N60508.AR.002496
NAS WHITING FIELD
5090.3a

FINAL SOIL GAS SURVEY FOR OUTLYING LANDING FIELD BARIN NAS WHITING FIELD FL
6/1/1993
TARGET ENVIRONMENTAL

FINAL REPORT
SOIL GAS SURVEY

OLF BARIN
11490 BARIN FIELD ROAD
FOLEY, ALABAMA

PREPARED FOR

ABB ENVIRONMENTAL SERVICES
2590 EXECUTIVE CENTER CIRCLE EAST
TALLAHASSEE, FLORIDA 32301

PREPARED BY

TARGET ENVIRONMENTAL SERVICES, INC.
9180 RUMSEY ROAD
COLUMBIA, MARYLAND 21045
(410) 992-6622

JUNE 1993

TABLE OF CONTENTS

	Page
EXECUTIVE SUMMARY	ii
Introduction	1
Sample Collection and Analysis	1
Quality Assurance/Quality Control (QA/QC) Evaluation	3
Results	4
Interpretation	4
Conclusions	6

FIGURES

Figure 1. Sample Locations

Figure 2. Total FID Volatiles

Figure 3. Tetrachloroethene (PCE)

TABLES

Table 1. Analyte Concentrations via GC/FID

Table 2. Analyte Concentrations via GC/ECD

APPENDICES

APPENDIX A - Field Procedures

APPENDIX B - Laboratory Procedures

APPENDIX C - Detectability & Terminology

EXECUTIVE SUMMARY

On May 17-22, 1993, **TARGET Environmental Services, Inc. (TARGET)** conducted a soil gas survey at the **Outlying Landing Field (OLF) Barin** in Foley, Alabama. A total of 88 passive soil gas samples were collected after 3 days of exposure at a depth of 1.5 feet. The samples were analyzed on a gas chromatograph equipped with a flame ionization detector (GC/FID) for petroleum hydrocarbons and an electron capture detector (GC/ECD) for chlorinated hydrocarbons. The objective of the survey was to investigate site soils for the presence of volatile organic compounds (VOC's) and to determine the magnitude and extent of any contamination detected.

Low levels of Total FID Volatiles were present in Samples 2 and 8, from the northern boundary of the site. Very low levels of toluene (1.0 to 1.2 μg/l) were observed in several samples collected around the pump islands and in 4 other widely scattered samples. The presence of similar concentrations of toluene in all three field control samples and in 3 of the 6 trip blanks suggests that the toluene may be the result of minor contamination of the vials during handling rather than a reflection of conditions in the soil vapor at these locations. None of the remaining FID analytes were present above the 1 μg/l reporting limit in any of the samples.

GC/ECD analysis revealed very low levels (<1.0 μg/l) of tetrachloroethene (PCE) in several areas of the site. Neither trans-1,2-dichloroethene (t-1,2-DCE) nor trichloroethene (TCE) were present above the 1 μg/l reporting limit in any of the samples.

Introduction

ABB Environmental Services, Inc. (ABB-ES) contracted **Target Environmental Services, Inc. (TARGET)** to perform a soil gas survey at the **Outlying Landing Field (OLF) Barin** in Foley, Alabama. The following site information was taken from the "Specification For Soil Gas Survey Services - RFP DDC93-022". The 30-acre survey area includes Site 19B, the Former Hangar Maintenance Area and Site 20B, the Underground Storage Tank and Fuel Pit Area. Numerous types of solvents (including toluene, carbon tetrachloride, trichloroethene, tetrachloroethene, trichloroethane and petroleum distillates), oils and fuels were reportedly used by maintenance personnel in their aircraft maintenance operations. Waste oils generated from servicing aircraft were stored in underground waste oil tanks prior to transport off-site for disposal.

The survey was designed by **ABB-ES** to include passive soil gas sampling at a depth of 18 inches below grade. Spacing between samples varied from approximately 50 feet to greater than 100 feet. Soils were reported to consist of silty sands, with clayey sands in some areas. Ground water reportedly occurs at approximately 12 feet. The field phase of the soil gas survey was conducted on May 17-22, 1993.

Sample Collection and Analysis

Soil gas samples were collected at a total of 88 locations at the site, as shown in Figure 1. Sampling point #9 was eliminated by the on-site **ABB-ES** representative. All samples were placed 18 inches below grade. The type of surface material and the dates of insertion and collection are reported in Table 1. The samplers were left in place for 3 days to allow equilibration with surrounding soil vapors. Samplers were retrieved in the same order they were inserted to insure

a uniform exposure period. A detailed explanation of the sampling procedure is provided in Appendix A.

All of the samples collected during the field phase of the survey were subjected to dual analyses. One analysis was conducted according to EPA Method 601 (modified) on a gas chromatograph equipped with an electron capture detector (ECD), and using direct injection. Specific analytes requested by **ABB-ES** to be standardized for this analysis were:

trans-1,2-dichloroethene (t12DCE)
trichloroethene (TCE)
tetrachloroethene (PCE)

The second analysis was conducted according to EPA Method 602 (modified) on a gas chromatograph equipped with a flame ionization detector (FID), and using direct injection. The analytes selected for standardization in this analysis were:

benzene
toluene
ethylbenzene
meta- and para- xylene
ortho- xylene

These compounds were chosen because of their utility in evaluating the presence of fuel products, or petroleum based solvents. An explanation of the laboratory procedures is provided in Appendix B.

The tabulated results of the laboratory analyses of the soil gas samples are reported in micrograms per liter (μg/l) in Tables 2 and 3. Although "micrograms per liter" is equivalent to "parts per billion (v/v)" in water analyses, they are not equivalent in gas analyses, due to the difference in the mass of equal volumes of water and gas matrices. The xylenes concentrations reported in Table 2 are the sum of the m- and p-xylene and the o-xylene concentrations for each sample.

