and semivolatile organic analyses. An alternative cleanup method was developed to

TABLE 2.1. SAMPLING PLAN FOR GULF COAST WASTE DISPOSAL AUTHORITY

Process Sampled	Process Desig.	Date Sampled	Number of Samples	Collection Method	Analyses
Landfill, Cell A, Acid Waste	P	10/30/86	8	Scooping	Loss on drying Silt and PM <sub>10</sub> content Metals and cyanide Pesticides Semivolatile organics
Landfill, Cell Q, Filter Cake	Q	10/30/86	8	Scooping	Loss on drying Silt and PM <sub>10</sub> content Metals and cyanide Pesticides Semivolatile organics
Landfill, Cell C, Metal Catalyst	R	10/30/86	8	Scooping	Loss on drying Silt and PM <sub>10</sub> content Metals and cyanide Pesticides Semivolatile organics
Land Treatment	X	11/8/86	8	Scooping	Loss on drying Silt and PM <sub>10</sub> content Metals Semivolatile organics Oil and grease content
Landfill Access Road	Y	11/8/86	2	Scooping	Loss on drying Silt and PM <sub>10</sub> content Metals Semivolatile organics
Background Samples	BGD	10/30/86	2	Scooping	Loss on drying Silt and PM <sub>10</sub> content Metals Semivolatile organics

minimize this problem, and the samples were analyzed at the lowest detection limit possible without jeopardizing the gas chromatograph/ massspectrometer (GC/MS).

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

## 2.1 BACKGROUND SAMPLES

Because many compounds and elements are either naturally occurring in the soil or may be present as a result of factors other than those which may be attributed to GCWDA's activities, background samples were taken at a point off-site and analyzed. The percent weight loss on drying (LOD) determined on ten-gram aliquots of the background samples averaged 24.00 percent. Later the background samples were oven dried at 105°C for 2.5 hours followed by desiccation for 18.25 hours prior to being screened for silt. The silt content of the two jars constituting the background sample (sample identification numbers BGD-525 and BGD-526) averaged 39.2 percent by weight (see Table 2.2), using a full sieve stack consisting of a 3/8, 4, 20, 40, 100, 140 and 200 mesh sieves for the determination. The composite silt material (sample identification number BGD-572) separated from the background samples was sonic sieved. Material passing through a 20 um sieve constituted the PM<sub>10</sub> content. The PM<sub>10</sub> content averaged 19.03 percent by weight of the silt material.

Results of the analyses for metals and cyanide are shown in Table 2.3. The analytical results for the metals in the background silt sample (Sample ID BGD-571) are in terms of micrograms of the metal or cyanide 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 GCWDA's activities. The results for the background samples have not been subtracted from the results for the other samples since risk assessments utilize the inclusive

TABLE 2.2.  
ANALYTICAL RESULTS OF SILT SCREENING, WEIGHT LOSS ON DRYING, AND PM<sub>10</sub> SIEVING  
FUGITIVE PARTICULATE FROM TSDF (85/12)

Site and Process	Sample ID	Percent Silt*	Percent Loss on Drying	Sample ID	Percent PM <sub>10</sub>
Gulf Coast Waste, TX Cell A, Acid Waste (Process P)	P-501	3.3	32.54		
	P-502	4.5	23.20		
	P-503	5.8	22.57		
	P-504	5.5	21.25		
	P-505	3.7	25.98		
	P-506	15.0	24.21		
	P-507	9.2	22.90	P-546	29.81
	P-508	15.1	23.34	P-546	30.96
<hr/>					
	Average	7.8	24.50		30.39
	Std. Dev.	4.8	3.52		0.81
Gulf Coast Waste, TX Cell Q, Filter Cake (Process Q)	Q-509	16.2	33.95		
	Q-510	13.7	29.51		
	Q-511	25.6	33.86		
	Q-512	10.4	34.26		
	Q-513	14.3	31.34	Q-556	53.54
	Q-514	11.5	31.19	Q-556	49.85
	Q-515	15.7	38.45	Q-556	54.90
	Q-516	19.4	31.75	Q-556	51.84
<hr/>					
	Average	15.9	33.04		52.53
	Std. Dev.	4.8	2.74		2.18
Gulf Coast Waste, TX Cell C, Metal Catalyst (Process R) Oven dried 1 hour @ 105°C	R-517	0.0	33.91		
	R-518	0.8	28.78		
	R-519	0.7	19.56		
	R-520	0.0	18.53		
<hr/>					
	Average	0.4	25.20		
	Std. Dev.	0.4	7.42		
Oven dried 2.5 hours @ 105°C	R-521	6.1	22.55		
	R-522	6.0	24.77		
	R-523	5.5	21.03	R-566	20.82
	R-524	15.9	22.49	R-566	22.70
<hr/>					
	Average	8.4	22.70		21.76
	Std. Dev.	5.0	1.54		1.33

(continued)

TABLE 2.2. (continued)

Site and Process	Sample ID	Percent Silt*	Percent Loss on Drying	Sample ID	Percent PM <sub>10</sub>
Gulf Coast Waste, TX Background Samples	BGD-525	42.5	22.38	BGD-572	19.02
	BGD-526	35.8	25.61	BGD-572	19.04
<hr/>					
	Average	39.2	24.00		19.03
	Std. Dev.	4.7	2.28		0.01
Gulf Coast Waste, TX Land Treatment (Process X)	X-527	5.1	5.82		
	X-528	1.2	18.95		
	X-529	1.9	13.61		
	X-530	1.7	8.22		
	X-531	0.6	11.42		
	X-532	1.4	11.88	X-587	2.49
	X-533	2.4	10.39	X-587	2.63
<hr/>					
	Average	2.04	11.47		2.56
	Std. Dev.	1.5	4.17		0.10
Gulf Coast Waste, TX Road Sample (Process Y)			3.80	Y-597	37.72
	Y-535	13.3	3.60	Y-597	39.78
	<hr/>				
	Average		3.70		38.75
	Std. Dev.		0.14		1.46

\*All silt values determined using a full stack of sieves.

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.

The background silt sample (sample ID BGD-570) was analyzed by for semivolatile organic compounds. The background sample extract was prepared by following the low-level procedure 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).



TABLE 2.3. ANALYTICAL RESULTS FOR METALS AND CYANIDE  
FUGITIVE PARTICULATE FROM TSDF (85/12)

Metals Analysis	Cell A, Acid Wastes			Cell Q, Filter Cake			Cell C, Metal Catalyst Land Treat.				Road	Background
Sample Identity	Silt P-541	PM10 P-543	>PM10 P-545	Silt Q-551	PM10 Q-553	>PM10 Q-555	Silt R-561	PM10 R-563	>PM10 R-565	Silt X-581	Silt Y-596	Silt BGD-571
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)
Aluminum (Al)	33,693	49,954	30,775	51,225	55,946	50,668	81,844	22,649	89,102	19,918	15,077	10,258
Antimony (Sb)	0.9	1.2	1.2	90.7	85.1	66.7	1.5	1.6	1.5	1.1	<0.5	<0.5
Arsenic (As)	8.7	13.9	6.0	19.3	24.0	14.2	4.7	6.4	12.0	52.6	3.9	3.4
Barium (Ba)	1,121	1,772	933	3,340	3,632	3,315	103	144	94.4	319	475	53.3
Beryllium (Be)	1.45	1.93	1.05	2.62	2.72	2.50	3.90	2.76	3.74	0.74	0.50	0.44
Cadmium (Cd)	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Chromium (Cr)	91.2	119	76.7	142	155	132	4,967	8,771	4,278	658	71.2	21.4
Cobalt (Co)	11.2	16.4	10.1	31.3	31.7	31.6	285	421	250	16.7	14.9	<0.4
Copper (Cu)	134	213	113	284	370	190	280	522	248	297	659	79.8
Iron (Fe)	17,198	24,609	15,186	25,182	25,867	24,773	204,890	338,654	173,248	60,205	8,911	5,883
Lead (Pb)	54.4	58.9	40.4	146	135	97.1	113	96.9	97.3	483	12.6	19.9
Manganese (Mn)	156	209	138	170	188	163	209	328	192	380	167	34.0
Mercury (Hg)	0.27	0.50	0.37	0.31	0.37	0.41	<0.03	0.41	<0.03	7.22	<0.03	<0.1
Molybdenum (Mo)	16.4	23.9	12.5	44.1	28.5	122	122	130	89.3	9.9	14.0	<6
Nickel (Ni)	41.9	52.8	39.7	52.7	52.1	50.8	522	258	525	44.1	16.9	<10
Osmium (Os)	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Selenium (Se)	0.5	1.1	<0.5	2.8	2.7	2.0	<0.5	<0.5	<0.5	1.1	<0.5	0.5
Silver (Ag)	<9	<9	<9	<9	<9	<9	<9	63.0	52.3	24.7	<9	<9
Thallium (Tl)	<0.5	0.5	<0.5	0.5	1.0	0.5	<0.5	<0.5	0.5	<0.5	<0.5	<0.5
Vanadium (V)	75.7	110	61.7	161	182	147	122	574	694	38.7	47.8	25.2
Zinc (Zn)	272	389	223	2,940	3,414	2,704	1,054	1,128	963	903	1,353	62.2
cyanide	3.3	4.7	3.0	1,280	1,680	1,250	0.8	2.1	<0.5	-	-	-

The background sample extract was cleaned by adsorption chromatography on Sephadex LH-20. The cleaned extract was analyzed by capillary-column gas chromatography/mass spectrometry (GC/MS) for the semivolatile compounds on the CLP's hazardous substance list (HSL). At a detection limit of 0.330 ug/g, none of the HSL semivolatile compounds were detected in the background sample (see Table 2.4).

With the exception of the use of a full stack of sieves and the use of the LH-20 cleanup method for the semivolatile organic compound analysis, all procedures for the background sample followed the sampling and analysis protocol.