Quality Assurance/Quality Control (QA/QC) Evaluation

Field QA/QC Samples

Duplicate samples were collected at every tenth location by placing two separate samplers within 1 foot of each other and exposing them for the same period of time. A **trip blank** was designated for each day of field work. The trip blanks consisted of a vial wrapped in teflon and held in its aluminum bag with all the sample vials which had not yet been emplaced. At the end of each day of sampling activities, a vial was removed from its aluminum bag, held for approximately 30 seconds (to simulate the time required to place a vial in the sampler prior to insertion in the ground), capped and submitted for analysis. **Field control samples** were also collected by placing a vial into a holder and wrapping the entire sampler apparatus in aluminum foil. One field control sample was left lying on the surface each day samplers were emplaced. The field control samples were also exposed for a period of 3 days. The laboratory results of the analysis of all these QA/QC samples are reported in Tables 2 and 3. Very low levels of toluene were present in all three field control samples and in 3 of the 6 trip blanks. The presence of similar levels in several of the field samples suggests that the toluene may be the result of minor contamination of the vials during handling rather than a reflection of conditions in the soil vapor at these locations. None of the remaining analytes were present above their respective reporting limits in any of these QA/QC samples.

Laboratory QA/QC Samples

To document analytical repeatability, a duplicate analysis was performed on every tenth field sample. Laboratory blanks of nitrogen gas were also analyzed after every tenth field sample. The results of these analyses are reported in Tables 2 and 3. The laboratory duplicate analyses

were within acceptable limits (i.e. the coefficient of variation was less than 15% in these samples, as required by SW846 for EPA Method 8010/8020). Concentrations of all analytes were below the reporting limit in all laboratory blanks.

Results

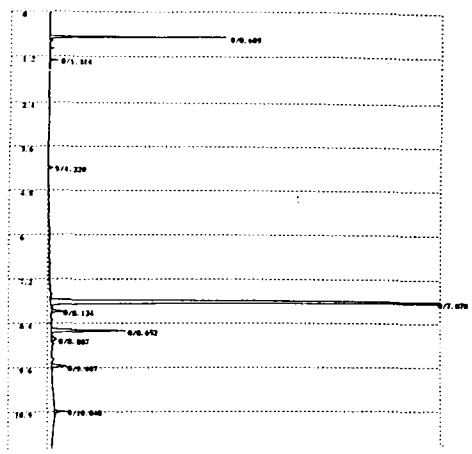
In order to provide graphic presentation of the results, selected individual data sets in Tables 1 and 2 have been mapped to produce Figures 2 through 4. Map sample points with no data shown indicate that the analyte concentrations in the sample were below the reporting limit. An explanation of the terminology used in this report is provided in Appendix C.

The Total FID Volatiles map (Figure 2) reveals levels of 162 μg/l in Sample 2 and 58 μg/l in Sample 8, from the northern boundary of the site. Toluene concentrations at or just above the reporting limit of 1 μg/l were present in several samples collected around the pump islands (Samples 10, 14 and 15), in Sample 3 to the north, and in Samples 30, 35 and 80 (from the western and eastern boundaries of the survey area). None of the remaining FID analytes were present above the 1 μg/l reporting limit in any of the samples.

GC/ECD analysis revealed very low levels (<1.0 μg/l) of tetrachloroethene (PCE, Figure 3) in several areas of the site. Neither trans-1,2-dichloroethene (t-1,2-DCE) nor trichloroethene (TCE) were present above the 1 μg/l reporting limit in any of the samples. No peaks which would represent unidentified chlorinated compounds were observed in any of the ECD chromatograms.

Interpretation

The FID chromatogram signatures of Samples 2 and 8, which contained detectable levels of Total FID Volatiles, reveal a series of late-eluting peaks characteristic of terpenes, as exemplified by the signature of Sample 2 (left). Terpenes are unsaturated hydrocarbons occurring in the essential oils and oleoresins of plants[1] and do not represent a contamination problem. Sufficient levels of volatile hydrocarbons are not present in the signatures of the remaining samples to allow chromatographic interpretation.



GC/FID Chromatogram Signature of Sample 2

Soil gas data suggest that very low levels of toluene are present around the pump islands and at four other widely separated locations. However, the presence of similar levels in all three field control samples and 3 of the 6 trip blanks suggests that the toluene may be the result of minor contamination of the vials during handling rather than a reflection of conditions in the soil vapor at these locations. The volatile hydrocarbons observed at 2 locations near the northern survey boundary are naturally occurring terpenes. Very low levels of PCE are present in several areas of the site. The widely scattered nature of the PCE occurrences and the uniform magnitude of the concentrations observed do not suggest a specific source area. Specific action levels cannot be set for soil gas. Decisions regarding the necessity for further action should be based upon comparisons of samples of soil or ground water with the regulatory action levels set for these media.

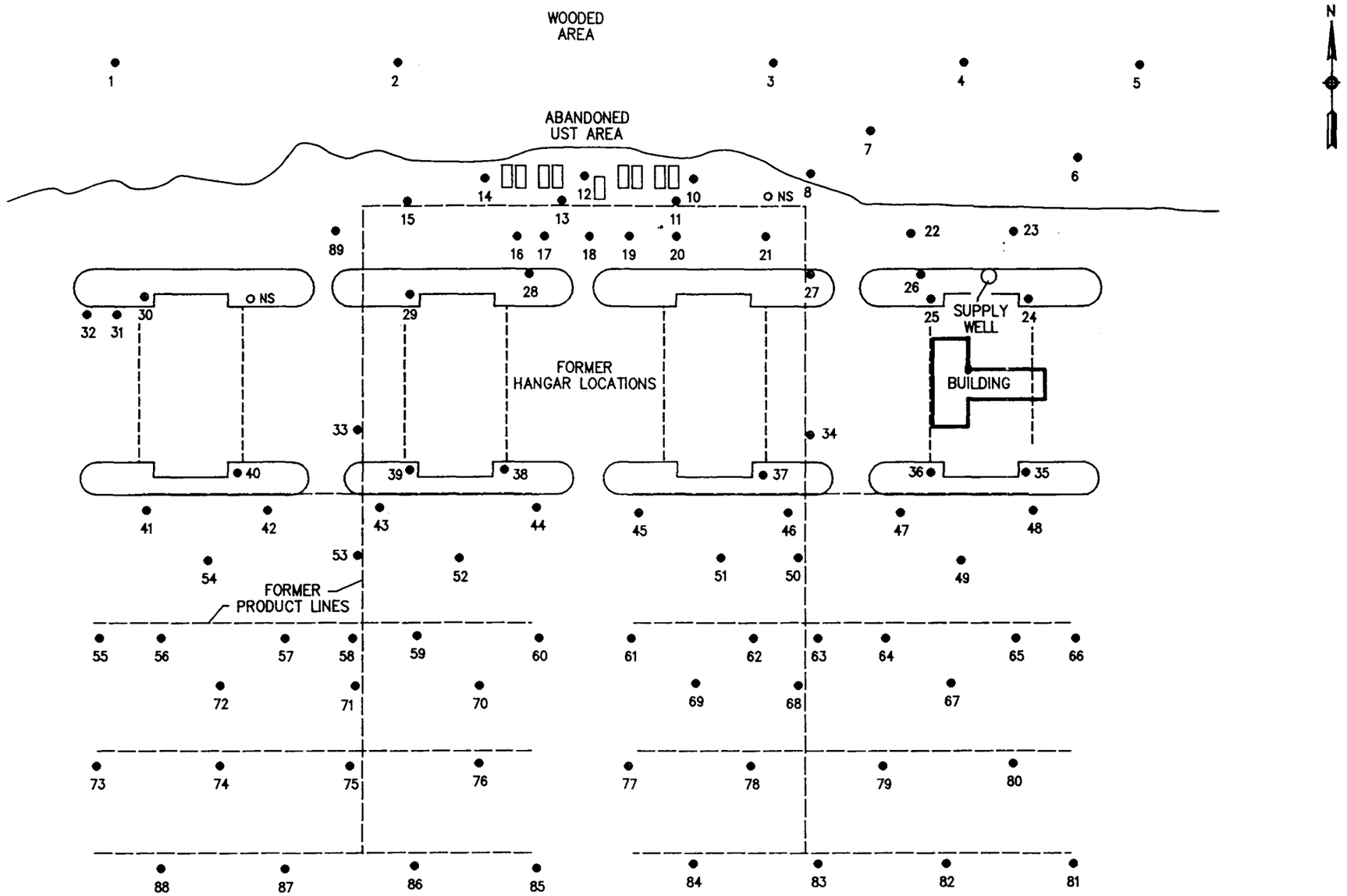
[1] Hawley's Condensed Chemical Dictionary, Eleventh edition, Van Nostrand Reinhold Company, New York, 1987.

Conclusions

- Soil gas data do not suggest the presence of significant petroleum or chlorinated hydrocarbon contamination in the near surface of the site.

- The volatile hydrocarbons observed at 2 locations near the northern survey boundary are naturally occurring terpenes.

- Very low levels of PCE are present in several areas of the site.



0 100 200
FEET

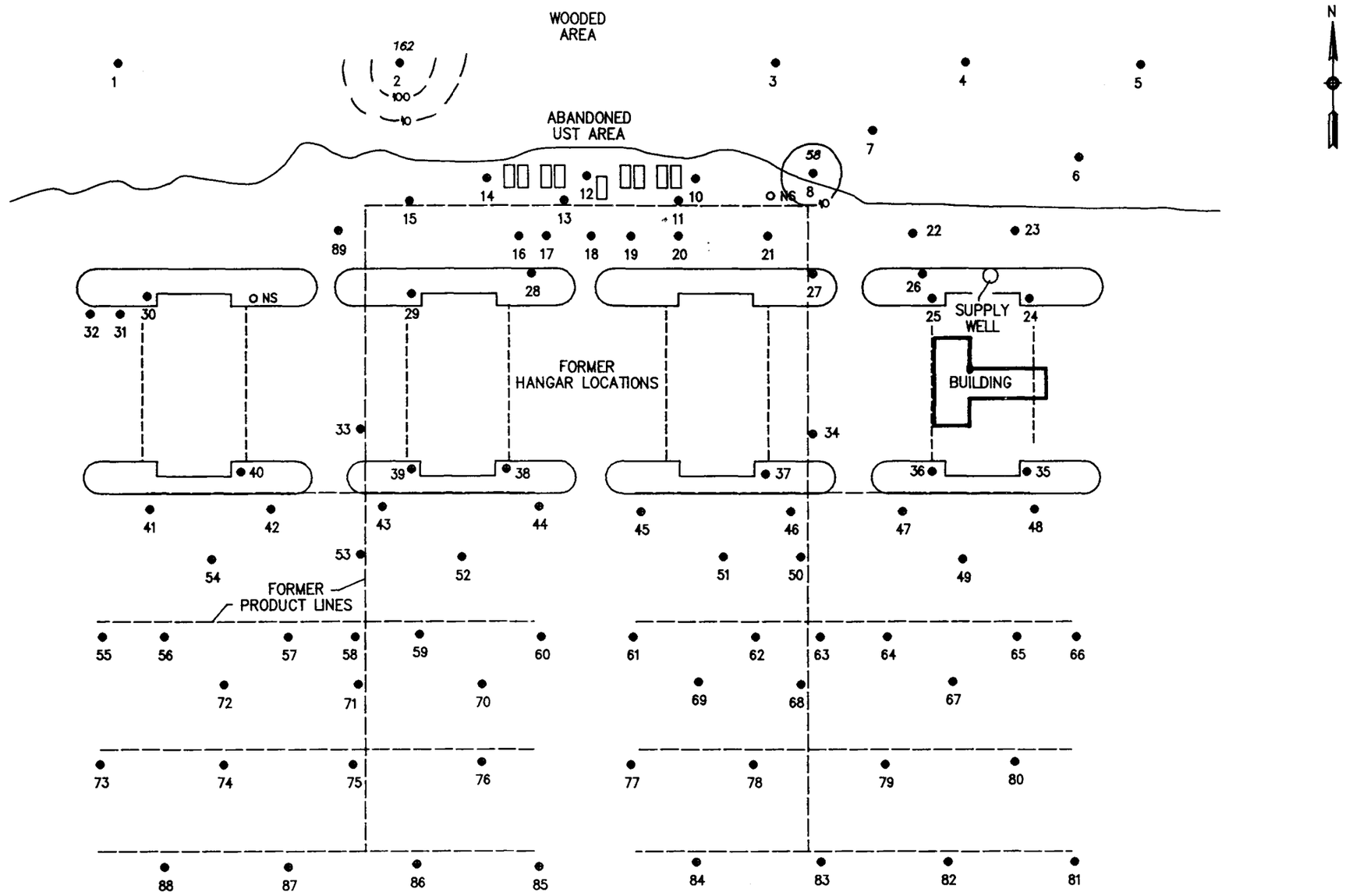
52 ● SOIL GAS SAMPLE LOCATION & DESIGNATION
○ NOT SAMPLED