## 2.2 CELL A, ACID WASTES (PROCESS P)

Cell A (Process P), used for disposal of acid wastes, was sampled using a grid layout. Eight samples were collected within this grid in a random manner as described in Chapter 4. The scoop sampling technique was employed to obtain near-surface samples. The LOD for Cell A samples (sample identification numbers P-501 through P-508) averaged 24.50 percent by weight (see Table 2.2). The samples were oven dried at 105°C for 3.5 hours followed by desiccation for 17 hours prior to silt screening. Each of the eight samples (identification numbers P-501 through P-508) were screened on a full stack of sieves to determine silt content which averaged 7.8 percent by weight. The silt composite (sample identification number P-546), resulting from screening samples P-501 through P-508, was then sonic sieved for PM<sub>10</sub> content which averaged 30.39 percent by weight in the silt sample. Portions of three fractions (silt, >PM<sub>10</sub>, and PM<sub>10</sub>) produced from the composite silt sample from Cell A were analyzed for metals and cyanide as shown in Table 2.3. The

TABLE 2.4. ANALYTICAL RESULTS FOR PESTICIDES AND SEMIVOLATILE ORGANIC HSL COMPOUNDS, FUGITIVE PARTICULATE FROM TSDF (85/12)

Semivolatile Analysis	Cell A, Acid Wastes		Cell Q, Filter Cake		Cell C, Metal Catalyst Land Treat.		Road	Background	
Sample Identity	Silt P-540	PM10 P-542	Silt Q-550	PM10 Q-552	Silt R-560	PM10 R-562	Silt X-580	Silt Y-595	Silt BGD-570
Compound	(ug/g)	(ug/g)	(ug/g)	(ug/g)	(ug/g)	(ug/g)	(ug/g)	(ug/g)	(ug/g)
2-Methylnaphthalene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.23 J	N.D.
Acenaphthene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.23 J	N.D.
Acenaphthylene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.12 J	N.D.
Anthracene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.06 J	N.D.
Benzo(a)anthracene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.11 J	N.D.
Benzo(b)fluoranthene	N.D.	N.D.	N.D.	0.25 J	N.D.	N.D.	N.D.	0.13 J	N.D.
Bis(2-ethylhexyl)phthalate	N.D.	N.D.	N.D.	N.D.	N.D.	3.10 J	N.D.	N.D.	N.D.
Butylbenzylphthalate	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.13 J	N.D.
Chrysene	N.D.	N.D.	0.21 J	0.21 J	N.D.	N.D.	22.0 J	0.34	N.D.
Di-n-butylphthalate	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	1.50	N.D.
Di-n-octylphthalate	N.D.	N.D.	N.D.	0.44 J	N.D.	2.60 J	10.0 J	N.D.	N.D.
Fluoranthene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.48	N.D.
Naphthalene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.04 J	N.D.
Phenanthrene	N.D.	0.37 J	N.D.	N.D.	N.D.	N.D.	27.0 J	1.50	N.D.
Phenol	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.04 J	N.D.
Pyrene	N.D.	N.D.	0.19 J	0.23 J	N.D.	N.D.	47.0 J	1.10	N.D.
Sample Detection Limit Semivolatile Compounds	3.30	3.30	1.58	1.75	3.30	3.30	62.9	0.33	0.33
Pesticide Analysis	Cell A, Acid Wastes		Cell Q, Filter Cake		Cell C, Metal Catalyst Land Treat.		Road	Background	
Sample Identity	Silt P-540	PM10 P-542	Silt Q-550	PM10 Q-552	Silt R-560	PM10 R-562	Silt X-580	Silt Y-595	Silt BGD-570
Compound	(ug/g)	(ug/g)	(ug/g)	(ug/g)	(ug/g)	(ug/g)	(ug/g)	(ug/g)	(ug/g)
Aroclor-1254	1.00	1.30	N.D.	N.D.	N.D.	N.D.	-	-	-
Sample Detection Limit Aroclor-1254	0.16	0.16	0.16	0.16	0.16	0.16	-	-	-

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.

portion of the silt sample that did not pass through the 20 um sieve was referred to as the "greater than PM<sub>10</sub>" (>PM<sub>10</sub>) fraction. All three fractions were analyzed to determine if the degree of contamination was less or greater in the PM<sub>10</sub> fraction (particle size dependent). The results for the metals and cyanide are expressed in micrograms (ug) of the metal per gram of sample on a dry basis. The concentrations measured for the background sample were not subtracted from the Cell A sample results.

Two silt fractions, silt and PM<sub>10</sub>, from Cell A were analyzed for pesticides and semivolatile organic HSL compounds. The >PM<sub>10</sub> fraction was not analyzed for organic compounds as a cost saving measure, since the evaluation of the particle size dependency of the degree of organic contamination will compare contamination values for the silt and PM<sub>10</sub> fractions only. The organic analyses were conducted on the sample extracts prepared using the low-level procedures in the CLP. The sample extracts were screened using gas chromatography as specified by the CLP and found to be at the medium concentration level. The Cell A sample extracts were then cleaned by adsorption chromatography on Sephadex LH-20. The cleaned extracts were analyzed after a 10-fold dilution necessary to protect the GC/MS. In the silt sample (P-540) none of the semivolatile HSL compounds were detected at the sample detection limit of 3.30 ug/g. Aroclor-1254 (a PCB compound) was found in the silt sample at a concentration of 1.00 ug/g (see Table 2.4). In the PM<sub>10</sub> fraction (P-542), one HSL compound was detected below the sample's detection limit of 3.30 ug/g. This compound, phenanthrene, met the mass spectral criteria, but the amount was less than the quantifiable detection limit and, therefore, is reported as an estimated value only.

With the exception of using a full stack of sieves for silt screening, using the LH-20 clean up procedure, and diluting the semivolatile organic

sample extracts prior to the GC/MS analysis, all procedures used for the Cell A samples followed the Sampling and Analysis Protocol.

### 2.3 CELL Q, FILTER CAKE (PROCESS Q)

Cell Q (Process Q), used for disposal of filter cake, was also sampled using a grid layout. Eight samples were collected within this grid in a random manner as described in Chapter 4. The scoop sampling technique was employed to obtain near-surface samples. As shown in Table 2.2, the LOD averaged 33.04 percent by weight for the eight samples (sample identification numbers Q-509 through Q-516). The samples were oven dried at 105°C for 6.5 hours followed by 85 hours of desiccation prior to silt screening. The resulting eight samples were screened with a full sieve stack for silt content which averaged 15.9 percent by weight. The silt composite (sample identification number Q-556) resulting from screening samples Q-509 through Q-516, was sonic sieved for PM<sub>10</sub> content which averaged 52.53 percent by weight of the silt. Portions of three fractions (silt, >PM<sub>10</sub>, and PM<sub>10</sub>) produced from the composite silt sample from Cell Q were analyzed for cyanide and metals. The analytical results for metals are shown in Table 2.3.

Two silt composite fractions, silt and PM<sub>10</sub>, from the Cell Q process samples were also analyzed for pesticides and semivolatile organic HSL compounds. Like the Cell A samples, the >PM<sub>10</sub> fraction was not analyzed for pesticides or semivolatile organic compounds. The analyses were conducted on the sample extracts prepared by the low-level procedure. The sample extracts were screened as specified by the CLP and found to be at the medium concentration level. The sample extracts were cleaned by adsorption chromatography on Sephadex LH-20. The cleaned extracts were analyzed without further dilutions other than those resulting from the cleanup procedure. In

the silt sample (Q-550), two semivolatile HSL compounds were detected. They were found at concentrations below the sample's quantifiable detection limit of 1.58 ug/g (see Table 2.4). In the PM<sub>10</sub> fraction (Q-552), four HSL compounds were detected. These were found at a concentration below the sample's quantifiable detection limit of 1.75 ug/g.

With the exception of using a full stack of sieves, using the LH-20 cleanup method for the semivolatile organic analysis, and diluting the semivolatile organic sample extracts prior to the GC/MS analysis, all procedures used on the Cell Q samples followed the Sampling and Analysis Protocol.

#### 2.4 CELL C, METAL CATALYST (PROCESS R)

Cell C (Process R), used for disposal of metal catalysts, was sampled using a grid cell layout. Eight samples were collected within this grid in a random manner as described in Chapter 4. The scoop sampling technique was employed to obtain near-surface samples. The LOD averaged 23.95 percent by weight for the eight samples (identification numbers R-517 through R-524). To assess the effect of oven drying time on silt yields, samples R-517 through R-520 were oven dried at 105°C for 1 hour prior to silt screening on a full sieve stack. The silt content of these four samples averaged 0.4 percent by weight. Samples R-521 through R-524 were oven dried for 2.5 hours at 105°C followed by 20.5 hours of desiccation prior to silt screening. The silt content for these four samples averaged 8.4 percent by weight on a full sieve stack. The silt from both sets was homogenized to form a silt composite (sample identification number R-566). The composite silt obtained was sonic sieved for PM<sub>10</sub> content which averaged 21.76 percent by weight.

Portions of the three fractions (silt,  $>PM_{10}$ ,  $PM_{10}$ ) obtained from the silt composite were taken for metals and cyanide analysis. The results of the metals and cyanide analyses of the samples are presented in Table 2.3. The concentrations measured for the background sample were not subtracted from the results for the silt sample.

Two silt composite fractions, silt and  $PM_{10}$ , from Cell C were also analyzed for pesticides and semivolatile organic HSL compounds. As for the Cell A samples, the  $>PM_{10}$  fraction was not analyzed for pesticides or semivolatile organic compounds. The Cell C extracts were prepared by the low-level procedure. They were screened as specified by the CLP and found to be at the medium concentration level and then cleaned by adsorption chromatography on Sephadex LH-20. The cleaned extracts were analyzed after a 10-fold dilution necessary to protect the GC/MS. None of the HSL compounds or pesticides were detected in the silt sample extract (R-560) at a detection limit of 3.30 ug/g (see Table 2.4). Two compounds were found in the  $PM_{10}$  fraction (R-562); both were found in concentrations below the quantifiable detection limit of 3.30 ug/g.

With the exception of the use of a full stack of sieves, the use of the LH-20 cleanup method, and diluting the semivolatile organic sample extracts prior to the GC/MS analysis, all procedures for the Cell C samples followed the Sampling and Analysis Protocol.

## 2.5 LAND TREATMENT AREA (PROCESS X)

The land treatment area (Process X) was sampled using a grid layout. Eight samples were collected within this grid in a random manner as described in Chapter 4. The scoop sampling technique was employed to obtain near-surface samples. A composite of aliquots from samples X-527 through X-533 was prepared

for analysis of oil and grease content. (Sample X-534 was lost when the sample jar was broken during sample shipment.) The oil and grease content of the composite sample (sample identification number X-586) was 7.97 percent by weight expressed on a dry weight basis, see Table 2.5 which includes quality assurance data generated using samples from another site. The LOD determined on samples X-527 through X-533 averaged 11.47 percent by weight (see Table 2.2). The samples were oven dried at 105°C for 2.5 hours followed by desiccation for 18.25 hours prior to silt screening on a full stack of sieves. The silt content averaged 2.0 percent by weight. A silt composite was made and sonic sieved to determine the PM<sub>10</sub> content which averaged 2.56 percent (for sample number X-587). Because of a low silt yield and the low PM<sub>10</sub> content of the silt, the decision was made not to produce PM<sub>10</sub> and <PM10 fractions for chemical analysis.

Portions of the silt composite were analyzed for metals and semivolatile organic HSL compounds. The results of the metals analyses are presented in Table 2.3. The silt sample subjected to semivolatile organics analysis was prepared by the low-level CLP procedure. The extract was screened by gas chromatography and found to be at the medium concentration level.

The land treatment area sample extract was cleaned by adsorption chromatography on Sephadex LH-20. The clean up procedure resulted in a 19.2-fold dilution. The cleaned extract was analyzed after another 10-fold dilution necessary to protect the GC/MS. Four HSL compounds were detected in the land treatment road sample extract. All four compounds, were found at a concentration below the quantifiable detection limit of 62.9 ug/g.

With the exception of using a full stack of sieves, using the LH-20 cleanup method, and diluting the semivolatile organic sample extract prior to the GC/MS analysis, all procedures used for the analysis of the land treatment area samples followed the Sampling and Analysis Protocol.