TARGET ENVIRONMENTAL SERVICES, INC.

This map is integral to a written report and should be viewed in that context.

FIGURE 1. Sample Locations

OLF BARIN
FOLEY, ALABAMA



0 100 200
FEET

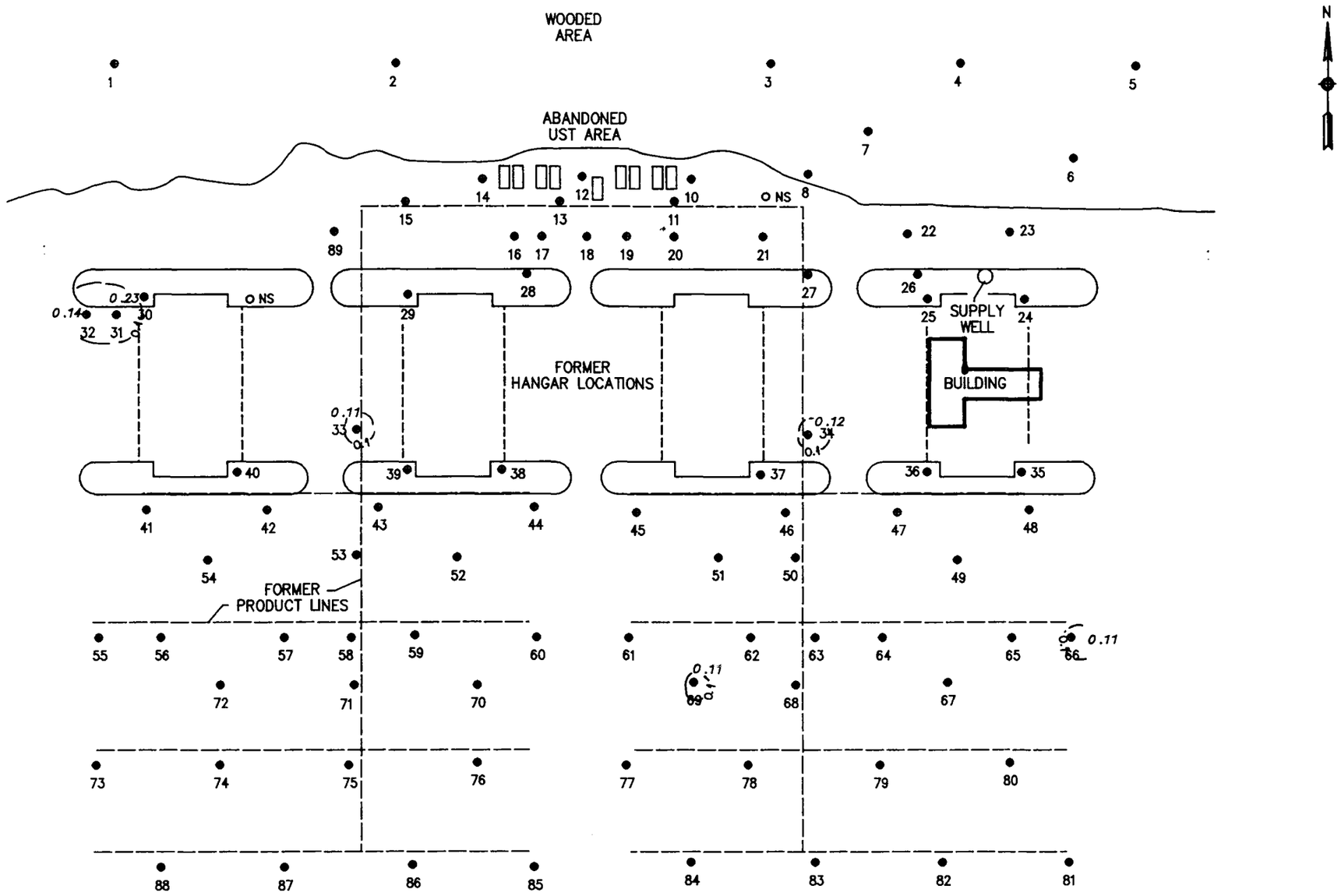
52 ● SOIL GAS SAMPLE LOCATION & DESIGNATION
○ NOT SAMPLED

TARGET ENVIRONMENTAL SERVICES, INC.

This map is integral to a written report and should be viewed in that context.