TABLE 2.5. ANALYTICAL RESULTS FOR OIL AND GREASE

Process ID	Process Description	Site	Oil and Grease
X	Land Treatment	GCWDA, Texas City, Texas	7.97%

## 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%

## 2.6 LANDFILL ACCESS ROAD (PROCESS Y)

The landfill access road (Process Y) was sampled using the sweeping technique. A 24-inch by 8-foot strip, across the road was sampled. A brush was used to sweep up loose particulate along the width of the road. Two sample jars were filled with the sample (Y-535). The LOD for the sample jars averaged 3.70 percent by weight. The sample was desiccated for 20.5 hours prior to silt screening on a full stack of sieves. For this sample, the silt content was 13.3 percent by weight, and the  $PM_{10}$  content of the silt averaged 38.75 percent by weight. Because a sufficient amount of silt was not available,  $PM_{10}$  and  $>PM_{10}$  fractions were not produced from the silt for analysis of metals and semivolatile organic compounds. The analytical results for metals in the landfill access road silt sample are shown in Table 2.3. The landfill access road sample was prepared for semivolatile organic analysis by the low-level CLP procedure. The sample extract was screened as specified by the CLP and found to be at the medium concentration level. The extract was cleaned by adsorption chromatography on Sephadex LH-20. The cleaned extract was analyzed without further dilution. Fourteen semivolatile HSL compounds were detected in the landfill access road sample extract. Five compounds, chrysene, di-n-butylphthalate, flouranthene, phenanthrene, and pyrene were found at concentrations above the quantifiable detection limit of 0.330 ug/g. The other nine compounds were found in concentrations below the quantifiable detection limit.

With the exception of using a full stack of sieves and the use of the LH-20 cleanup method, all procedures for the landfill access road sample followed the Sampling and Analysis Protocol.

## 2.7 CONCLUSIONS

At this site, sampling was affected by heavy rains associated with a hurricane. Water was standing in at least some of the sampling grid cells of many of the processes sampled. Sampling of the land treatment area (Process X) and the landfill access road (Process Y) was delayed for a week because of the excess moisture present in and on the soil. Some of samples collected (during the first visit) from Process Q actually had water standing in the jars. The LOD values determined at this site may not be representative due to the unusually heavy rains preceding sampling.

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

The LOD measurement was intended to measure the moisture content of the soil samples. However, the LOD procedure is an indirect measure of moisture, and a high bias can occur when volatile compounds are lost from the sample during the procedure. The LOD values were used to select the drying procedures for the samples (e.g., desiccation or oven drying).

The only significant problem encountered during the organic analyses was the fact that the samples contained a significant amount of non-HSL organic compounds. This prevented the semivolatile organics analyses from being conducted at the level described in the analytical protocol. Because of the high concentrations of organics, the samples had to be diluted to protect the analytical equipment. An alternative sample clean-up procedure was used on the sample extracts in an attempt to remove these organics. The clean-up procedure used on the semivolatile organic sample extracts permitted the samples to be analyzed at quantifiable detection limits lower than those that could be achieved by following the CLP procedures.

### 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. Active lift for landfill cell A;
- b. Active lift for landfill cell C;
- c. Active lift for landfill cell Q;
- d. Major access road for the landfill; and
- e. Land treatment (primary unit).

The following process descriptions are based largely upon: (1) the information provided by the facility; and (2) observations made during the course of the survey/sampling effort. Occasional reference is also made to the trip report from a prior EPA-sponsored visit concerned with air emissions of volatile organic compounds.<sup>1</sup>

#### 3.1 LANDFILL (CELLS A, C, Q)

The facility has been in operation for about 5 years. Approximately 20 acres are dedicated for landfill use. The landfill is surrounded by a dike built to 100-year flood specifications. At the time of survey, the active portion of the landfill was composed of five smaller cells separated by relatively broad strips of undisturbed, grass-covered soil. The landfill cells have a nominal 15-ft depth; it is estimated that approximately 40% of the below grade capacity has been used.

The subcell designations which relate to conditions specified in the facility Part A permit are as follows:

- A - acid wastes/polymerization catalysts
- C - reduced metal catalysts
- F - fluoride wastes from alkylation units
- M - general organics and nonhazardous material
- Q - centrifuge filter cake from acrylonitrile manufacturing

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<sup>1</sup> Case Study Visit Report for Gulf Coast Waste Disposal Authority (Vol. I) prepared by Radian Corporation, October 1984.

It is anticipated that after the Part B permitting process is completed, the subcell configuration will be simplified to consist of three cells:

- I - nonhazardous
- II - hazardous
- III - hazardous centrifuge filter cake

The landfill is used exclusively to dispose of wastes generated by four nearby industrial concerns. Principal wastes and approximate quantities disposed for the current year (January through October) are shown below.

<u>EPA Hazardous Waste No.</u>	<u>Quantity (tons)</u>	<u>Description</u>
D001	237	Tank bottoms
D002	23	Nonlisted corrosive wastes
D003	600	Nonlisted reactive wastes
D004	6	Arsenic containing acid
D007	1,530	Cooling tower sludge (contains chromium)
D008	3	Lead containing waste
P063	250	Hydrocyanic acid
U052	3	Cresols, cresylic acid

Comparable figures for 1982 are available in Reference 1. Hazardous wastes represent a fairly small percentage of the total landfill receipts. According to facility personnel, through September about 13,000 tons of waste had been received, of which roughly 20% is defined as hazardous (i.e., as above). Figure 3.1 presents a similar breakdown of annual facility receipts (landfill and land treatment).

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

<u>Equipment (commercial designation if available)</u>	<u>Function</u>	<u>Activity Units</u>
Bulldozer (Case 850C)	Waste spreading/lift construction and maintenance.	Estimated activity ~ 2 hr/day.
Waste carrier traffic-- highly variable mix	Transfer of waste material from the four clients served by operation.	Facility receives about 40 loads/day. Capacity of haulers varies from ~ 2 yd <sup>3</sup> to ~ 20 yd <sup>3</sup> . Note this includes hazardous and nonhazardous wastes.

Due to heavy rainfall prior to and during the site visit, actual landfill activity was minimal. However, observations suggest that under "dry" conditions, two features of the landfill operation may potentially result in the resuspension of contaminated material. These are: (1) routing of waste carrier traffic over the exposed active lift during waste loadout; and (2) apparent limited use of temporary cover material. These features may not be applicable to cell Q where it appeared that temporary cover was being used.

### 3.2 LAND TREATMENT

The working surface of the land treatment unit is approximately 10 acres, and is divided into two plots--the primary plot encompassing about 8 acres and an extension of about 2 acres. The two plots are separated by an earthen berm. Like the landfill, the unit has been in operation for about 5 years.

The principal wastes and approximate quantities applied at the land farm for the current year (January through October) are shown below.

<u>EPA Hazardous Waste No.</u>	<u>Quantity (tons)</u>	<u>Description</u>
K048	940	Dissolved air flotation (DAF) float
K051	565	API separator sludge
K052	421	Tank bottoms (leaded)

Comparable figures for 1982 are available in Reference 1. A comparison of annual landfarm versus landfill receipts is given in Figure 3.2.

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

<u>Equipment (commercial designation if available)</u>	<u>Function</u>	<u>Activity Units</u>
Farm tractor (Case 4490) with implements: 1. Rigid tooth harrow 2. Land plane 3. Offset disc harrow	Rigid tooth harrow is primary implement for incorporation and cultivation (disc harrow used occasionally). Land plane used to restore "hardpan" for trafficability.	Rigid tooth harrow used on regular basis (twice/week). Land plane highly intermittent operation--perhaps 2-3 times/yr.
Vacuum trucks	Transport and application of waste	Truck capacities vary from 2,000-5,000 gal. Current year receipts indicate about 4 loads/week.

The wastes are discharged directly from the vacuum truck to the land farm surface by a hose attached to the truck main. Gravity is the principal mechanism used to spread the waste. It is estimated that a "typical" load covers 0.25 to 0.50 acres.

The facility is located in an area in which excess soil moisture associated with heavy rainfall often controls waste application frequency and cultivation schedule. As a result, application frequency is highly waste and weather dependent. The unit operations have evolved to meet the unique soil and climate conditions of the area. The key to the operation is establishment and maintenance of a "hardpan" surface below the nominal zone of incorporation. This hardpan represents the actual base for the tractor working the treatment unit, and thus maintenance of this base is critical to insure trafficability on the greatest number of days per year. As noted above, a rigid tooth harrow is the primary implement used for incorporation of the waste material. The surface is typically cultivated about twice per week; the zone of incorporation is taken as < 6 in.

### 3.3 UNPAVED ROADWAYS

A surface sample was collected from the landfill access road. Estimated traffic volumes for the road are on the order of 80 passes per day. The vehicle mix is considered highly variable.

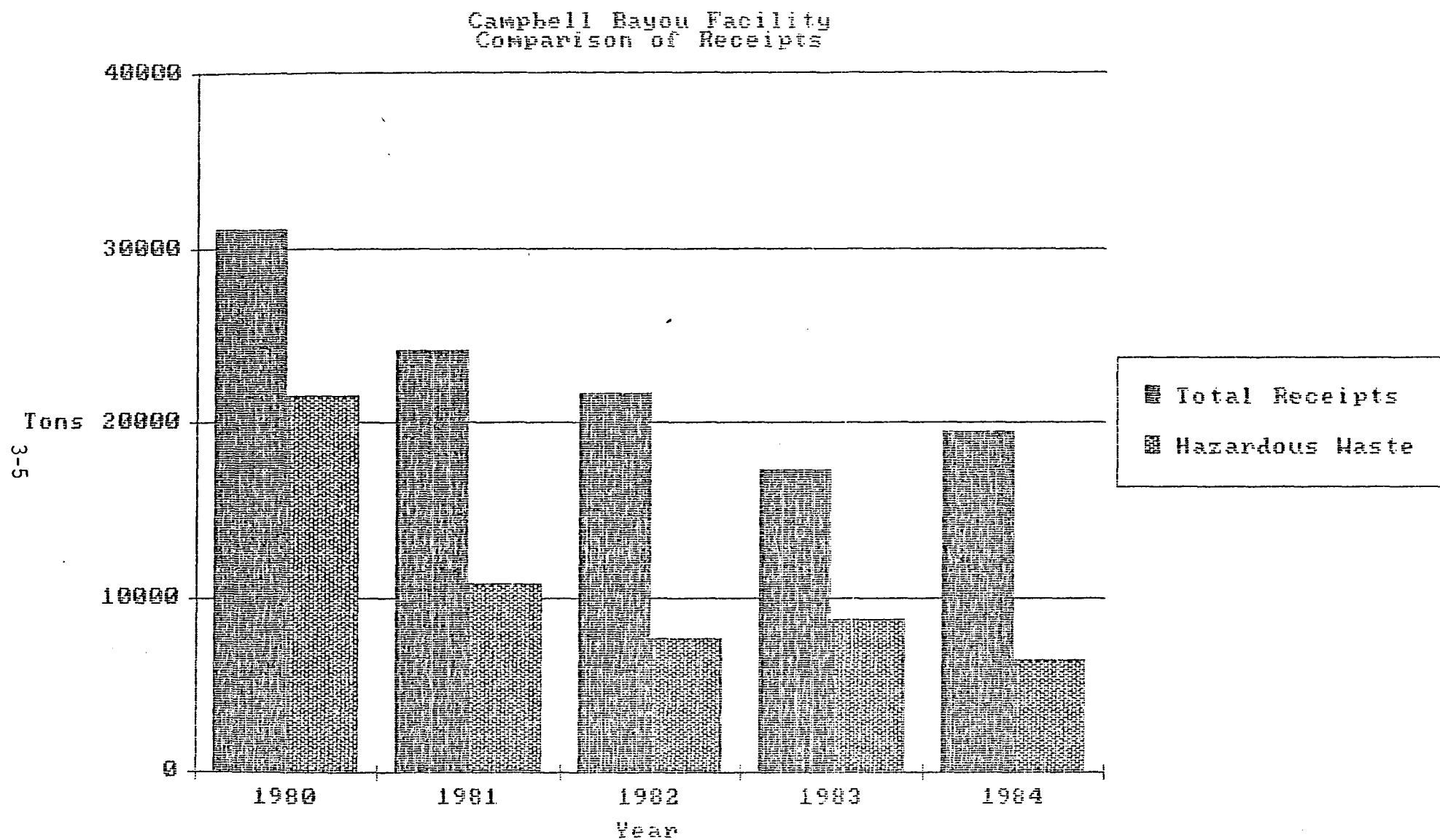


Figure 3.1. Campbell Bayou facility comparison of receipts.



Comparison of Landfill and Landfarm Receipts

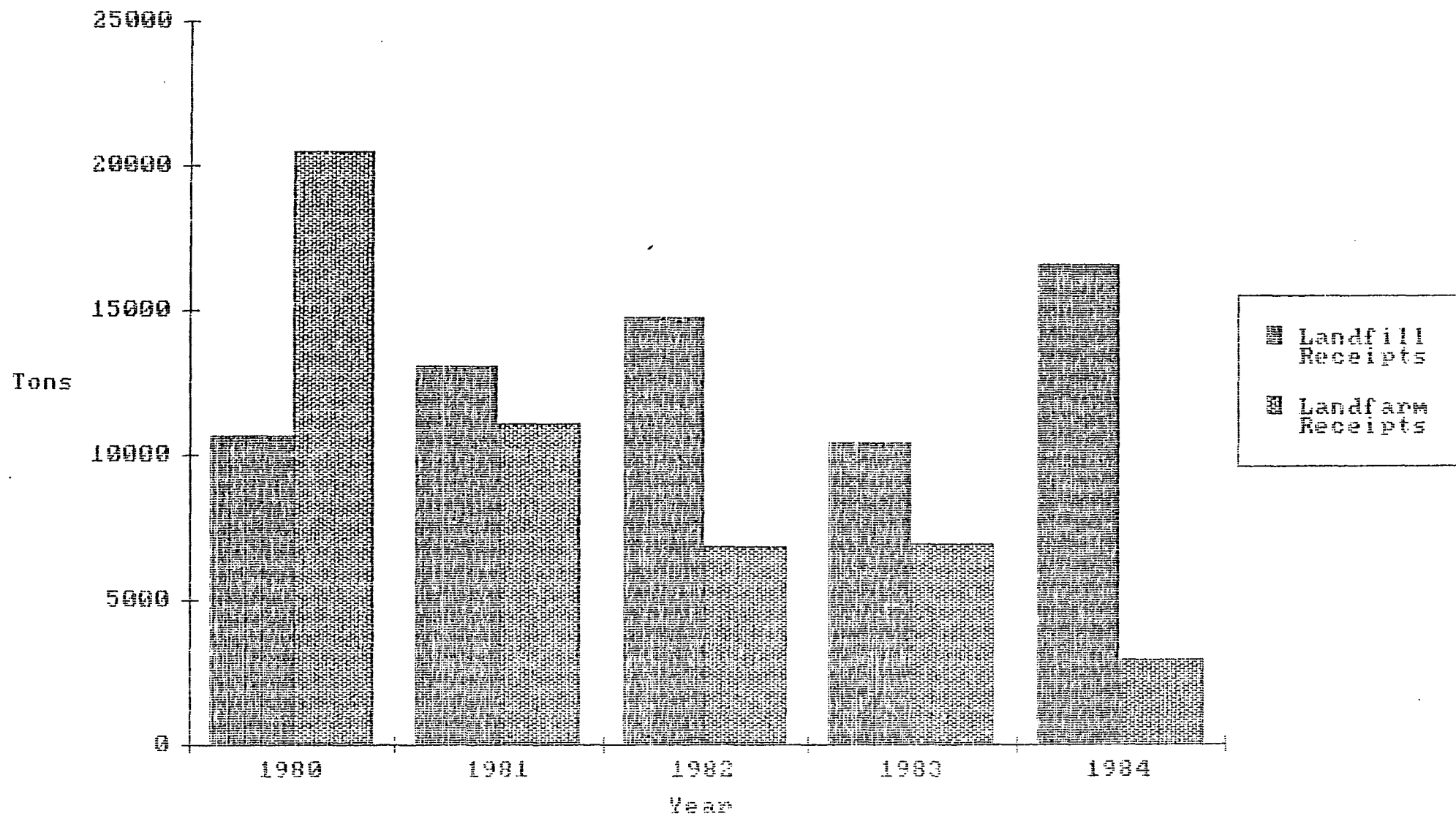


Figure 3.2. Comparison of landfill and land farm receipts.

## 4.0 SAMPLING AND ANALYSIS

This section outlines the procedures used for (1) the sampling conducted at Gulf Coast Waste Disposal Authority's (GCWDA) facility at Texas City, Texas and (2) the analysis of the samples collected. Included are descriptions of the location of each process sampled and the sampling grid used 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: three cells in the landfill, a land treatment area, and an unpaved road segment. All of the samples were analyzed for percent weight loss on drying (LOD), silt and PM<sub>10</sub> content, metals and semi-volatile organic compounds. In addition, the samples from the landfill cells were analyzed for cyanide and pesticides and the land treatment area samples were analyzed for oil and grease content. A tabular presentation of the sampling plan for GCWDA with 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 show the site plot plan for GCWDA. The scale of Figure 4.1 is approximately 1 inch equals 400 feet. The location of each process sampled is indicated on this site plan using the designated process letter. Pertinent topographical features, both natural and man-made, are also shown.



#### 4.2 CELL A, ACID WASTE (PROCESS P)

Cell A, designated process P, is located at the west end of the GCWDA (see Figure 4.1). The process boundaries of the active face were determined to approximate a rectangle with sides of 100' and 120'. Based on these dimensions, the sampling grid was designed and laid out using 20 foot square grid cells (see Figure 4.2). The grid cells were numbered from left to right starting in the northwest corner of the sampling grid.

MRI determined that eight grid cells would be sampled. A random number table was used to select the grid cells for sampling (Appendix C). Grid cell 12 was eliminated because it was on grass and grid cell 19 was eliminated because it was in water. Grid cells 16 and 11 were chosen as alternatives.

Because this process involved a temporary soil cover which is a moderately disturbed surface, MRI decided that it would be sampled using the scooping technique (see Appendix C). Within each cell, a sampling template was randomly tossed four times. 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 P-501 through P-508. Figure 4.2 shows each sample and the corresponding grid cell from which it was taken.

A ten-gram aliquot of each sample from this process was first analyzed for percent weight loss on drying (LOD) by drying for 12 to 16 hours in a 105°C oven. Because the LOD averaged over 10 percent, all the samples were oven-dried at 105°C for 3.5 hours followed by desiccation for 17 hours (see Table 4.1). Following drying, the samples were screened to determine percent silt content and the silt composite was sonic sieved to determine percent PM<sub>10</sub> content (see Appendix C for specifics of sample handling during each of these analyses).

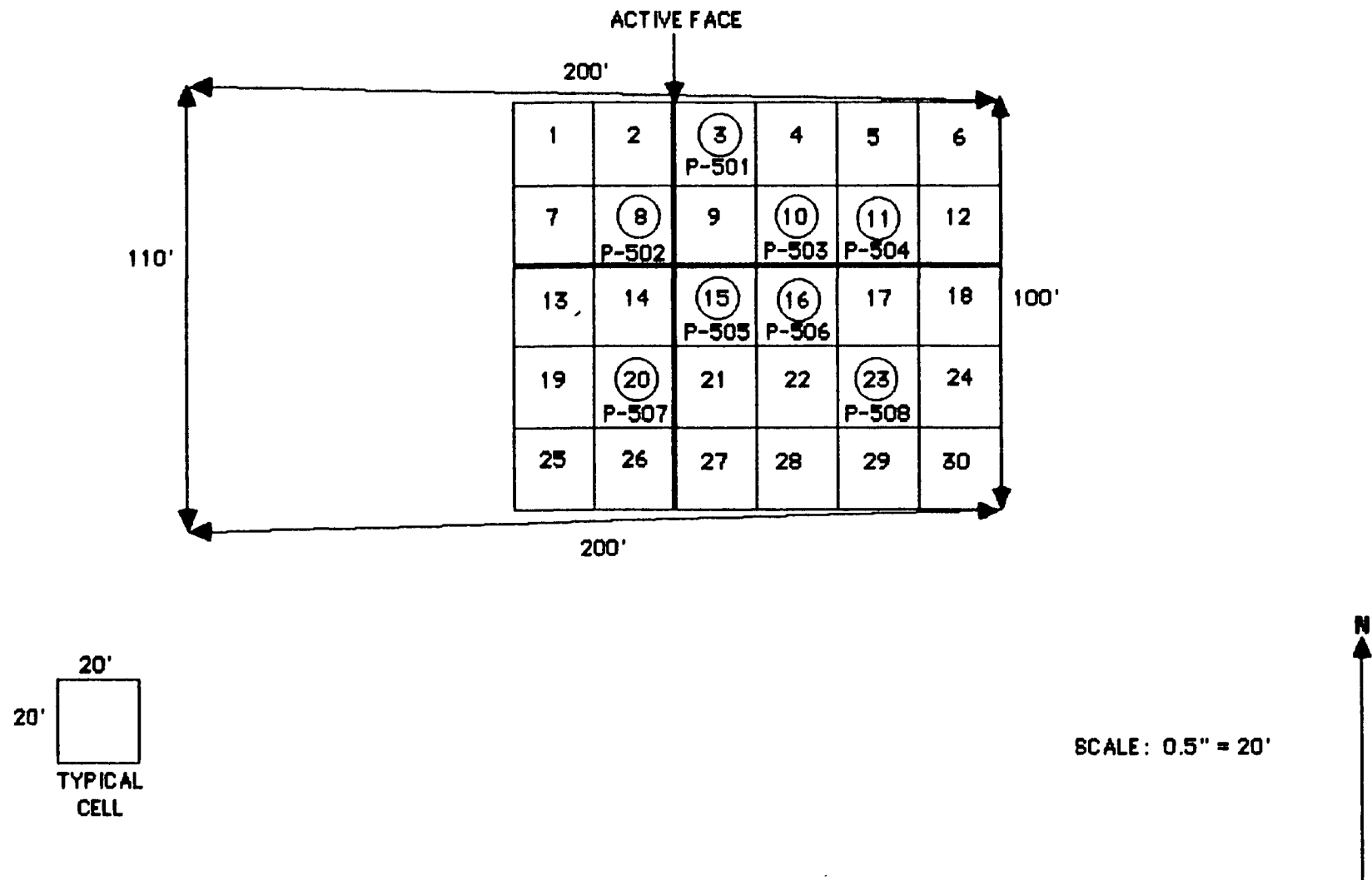


FIGURE 4.2. SAMPLING GRID, PROCESS DIMENSIONS, AND SAMPLE NUMBERS FOR THE "A" CELL (ACID WASTE) AT GULF COAST WASTE DISPOSAL AUTHORITY (PROCESS P).