FIGURE 2. Total FID Volatiles (calc'd $\mu g/l$)

OLF BARIN
FOLEY, ALABAMA



0 100 200
FEET

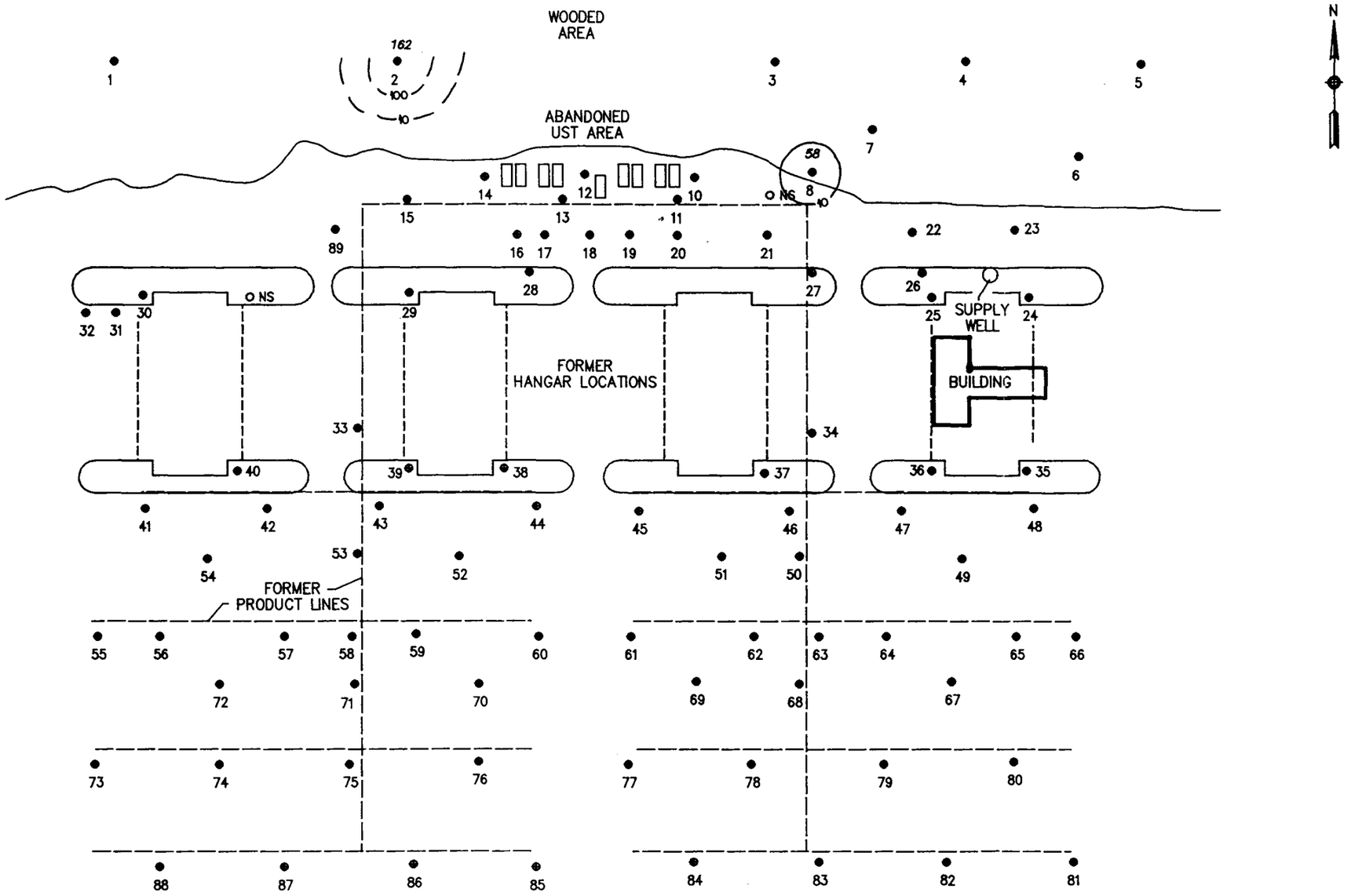
52 ● SOIL GAS SAMPLE LOCATION & DESIGNATION
○ NOT SAMPLED

TARGET ENVIRONMENTAL SERVICES, INC.

This map is integral to a written report and should be viewed in that context.

FIGURE 3. Tetrachloroethene (PCE) (μg/l)

OLF BARIN
FOLEY, ALABAMA



0 100 200
FEET

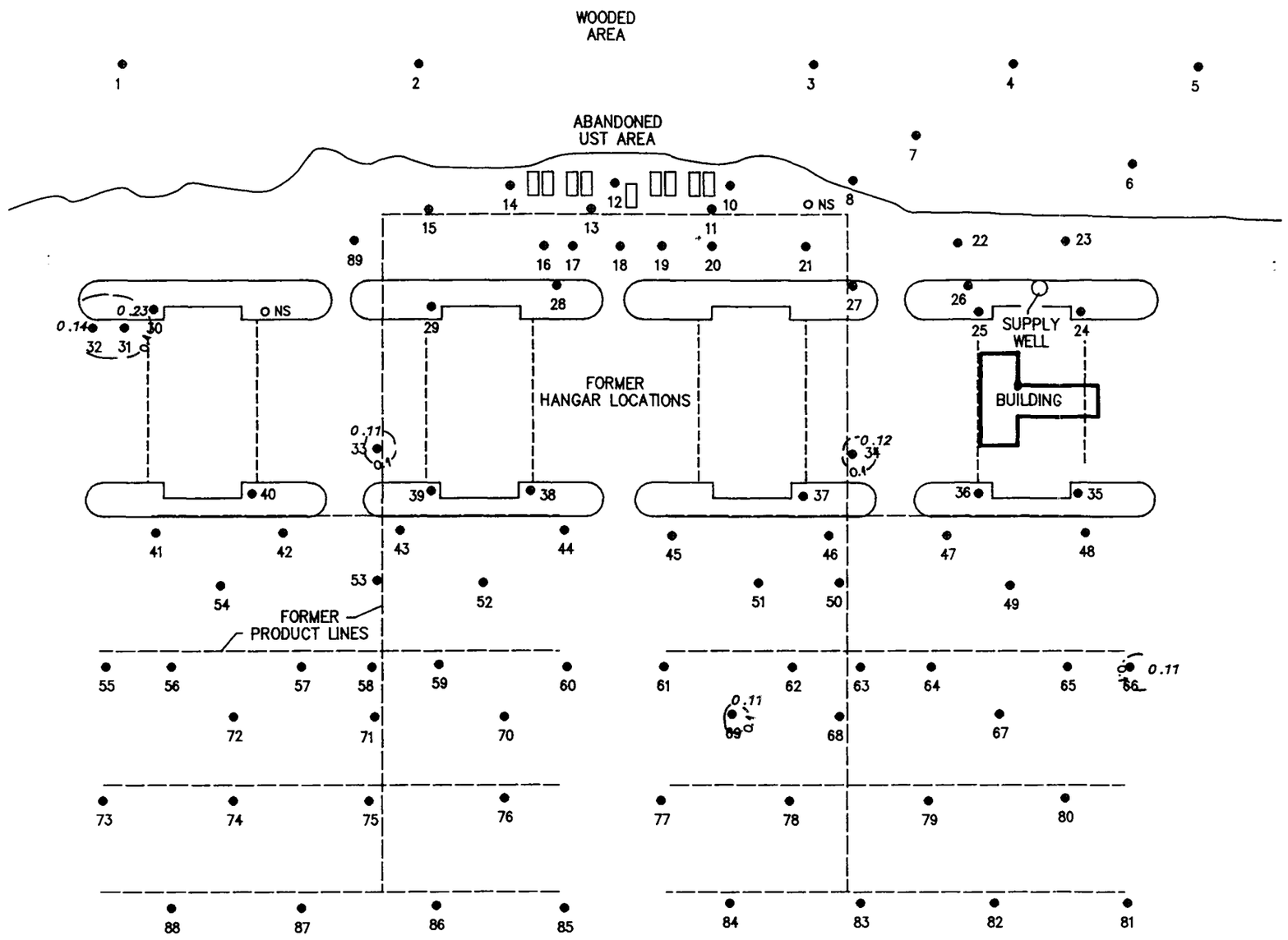
52 ● SOIL GAS SAMPLE LOCATION & DESIGNATION
o NOT SAMPLED

TARGET ENVIRONMENTAL SERVICES, INC.

This map is integral to a written report and should be viewed in that context.

FIGURE 2. Total FID Volatiles (calc'd μg/l)

OLF BARIN
FOLEY, ALABAMA



0 100 200
FEET

52 ⊕ SOIL GAS SAMPLE LOCATION & DESIGNATION
O NOT SAMPLED

TARGET ENVIRONMENTAL SERVICES, INC.

This map is integral to a written report and should be viewed in that context.

FIGURE 3. Tetrachloroethene (PCE) ($\mu g/l$)

OLF BARIN
FOLEY, ALABAMA

TABLE 1

INSERTION AND COLLECTION DATES
AND SURFACE MATERIAL

SAMPLE	DATE OF INSERTION*	DATE OF COLLECTION*	SURFACE MATERIAL
1	17-May	20-May	grass
2	17-May	20-May	grass
3	17-May	20-May	grass
4	17-May	20-May	grass
5	17-May	20-May	grass
6	18-May	21-May	grass
7	19-May	22-May	grass
8	19-May	22-May	grass
10	17-May	20-May	grass
11	17-May	20-May	grass
12	17-May	20-May	grass
13	17-May	20-May	grass
14	17-May	20-May	grass
15	18-May	21-May	grass
16	18-May	21-May	grass
17	18-May	21-May	asphalt
18	18-May	21-May	asphalt
19	18-May	21-May	grass
20	18-May	21-May	grass
21	18-May	21-May	grass
22	18-May	21-May	grass
23	18-May	21-May	grass
24	18-May	21-May	grass
25	18-May	21-May	grass
26	18-May	21-May	grass
27	18-May	21-May	grass
28	18-May	21-May	grass
29	18-May	21-May	grass
30	18-May	21-May	grass
31	18-May	21-May	concrete
32	18-May	21-May	concrete
33	19-May	22-May	concrete
34	19-May	22-May	concrete
35	18-May	21-May	grass

** SAMPLES WERE COLLECTED IN THE SAME ORDER THEY WERE INSERTED*

TABLE 1 (CONT.)

INSERTION AND COLLECTION DATES
AND SURFACE MATERIAL

SAMPLE	DATE OF INSERTION*	DATE OF COLLECTION*	SURFACE MATERIAL
36	18-May	21-May	grass
37	18-May	21-May	grass
38	18-May	21-May	grass
39	18-May	21-May	grass
40	18-May	21-May	grass
41	18-May	21-May	concrete
42	18-May	21-May	concrete
43	18-May	21-May	concrete
44	18-May	21-May	concrete
45	18-May	21-May	concrete
46	18-May	21-May	concrete
47	18-May	21-May	concrete
48	18-May	21-May	concrete
49	18-May	21-May	soil
50	18-May	21-May	soil
51	18-May	21-May	soil
52	18-May	21-May	soil
53	18-May	21-May	soil
54	18-May	21-May	soil
55	18-May	21-May	concrete
56	18-May	21-May	concrete
57	19-May	22-May	concrete
58	19-May	22-May	concrete
59	19-May	22-May	concrete
60	19-May	22-May	concrete
61	19-May	22-May	concrete
62	19-May	22-May	concrete
63	19-May	22-May	concrete
64	19-May	22-May	concrete
65	19-May	22-May	concrete
66	19-May	22-May	concrete
67	19-May	22-May	soil
68	19-May	22-May	soil
69	19-May	22-May	soil

** SAMPLES WERE COLLECTED IN THE SAME ORDER THEY WERE INSERTED*

TABLE 1 (CONT.)