TABLE 4.1. SAMPLE DRYING PROCEDURE SUMMARY

Process Sample ID Letter	Process Description	Drying Procedure
P	Cell A, Acid Wastes	Oven dried at 105°C for 3.5 hours followed by 17 hours of desiccation
Q	Cell Q, Filter Cake	Oven dried at 105°C for 6.5 hours followed by 85 hours of desiccation
R	Cell C, Metal Catalyst	Oven dried at 105°C for 2.5 hours followed by 20.5 hours of desiccation
BGD	Background Sample	Oven dried at 105°C for 2.5 hours followed by 18.25 hours of desiccation
X	Land Treatment	Oven dried at 105°C for 2.5 hours followed by 18.25 hours of desiccation
Y	Landfill Access Road	Desiccated for 20.5 hours

Using the screening and sieving techniques described in Appendix C, all the samples from this process were utilized to make composite samples of the silt,  $PM_{10}$ , and  $>PM_{10}$  fractions. The part of the silt sample that did not pass through the 20 um sonic sieve was referred to as the "greater than  $PM_{10}$ " ( $>PM_{10}$ ) fraction. Portions of these fractions 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 of 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 (Hg) samples were prepared and analyzed by the cold-vapor atomic absorption procedure following EPA Method 7471. Two modifications were used in the final dilutions of the digestates. The samples for inductively-coupled argon

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

Element	ICAP***	Detection Limits (ug/g)*	
		GFAA***	Cold Vapor AA***
Aluminum (Al)	40	-----	
Antimony (Sb)	-----	1.0	
Arsenic** (As)	-----	1.0	
Barium** (Ba)	0.7	-----	
Beryllium (Be)	0.1	-----	
Bismuth (Bi)	10.0	-----	
Cadmium** (Cd)	0.4	-----	
Chromium** (Cr)	0.7	-----	
Cobalt (Co)	0.7	-----	
Copper (Cu)	7.3	-----	
Iron (Fe)	100	-----	
Lead** (Pb)	10.0	-----	
Manganese (Mn)	5.9	-----	
Mercury** (Hg)	-----	-----	0.25
Molybdenum (Mo)	9.0	-----	
Nickel (Ni)	2.2	-----	
Osmium (Os)	4.0	-----	
Selenium** (Se)	-----	1.0	
Silver** (Ag)	10	-----	
Thallium (Tl)	-----	1.0	
Vanadium (V)	3.9	-----	
Zinc (Zn)	0.2	-----	

\* 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

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 by EPA Method 7841 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 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 two silt fractions from the Cell A samples were prepared for analysis of semivolatile organics and pesticides following the low-level concentration level 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  $>PM_{10}$  fraction was not analyzed for organic compounds as a cost saving measure, since the particle size dependency of the degree of contamination will compare the contamination values for the silt and  $PM_{10}$  fractions only. The sample extracts were screened by gas chromatography/ flame ionization detection (GC/FID) to determine the concentration level of the organic compounds in the sample extracts. The extracts were found to be at the medium level (i.e., containing any organic compound over 20 ug/g).

A cleanup procedure for the sample extracts using adsorption chromatography to remove aliphatic compounds was developed to reduce the amount of sample dilution necessary to protect the gas chromatograph/mass spectrometer (GC/MS).



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

(Continued)

TABLE 4.3. (continued)

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3-NITROANILINE
4-NITROANILINE
NITROBENZENE
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

---

This allowed the GC/MS analyses to be conducted at a lower detection limit. The extracts from Cell A samples were concentrated and subjected to an adsorption chromatography cleanup procedure using Sephadex LH-20 (described in Appendix C). The cleaned extracts were analyzed by GC/MS after a 10-fold dilution. The detection limit was 3.30 ug/g and for the silt (P-540) and PM<sub>10</sub> (P-542) fractions after the 10-fold dilution needed to protect the GC/MS.

#### 4.3 CELL Q, FILTER CAKE (PROCESS Q)

Cell Q is located in the northeast corner of the active landfill area (see Figure 4.1). The process boundaries of the active face approximated a rectangle with side dimensions of 75' and 105'. MRI determined that the grid cells would be 15 feet square, and the sampling grid was laid out using surveyors stakes and tape. The grid cells were numbered as shown in Figure 4.3.

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). Grid cells 11 and 31 were rejected because too many cells selected were on the process boundaries. Cells 2 and 24 were selected as alternatives.

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	AROCLOR 1016
21	AROCLOR 1221
22	AROCLOR 1232
23	AROCLOR 1242
24	AROCLOR 1248
25	AROCLOR 1254
26	AROCLOR 1260

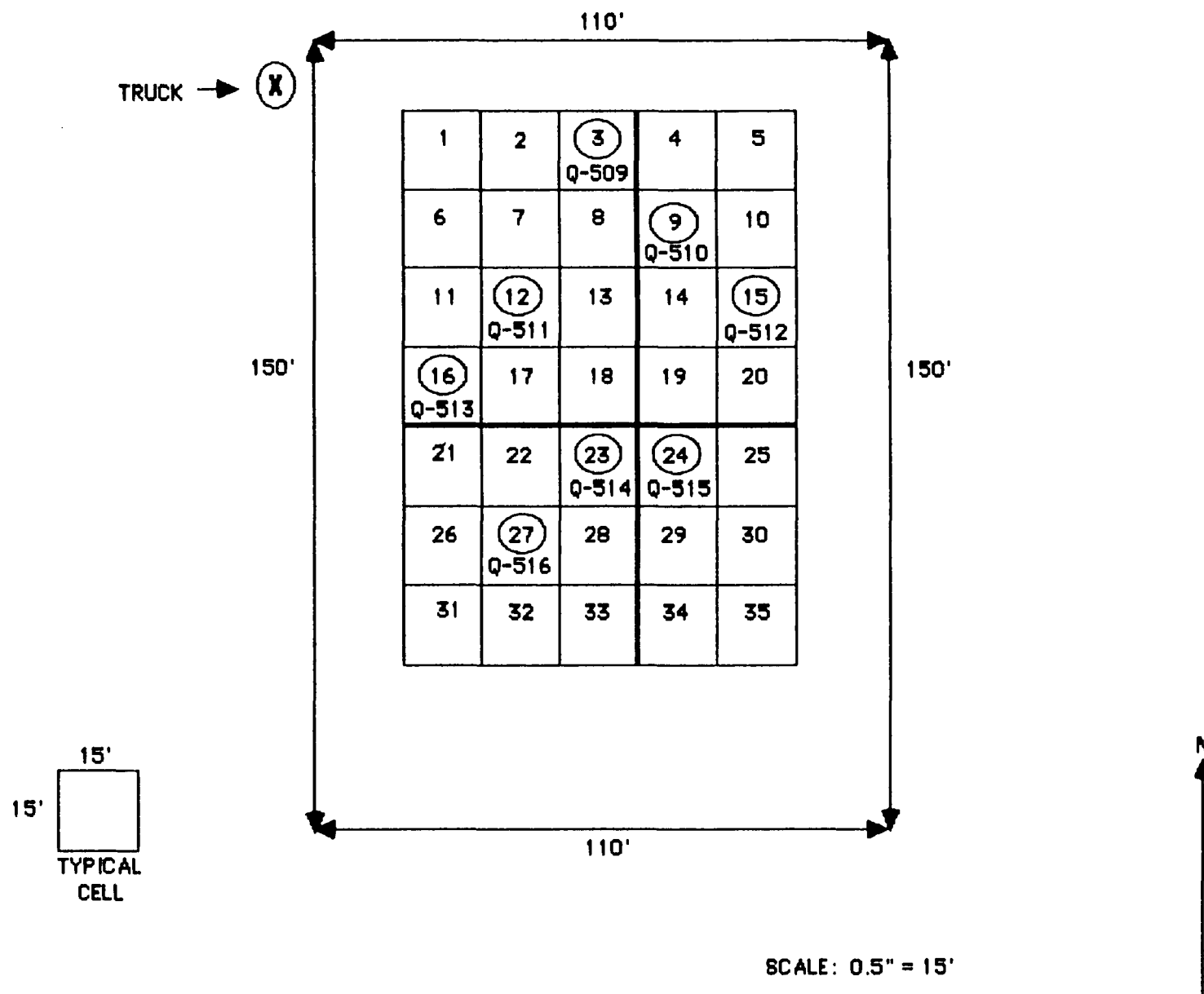


FIGURE 4.3. SAMPLING GRID, PROCESS DIMENSIONS, AND SAMPLE NUMBERS FOR "Q" CELL (CENTRIFUGE FILTER CAKE) AT GULF COAST WASTE DISPOSAL AUTHORITY (PROCESS Q).

MRI determined that for sample collection, the scooping technique should be used at this process. As previously described for Process P, 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.

Because the LOD determination on 10-gram portions of each sample yielded an average value greater than 10 percent, the samples from this process were oven-dried at 105°C for 6.5 hours followed by desiccation for 85 hours (see Table 4.1). They were then screened to determine percent silt content and sonic sieved to determine PM<sub>10</sub> 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<sub>10</sub>, and >PM<sub>10</sub> fractions from this process. Portions of the silt, PM<sub>10</sub>, and >PM<sub>10</sub> fractions were sent to RTI for metals and cyanide analyses and portions of silt and PM<sub>10</sub> fractions were sent to PEI for pesticides and semivolatile organics analysis. As for Process P, the >PM<sub>10</sub> fraction was not analyzed for pesticides or semivolatile organic compounds. All samples were analyzed for metals, cyanide, and semivolatile organic compounds as described previously for the composite samples from Process P.

Like the Process P samples, the organic extracts from the Cell Q samples were concentrated and subjected to the LH-20 cleanup procedure. The cleaned extracts were analyzed by GC/MS without further dilution, other than the dilutions resulting from the LH-20 cleanup procedure. The detection limit for the silt fraction (Q-550) was 1.58 ug/g (see Table 2.4) after a 4.8-fold dilution from the cleanup procedure. For the PM<sub>10</sub> fraction (Q-552) with a 5.3-fold cleanup dilution factor, the sample detection limit was 1.75 ug/g.

#### 4.4 CELL C, METAL CATALYSTS (PROCESS R)

Cell C, designated Process R, is located in the northwest corner of the landfill area (see Figure 4.1). The process boundaries of the active face approximated a rectangle with sides of 22' and 96'. MRI decided that the area was too small for random grid cell sampling, so the active face of Cell A was divided into 8 equal rectangular grid cells (12' by 22') and all were sampled.