INSERTION AND COLLECTION DATES
AND SURFACE MATERIAL

SAMPLE	DATE OF INSERTION*	DATE OF COLLECTION*	SURFACE MATERIAL
70	19-May	22-May	soil
71	19-May	22-May	soil
72	19-May	22-May	soil
73	19-May	22-May	concrete
74	19-May	22-May	concrete
75	19-May	22-May	concrete
76	19-May	22-May	concrete
77	19-May	22-May	concrete
78	19-May	22-May	concrete
79	19-May	22-May	concrete
80	19-May	22-May	concrete
81	19-May	22-May	concrete
82	19-May	22-May	concrete
83	19-May	22-May	concrete
84	19-May	22-May	concrete
85	19-May	22-May	concrete
86	19-May	22-May	concrete
87	19-May	22-May	concrete
88	19-May	22-May	concrete
89	18-May	21-May	grass
FIELD CONTROL SAMPLES			
01FB	17-May	20-May	N/A
02FB	18-May	21-May	N/A
03FB	19-May	22-May	N/A
TRIP BLANKS			
01TB		17-May	N/A
02TB		17-May	N/A
03TB		18-May	N/A
04TB		18-May	N/A
05TB		19-May	N/A
06TB		19-May	N/A

** SAMPLES WERE COLLECTED IN THE SAME ORDER THEY WERE INSERTED*

TABLE 1 (CONT.)

INSERTION AND COLLECTION DATES
AND SURFACE MATERIAL

SAMPLE	DATE OF INSERTION*	DATE OF COLLECTION*	SURFACE MATERIAL
FIELD DUPLICATE ANALYSIS			
8	19-May	22-May	grass
8D	19-May	22-May	grass
14	17-May	20-May	grass
14D	17-May	20-May	grass
19	18-May	21-May	grass
19D	18-May	21-May	grass
30	18-May	21-May	grass
30D	18-May	21-May	grass
37	18-May	21-May	grass
37D	18-May	21-May	grass
53	18-May	21-May	soil
53D	18-May	21-May	soil
69	19-May	22-May	soil
69D	19-May	22-May	soil
76	19-May	22-May	concrete
76D	19-May	22-May	concrete

** SAMPLES WERE COLLECTED IN THE SAME ORDER THEY WERE INSERTED*

TABLE 2

ANALYTE CONCENTRATIONS VIA GC/FID (µg/l)

SAMPLE	BENZENE	TOLUENE	ETHYL-BENZENE	XYLENES	TOTAL FID VOLATILES**
REPORTING LIMIT	1.0	1.0	1.0	1.0	10
1	<1.0	<1.0	<1.0	<1.0	<10
2	<1.0	<1.0	<1.0	<1.0	162
3	<1.0	1.2	<1.0	<1.0	<10
4	<1.0	<1.0	<1.0	<1.0	<10
5	<1.0	<1.0	<1.0	<1.0	<10
6	<1.0	<1.0	<1.0	<1.0	<10
7	<1.0	<1.0	<1.0	<1.0	<10
8	<1.0	<1.0	<1.0	<1.0	58
10	<1.0	1.0	<1.0	<1.0	<10
11	<1.0	<1.0	<1.0	<1.0	<10
12	<1.0	<1.0	<1.0	<1.0	<10
13	<1.0	<1.0	<1.0	<1.0	<10
14	<1.0	1.1	<1.0	<1.0	<10
15	<1.0	1.0	<1.0	<1.0	<10
16	<1.0	<1.0	<1.0	<1.0	<10
17	<1.0	<1.0	<1.0	<1.0	<10
18	<1.0	<1.0	<1.0	<1.0	<10
19	<1.0	<1.0	<1.0	<1.0	<10
20	<1.0	<1.0	<1.0	<1.0	<10
21	<1.0	<1.0	<1.0	<1.0	<10
22	<1.0	<1.0	<1.0	<1.0	<10
23	<1.0	<1.0	<1.0	<1.0	<10
24	<1.0	<1.0	<1.0	<1.0	<10
25	<1.0	<1.0	<1.0	<1.0	<10
26	<1.0	<1.0	<1.0	<1.0	<10
27	<1.0	<1.0	<1.0	<1.0	<10
28	<1.0	<1.0	<1.0	<1.0	<10
29	<1.0	<1.0	<1.0	<1.0	<10
30	<1.0	1.0	<1.0	<1.0	<10
31	<1.0	<1.0	<1.0	<1.0	<10
32	<1.0	<1.0	<1.0	<1.0	<10
33	<1.0	<1.0	<1.0	<1.0	<10
34	<1.0	<1.0	<1.0	<1.0	<10
35	<1.0	1.0	<1.0	<1.0	<10
36	<1.0	<1.0	<1.0	<1.0	<10

**CALCULATED USING THE SUM OF THE AREAS OF ALL INTEGRATED CHROMATOGRAM PEAKS AND THE INSTRUMENT RESPONSE FACTOR FOR TOLUENE*

TABLE 2 (CONT.)