Because this process involved a moderately disturbed surface, MRI decided that the scooping technique would be used for sampling. Like Processes P and Q, Cell A samples were collected from inside the areas defined by random tosses of the sampling template. Eight samples, numbered R-517 through R-524 were taken from Cell A. Figure 4.4 shows each sample and the corresponding grid cell where the sample was taken.

A 10-gram aliquot of each sample from this process was first analyzed for its LOD by drying for 12 to 16 hours in a 105°C oven. Later, all samples were oven-dried at 105°C for 2.5 hours followed by desiccation for 20.5 hours. The dried samples were screened for percent silt content and sonic sieved for percent PM<sub>10</sub> content (see Appendix C).

The same screening and sieving techniques were used to make composite samples of the silt, PM<sub>10</sub>, and >PM<sub>10</sub> fractions from this process. Portions of each fraction were submitted to RTI for metals and cyanide analyses. Like the other two landfill processes, only the silt and PM<sub>10</sub> fractions were submitted to PEI for pesticides and semivolatile organics analysis. The fractions were analyzed for metals, cyanide, pesticides, and semivolatile organic compounds as described previously for the composite samples from Process P. Like the Process P sample extracts, the Process R samples were screened by GC/FID and found to be at the medium concentration level. The Process R sample extracts were concentrated and subjected to the LH-20 cleanup procedure. The cleaned extracts were analyzed by GC/MS after a 10-fold dilution, necessary

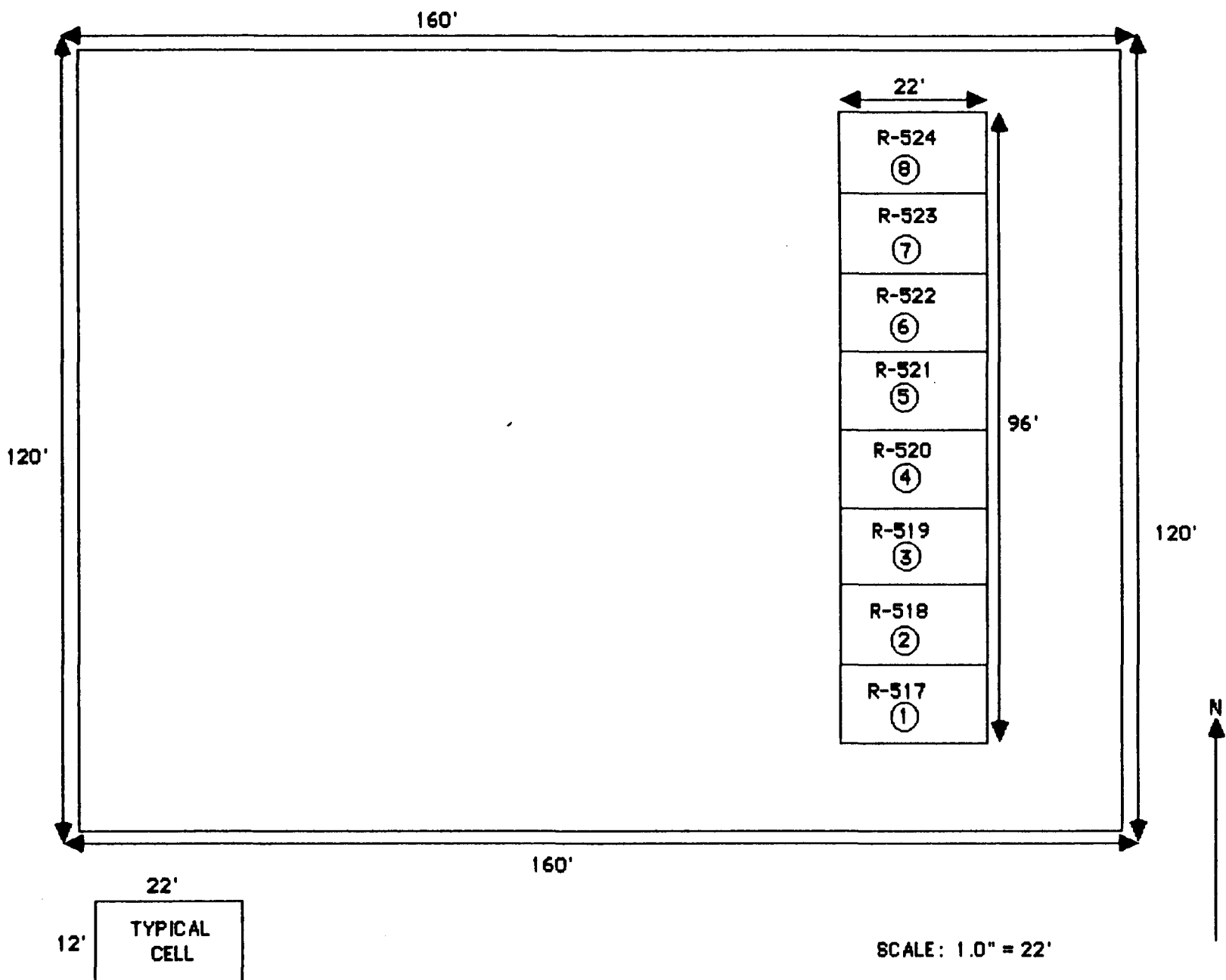


FIGURE 4.4. SAMPLING GRID, PROCESS DIMENSIONS, AND SAMPLE NUMBERS FOR ACTIVE AREA OF "C" CELL (METAL CATALYSTS) AT GULF COAST WASTE DISPOSAL AUTHORITY (PROCESS R).

to protect the instrument. The detection limit for the Process R samples was 3.30 ug/g after the 10-fold dilution.

#### 4.5 LAND TREATMENT AREA (PROCESS X)

The land treatment area (Process X) was located due north of the main road through the facility in the northwest corner (see Figure 4.1). The entire land treatment area shown in Figure 4.1 was not included in the process as defined for the sampling grid system because of the water present on its surface following the heavy rains. The boundaries for the process area sampled in the land treatment area approximated a rectangle with dimensions of 240' by 360'. MRI determined that the grid cells would be 30 feet square. The sampling grid was laid out using surveyors stakes and tape and the grid cells were numbered as shown in Figure 4.5.

MRI directed that eight grid cells be sampled. As for Process P, a random number table was used to select the specific grid cells for sampling (see Appendix C). Grid cells 54 and 86 were rejected because of water standing in the cells. Cells 68 and 90 were selected as alternative cells for sampling. MRI determined that for sample collection, the scooping technique would be used for this process. As described previously for Process P, a sampling template was used to determine where sample aliquots were taken from within the selected grid cells.

For the determination of oil and grease content for the land treatment area samples, 10-gram aliquots were taken from each sample and mixed to form a composite sample. The oil and grease content was determined on the composite sample using the procedures described in Appendix C.

The LOD determination was conducted on a second 10-gram portion taken from each land treatment area sample. Because the LOD values averaged over 10



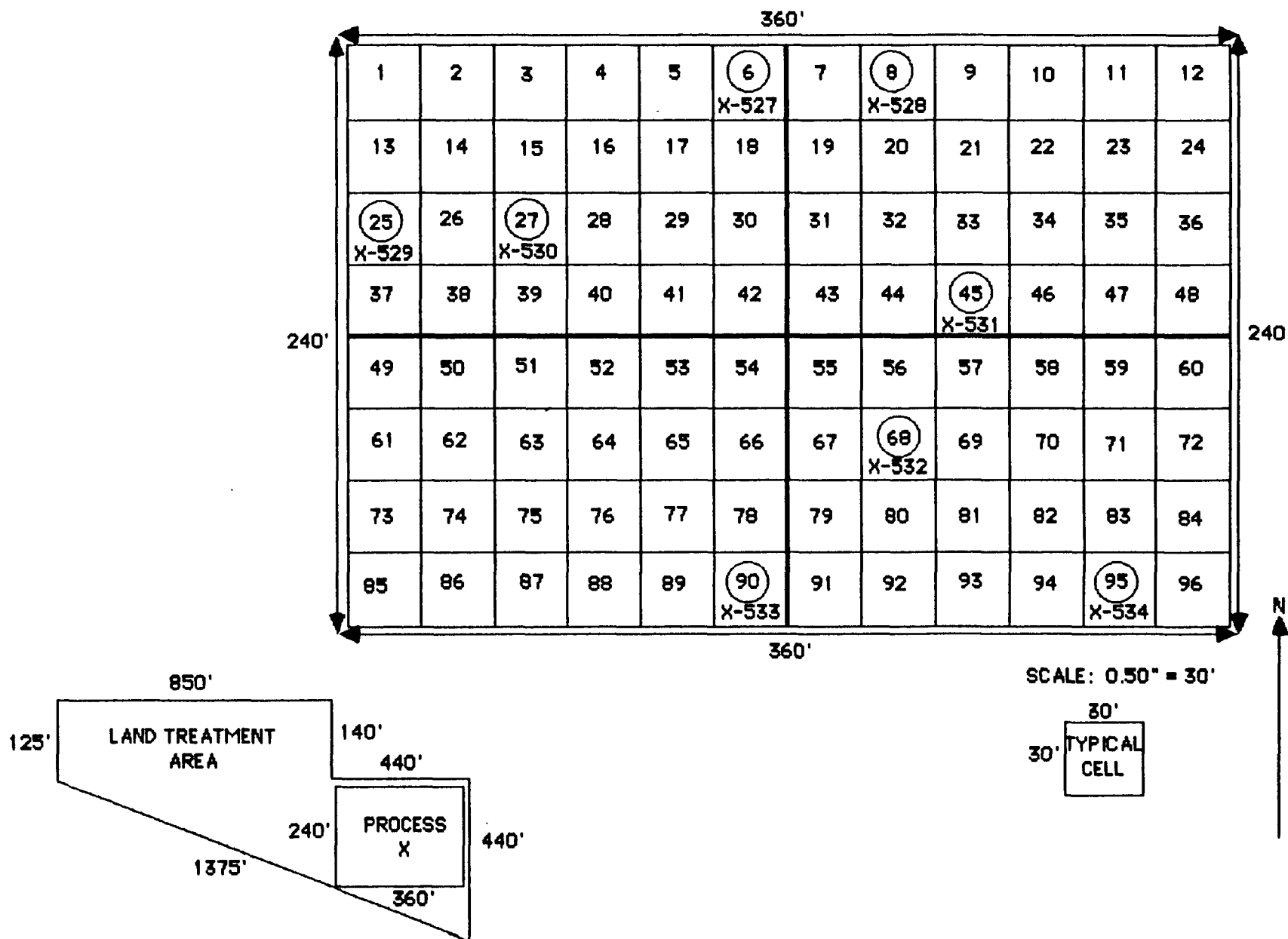


FIGURE 4.5. PROCESS DIMENSIONS, SAMPLING GRID AND SAMPLE NUMBERS FOR LAND TREATMENT AREA AT GULF COAST WASTE DISPOSAL AUTHORITY (PROCESS X).

percent, the samples were oven-dried at 105°C for 2.5 hours and desiccated for 18.25 hours prior to silt screening. The silt resulting from screening each sample was mixed to form a silt composite and the PM<sub>10</sub> content was determined on the silt composite by sonic sieving. Because the silt yield was low and the PM<sub>10</sub> content of the silt was also low, the decision was made not to produce PM<sub>10</sub> and >PM<sub>10</sub> fractions from the silt for the chemical analyses.

Portions of the silt fraction were submitted to RTI and PEI for metals analysis and semivolatile organics analysis, respectively. They were analyzed for metals and semivolatile organic compounds as described previously for the composite samples from Process P.

As for the Process P samples, the land treatment sample extract was concentrated and subjected to the LH-20 cleanup procedure. The cleaned extract was analyzed by GC/MS after a 10-fold dilution necessary to protect the instrument and a 19.1-fold dilution resulting from the LH-20 cleanup procedure. The detection limit for the sample was 62.9 ug/g with a cumulative dilution factor of 191.

#### 4.6 LANDFILL ACCESS ROAD (PROCESS Y)

The landfill access road was sampled near the entrance to the landfill area (see Figure 4.1). Sampling covered an 8 foot width of the road in a 24-inch wide strip (see Figure 4.6).

Since unpaved roads are a hard-crust, undisturbed surfaces, MRI recommended sampling this process using the sweeping technique. A disposable brush was used to brush the loose particulate from the road into a scoop which was used to deposit it into a sample jar. The single sample taken was numbered Y-535.

DATE: 11/08/85

PROCESS LETTER: Y

SITE NAME GULF COAST WASTE DISPOSAL AUTHORITY

LOCATION TEXAS CITY, TEXAS

SAMPLING TEAM S. PLAISANCE, K. SPEARS

PROCESS NAME ROAD SAMPLE

SAMPLING TECHNIQUE SWEEPING

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

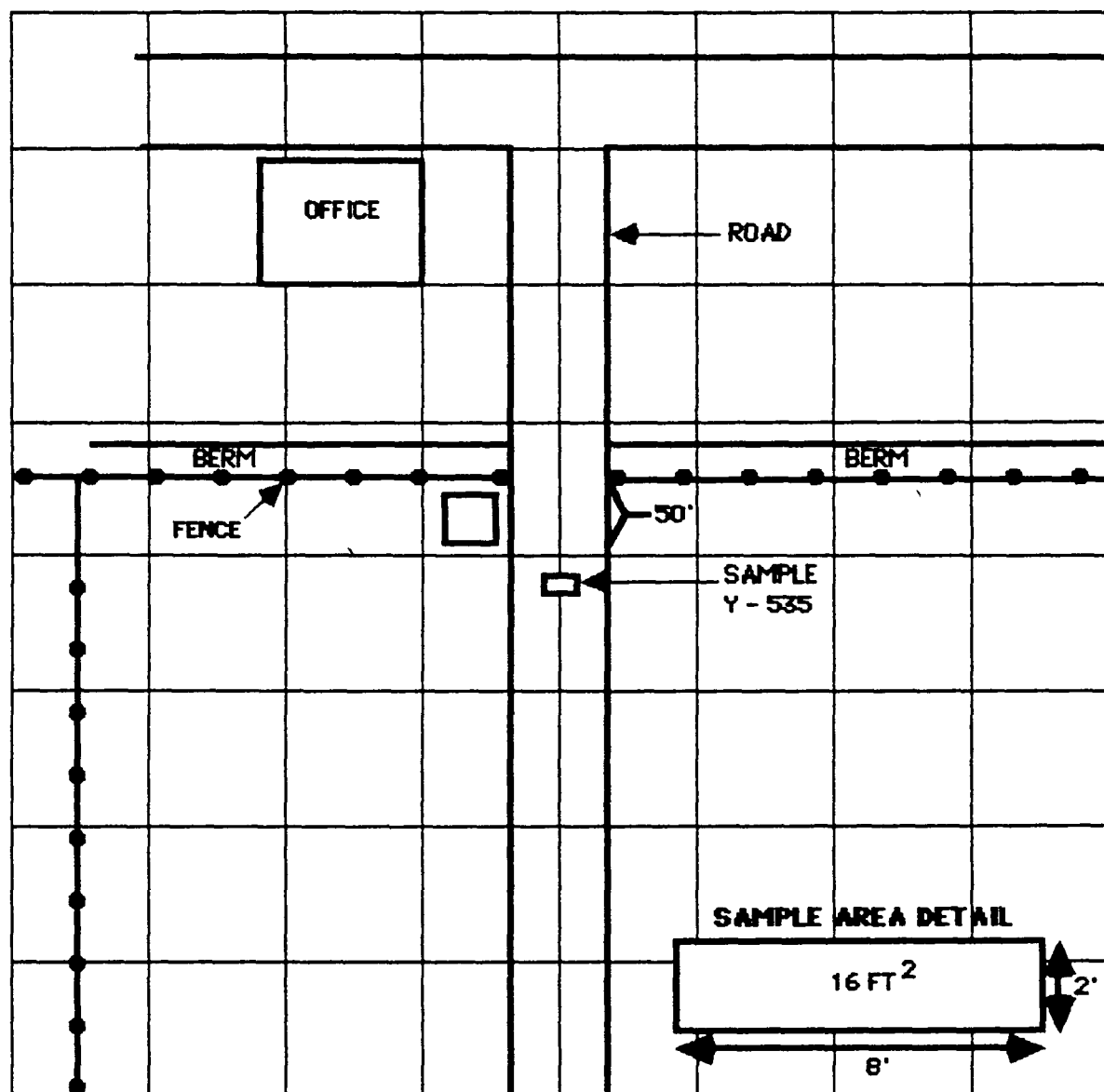


FIGURE 4.6. SKETCH SHOWING APPROXIMATE LOCATION OF ROAD SAMPLE (INCLUDING DIMENSIONS) TAKEN AT GULF COAST WASTE DISPOSAL (PROCESS Y).

The sample from this process was first analyzed for LOD by drying a 10-gram portion for 12 to 16 hours in a 105°C oven. Later, the entire sample was dried in a desiccator for 20.5 hours. It was analyzed for percent silt content and percent PM<sub>10</sub> content (see Appendix C). Because an insufficient amount of silt was available, the sample was not screened to produce PM<sub>10</sub> and >PM<sub>10</sub> material for chemical analysis.

Portions of the silt fraction only were submitted to RTI and PEI for analysis of metals and semivolatile organics, respectively. They were analyzed for metals, and semivolatile organic compounds as described previously for the composite samples from Process P.

As for the Process P sample extracts, the landfill access road sample extract was concentrated and subjected to the LH-20 cleanup procedure. The cleaned extract was analyzed by GC/MS at a detection limit of 0.330 ug/g without any dilution.

#### 4.7 BACKGROUND SAMPLES

Two background samples were taken at GCWDA in an area outside the main gate of the facility (see Figure 4.7). The scooping technique was used for sample collection. These samples were numbered BGD-525 and BGD-526.

These background samples were analyzed for LOD and oven-dried for 2.5 hours at 105°C and then desiccated for 18.25 hours. The dried samples were analyzed for percent silt and percent PM<sub>10</sub> content (see Appendix C). The insufficient quantity of silt produced by screening the samples did not allow the production of PM<sub>10</sub> and >PM<sub>10</sub> material for chemical analysis.

Portions of the silt fraction generated by screening the background samples were sent to RTI and PEI for metals analysis and semivolatile organics analysis, respectively. They were analyzed for metals and semivolatile organic compounds as described previously for the composite samples from Process P.

DATE: 10/30/85

PROCESS LETTER: BGD

SITE NAME GULF COAST WASTE DISPOSAL AUTHORITY

LOCATION TEXAS CITY, TEXAS

SAMPLING TEAM GENE RILEY, PHIL ENGLEHART

PROCESS NAME BACKGROUND SAMPLES

SAMPLING TECHNIQUE SCOOPING

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

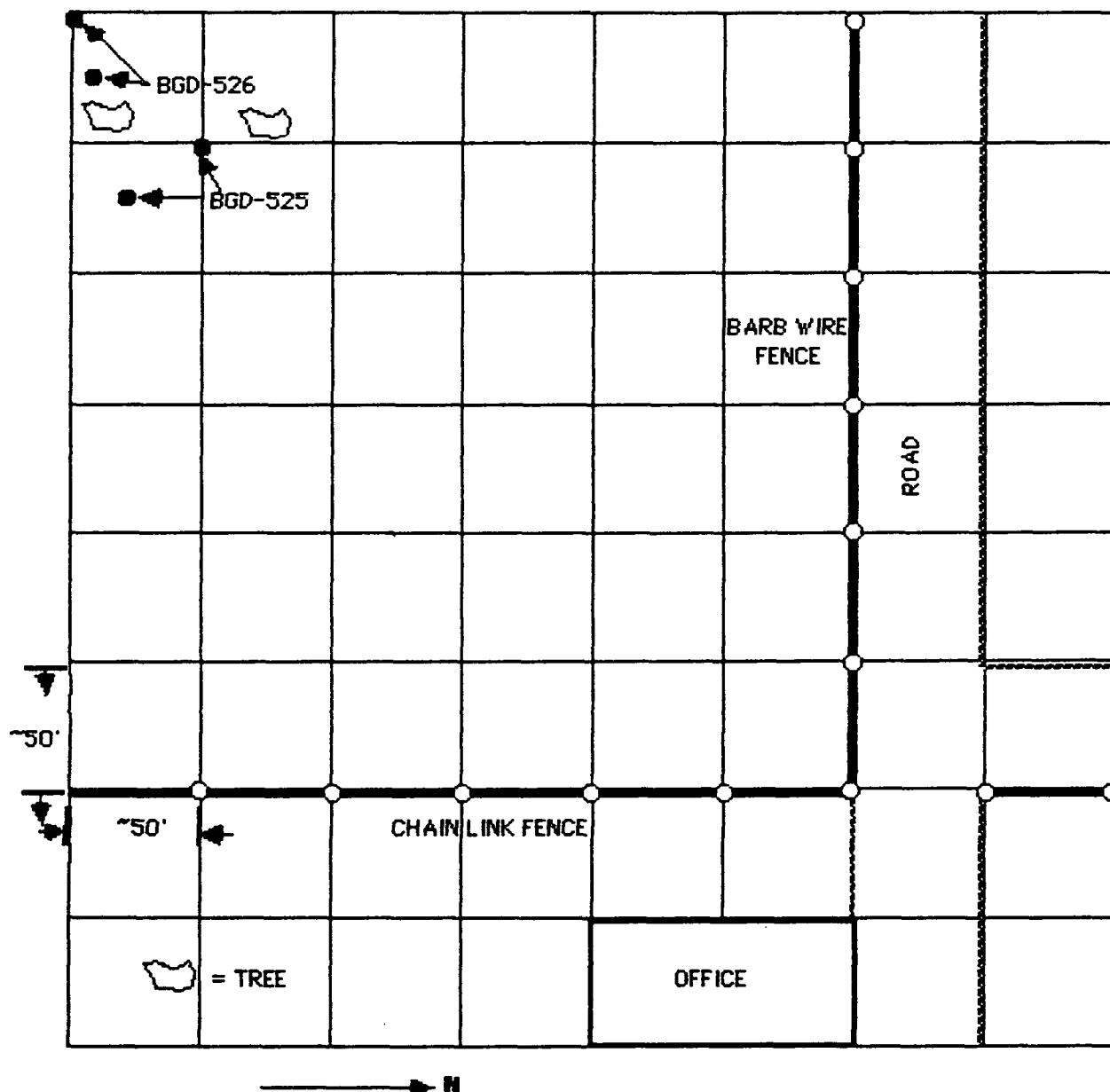


FIGURE 4.7. SKETCH SHOWING APPROXIMATE LOCATIONS WHERE BACKGROUND SAMPLES WERE TAKEN AT GCWDA.

Like all the process samples, the background sample extract was concentrated and subjected to the LH-20 cleanup procedure. The clean extract was analyzed by GC/MS at a detection limit of 0.330 ug/g without any dilution.

## 5.0 QUALITY ASSURANCE

The quality assurance (QA) measures for the chemical analyses were the quality control (QC) measures conducted internally by each laboratory. For the metals analysis, RTI used National Bureau of Standards (NBS) water (1643 B) as check samples for the accuracy of the instrumentation. An NBS fly ash sample (1633 A) was used as a QA sample to check the overall accuracy of the digestion and analysis procedures. One sample (P-545) was spiked with eight elements and their percent recoveries calculated to assess matrix effects. A sample (R-565) was analyzed in duplicate to demonstrate analytical precision. Quality assurance results for the metals analysis are presented in Table 5.1.

For the QA on the analysis of the semivolatile organics and pesticides (Table 5.2), PEI used a sample (Q-550) for a matrix spike (MS) and a matrix spike duplicate (MSD). The percent recoveries were determined and the relative percent difference (RPD) for the duplicates calculated. For the matrix spike, the recovery of 2, 4-dinitrotoluene was 93%, which was above the QC limit of 89%, and the recovery of 1,4-dichlorobenzene was 11%, which was below the QC limit of 28%. For the matrix spike duplicate, the recoveries of N-nitrosodipropylamine, 1,4-dichlorobenzene phenol, and 2-chlorophenol were all below the QC limits of 41, 28, 26, and 25%, respectively. The RPD's of the concentration values for the matrix spike duplicates for N-nitrosodipropylamine, 1,4-dichlorobenzene, phenol, 2-chlorophenol, 4-chloro-3-methylphenol, and 4-nitrophenol were below the QC limits of 38, 27, 35, 50, 33, and 50%, respectively. The poor recovery of the matrix spike compounds was thought to be primarily related to the amount of dilution required. The

TABLE 5.1. QUALITY ASSURANCE RESULTS FOR METALS ANALYSIS FOR GCWDA

Sample Identity	EPA Check Sample		NBS Fly Ash 1633 A		NRC Sediment MESS-1		Matrix Spike (P-545)			Duplicates	
	Expected	Found	Expected	Found	Expected	Found	Expected	Found	Percent	R-565	R-565
Elements (ug/g)	(ug/g)	(ug/g)	(ug/g)	(ug/g)	(ug/g)	(ug/g)	(ug/g)	(ug/g)		(ug/g)	(ug/g)
Aluminum (Al)	-	-	140,000	18,000	58,000	14,000	30,859	31,436	-	89,102	83,695
Antimony (Sb)	8.2	9.0	7.0	3.5	0.73	0.73	-	-	-	1.5	1.3
Arsenic (As)	43.0	43.6	145	136	10.6	10.3	25.50	28.30	111%	12.0	5.7
Barium (Ba)	-	-	1500	743	-	46.0	1,713	1,300	76%	94.4	88.6
Beryllium (Be)	29.0	30.5	12.0	3.9	1.9	0.9	482	422	88%	3.7	3.6
Cadmium (Cd)	9.1	7.7	1.0	3.0	0.6	0.1	481	412	86%	<5	<5
Chromium (Cr)	7.1	6.8	196	41.4	71.0	31.3	173	142	82%	4,278	4,103
Cobalt (Co)	43.0	40.1	46.0	15.9	10.8	10.5	10.1	11.5	-	250	240
Copper (Cu)	8.9	12.3	118	43.3	25.1	23.3	594	541	91%	248	239
Iron (Fe)	-	-	94,000	35,000	36,500	23,000	15,285	14,718	-	173,248	172,113
Lead (Pb)	43.0	43.0	72.4	64.5	34.0	53.2	521	446	86%	97.3	94.5
Manganese (Mn)	13.0	12.9	190	78.0	513	322	619	550	89%	192	187
Mercury (Hg)	-	-	0.17	0.18	-	-	0.45	0.46	103%	<0.03	<0.03
Molybdenum (Mo)	-	-	29	66	-	25.4	109	84	77%	89.3	92.0
Nickel (Ni)	-	-	127	40.0	29.5	22.8	136	119	88%	528	483
Osmium (Os)	-	-	-	-	-	-	-	-	-	<2	<2
Selenium (Se)	7.6	6.9	10.3	7.6	0.4	0.4	20.0	19.7	99%	<0.5	<0.5
Silver (Ag)	-	-	-	-	-	-	494	437	88%	52.3	116
Thallium (Tl)	25.2	26.7	5.7	2.7	0.7	0.3	19.9	17.8	89%	0.5	<0.5
Vanadium (V)	130	123	300	121	72.4	42.9	158	147	93%	694	663
Zinc (Zn)	10.0	10.0	200	94.2	191	247	703	599	85%	963	912
cyanide	-	-	-	-	-	-	-	-	-	<0.5	<0.5



TABLE 5.2. QUALITY ASSURANCE RESULTS FOR PESTICIDES  
AND SEMIVOLATILE ORGANICS ANALYSIS

SOIL SURROGATE PERCENT RECOVERY SUMMARY

Sample Identity	Silt P-540	PM-10 P-542	Silt Q-550	PM-10 Q-552	Silt R-560	PM-10 R-562	Silt BGD-570	Silt X-580	Silt Y-595	Sample Blank	Matrix Spike	Matrix Duplicate	Spike
Surrogate Compounds													
Nitrobenzene-d5	20%	34%	30%	16%	0%	44%	2%	0%	41%	0%	54%	34%	
2-Fluorobiphenyl	69%	80%	103%	88%	56%	77%	41%	0%	80%	0%	121%	108%	
Terphenyl-d14	99%	106%	135%	139%	102%	118%	97%	0%	88%	106%	153%	128%	
Phenol-d5	35%	59%	25%	25%	31%	61%	19%	0%	52%	0%	73%	60%	
2-Fluorophenol	0%	11%	0%	0%	0%	39%	1%	0%	15%	0%	16%	0%	
2,4,6-Tribromophenol	81%	86%	53%	52%	54%	32%	107%	0%	36%	62%	99%	83%	

SEMIVOLATILE ORGANIC SOIL MATRIX SPIKE/MATRIX SPIKE DUPLICATE RECOVERY SUMMARY

Sample Identity Q-550	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	2.0 J	59%	1.9	56%	7%
Acenaphthene	3.3	0.0	3.8	113%	3.3	99%	13%
2,4-Dinitrotoluene	3.3	0.0	3.1	93%	2.1	64%	38%
Pyrene	3.3	0.2 J	4.1	117%	3.6	103%	12%
N-Nitrosodi-n-Propylamine	3.3	0.0	1.5 J	45%	0.94 J	28%	46%
1,4-Dichlorobenzene	3.3	0.0	0.37 J	11%	0.25 J	8%	38%
Pentachlorophenol	6.7	0.0	3.8 J	57%	5.0 J	75%	26%
Phenol	6.7	0.0	3.5	52%	1.5 J	22%	82%
2-Chlorophenol	6.7	0.0	2.3	35%	0.92 J	14%	88%
4-Chloro-3-methylphenol	6.7	0.0	5.5	83%	3.3	50%	50%
4-Nitrophenol	6.7	0.0	5.3 J	79%	3.1 J	46%	53%
2-Methylnaphthalene *	0.0	0.0	0.25 J	-	0.18 J	-	33%
Dimethyl Phthalate *	0.0	0.0	0.0	-	0.50 J	-	0%
Diethylphthalate *	0.0	0.0	0.0	-	0.18 J	-	0%
N-nitrosodiphenylamine *	0.0	0.0	1.8 J	-	1.3 J	-	32%
Phenanthrene *	0.0	0.0	0.48 J	-	0.0	-	0%
Butylbenzylphthalate *	0.0	0.0	0.0	-	0.10 J	-	0%
Bis(2-ethylhexyl)phthalate *	0.0	0.0	0.96 J	-	1.3 J	-	30%
Di-n-octylphthalate *	0.0	0.0	0.76 J	-	0.82 J	-	8%
Sample Detection Limit (ug/g)							
Pentachlorophenol, 4-Nitrophenol		7.7	13.6		8.0		
All other compounds		1.6	2.8		1.7		

\* = 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 R-560	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	0.015	57%	0.013	48%	17%
Heptachlor	0.027	0.0	0.013	50%	0.012	44%	12%
Aldrin	0.027	0.0	0.022	84%	0.020	76%	10%
Dieldrin	0.067	0.0	0.052	77%	0.051	77%	0%
Endrin	0.067	0.0	0.066	100%	0.065	98%	2%
4,4'-DDT	0.067	0.0	0.059	89%	0.055	83%	7%
Sample Detection Limit (ug/g)							
Lindane, Heptachlor, Aldrin		0.008	0.008		0.008		
Dieldrin, Endrin, 4,4'-DDT		0.016	0.016		0.016		

## SUMMARY OF METHOD BLANK ANALYSIS

Blank ID	Compound Identity	Concentration
		(ug/g)
Sample Blank for Semivolatile Organics	Di-n-butylphthalate	0.063 J

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

recovery of the pesticide matrix spike compounds for sample R-560 were within the QC limits for all compounds. The matrix spike samples did not require dilution prior to analysis and are believed to be accurate.

All samples received were also spiked with surrogate compounds and the percent recoveries of these compounds were determined. Recovery of nitrobenzene-d<sub>5</sub> was below the CLP QC limit of 23% for samples P-540, Q-552, R-560, BGD-570, X-580, and the sample blank. Recovery of 2-fluorobiphenyl was below the QC limit of 30% for samples X-580 and the sample blank, and above the QC limit of 115% for the Q-550 matrix spike (MS). Recovery of terphenyl-d<sub>14</sub> was above the QC limit of 137% for samples Q-552 and Q-550 MS and below the QC limit of 18% for X-580. Recovery of phenol-d<sub>5</sub> was below the QC limit of 24% for samples BGD-570 and X-580 and the sample blank. Recoveries of 2-fluorophenol were below the QC limit of 25% for all samples except sample R-562. Recovery for 2,4,6-tribromophenol was below the QC limit of 19% for sample X-580 only.

The accuracy of the percent recovery of the surrogates, like the matrix spike samples, is affected by the amount of sample dilution. In the case of sample X-580, the land treatment sample, the cumulative dilution was 191-fold and none of the surrogate compounds were found. In contrast, the road sample, Y-595, was not diluted at all and the surrogate compound recoveries for this sample were acceptable. For the method blank analysis only one compound, di-n-butylphthalate, was detected at an estimated concentration of 0.063 ug/g. The concentration of di-n-butylphthalate was well below the QC limit for common phthalate esters.