ANALYTE CONCENTRATIONS VIA GC/FID (µg/l)

SAMPLE	BENZENE	TOLUENE	ETHYL-BENZENE	XYLENES	TOTAL FID VOLATILES**
REPORTING LIMIT	1.0	1.0	1.0	1.0	10
37	<1.0	<1.0	<1.0	<1.0	<10
38	<1.0	<1.0	<1.0	<1.0	<10
39	<1.0	<1.0	<1.0	<1.0	<10
40	<1.0	<1.0	<1.0	<1.0	<10
41	<1.0	<1.0	<1.0	<1.0	<10
42	<1.0	<1.0	<1.0	<1.0	<10
43	<1.0	<1.0	<1.0	<1.0	<10
44	<1.0	<1.0	<1.0	<1.0	<10
45	<1.0	<1.0	<1.0	<1.0	<10
46	<1.0	<1.0	<1.0	<1.0	<10
47	<1.0	<1.0	<1.0	<1.0	<10
48	<1.0	<1.0	<1.0	<1.0	<10
49	<1.0	<1.0	<1.0	<1.0	<10
50	<1.0	<1.0	<1.0	<1.0	<10
51	<1.0	<1.0	<1.0	<1.0	<10
52	<1.0	<1.0	<1.0	<1.0	<10
53	<1.0	<1.0	<1.0	<1.0	<10
54	<1.0	<1.0	<1.0	<1.0	<10
55	<1.0	<1.0	<1.0	<1.0	<10
56	<1.0	<1.0	<1.0	<1.0	<10
57	<1.0	<1.0	<1.0	<1.0	<10
58	<1.0	<1.0	<1.0	<1.0	<10
59	<1.0	<1.0	<1.0	<1.0	<10
60	<1.0	<1.0	<1.0	<1.0	<10
61	<1.0	<1.0	<1.0	<1.0	<10
62	<1.0	<1.0	<1.0	<1.0	<10
63	<1.0	<1.0	<1.0	<1.0	<10
64	<1.0	<1.0	<1.0	<1.0	<10
65	<1.0	<1.0	<1.0	<1.0	<10
66	<1.0	<1.0	<1.0	<1.0	<10
67	<1.0	<1.0	<1.0	<1.0	<10
68	<1.0	<1.0	<1.0	<1.0	<10
69	<1.0	<1.0	<1.0	<1.0	<10
70	<1.0	<1.0	<1.0	<1.0	<10
71	<1.0	<1.0	<1.0	<1.0	<10

**CALCULATED USING THE SUM OF THE AREAS OF ALL INTEGRATED CHROMATOGRAM PEAKS AND THE INSTRUMENT RESPONSE FACTOR FOR TOLUENE*

TABLE 2 (CONT.)

ANALYTE CONCENTRATIONS VIA GC/FID (µg/l)

SAMPLE	BENZENE	TOLUENE	ETHYL-BENZENE	XYLENES	TOTAL FID VOLATILES**
REPORTING LIMIT	1.0	1.0	1.0	1.0	10
72	<1.0	<1.0	<1.0	<1.0	<10
73	<1.0	<1.0	<1.0	<1.0	<10
74	<1.0	<1.0	<1.0	<1.0	<10
75	<1.0	<1.0	<1.0	<1.0	<10
76	<1.0	<1.0	<1.0	<1.0	<10
77	<1.0	<1.0	<1.0	<1.0	<10
78	<1.0	<1.0	<1.0	<1.0	<10
79	<1.0	<1.0	<1.0	<1.0	<10
80	<1.0	1.1	<1.0	<1.0	<10
81	<1.0	<1.0	<1.0	<1.0	<10
82	<1.0	<1.0	<1.0	<1.0	<10
83	<1.0	<1.0	<1.0	<1.0	<10
84	<1.0	<1.0	<1.0	<1.0	<10
85	<1.0	<1.0	<1.0	<1.0	<10
86	<1.0	<1.0	<1.0	<1.0	<10
87	<1.0	<1.0	<1.0	<1.0	<10
88	<1.0	<1.0	<1.0	<1.0	<10
89	<1.0	<1.0	<1.0	<1.0	<10
FIELD CONTROL SAMPLES					
01FB	<1.0	1.2	<1.0	<1.0	<10
02FB	<1.0	1.1	<1.0	<1.0	<10
03FB	<1.0	2.1	<1.0	<1.0	<10
TRIP BLANKS					
01TB	<1.0	<1.0	<1.0	<1.0	<10
02TB	<1.0	<1.0	<1.0	<1.0	<10
03TB	<1.0	1.1	<1.0	<1.0	<10
04TB	<1.0	1.0	<1.0	<1.0	<10
05TB	<1.0	1.3	<1.0	<1.0	<10
06TB	<1.0	<1.0	<1.0	<1.0	<10

**CALCULATED USING THE SUM OF THE AREAS OF ALL INTEGRATED CHROMATOGRAM PEAKS AND THE INSTRUMENT RESPONSE FACTOR FOR TOLUENE*

TABLE 2 (CONT.)

ANALYTE CONCENTRATIONS VIA GC/FID (µg/l)

SAMPLE	BENZENE	TOLUENE	ETHYL-BENZENE	XYLENES	TOTAL FID VOLATILES**
REPORTING LIMIT	1.0	1.0	1.0	1.0	10
FIELD DUPLICATE ANALYSIS					
8	<1.0	<1.0	<1.0	<1.0	58
8D	<1.0	<1.0	<1.0	<1.0	<10
14	<1.0	1.1	<1.0	<1.0	<10
14D	<1.0	<1.0	<1.0	<1.0	<10
19	<1.0	<1.0	<1.0	<1.0	<10
19D	<1.0	1.0	<1.0	<1.0	<10
30	<1.0	1.0	<1.0	<1.0	<10
30D	<1.0	<1.0	<1.0	<1.0	<10
37	<1.0	<1.0	<1.0	<1.0	<10
37D	<1.0	<1.0	<1.0	<1.0	<10
53	<1.0	<1.0	<1.0	<1.0	<10
53D	<1.0	<1.0	<1.0	<1.0	<10
69	<1.0	<1.0	<1.0	<1.0	<10
69D	<1.0	<1.0	<1.0	<1.0	<10
76	<1.0	<1.0	<1.0	<1.0	<10
76D	<1.0	<1.0	<1.0	<1.0	<10
LABORATORY DUPLICATE ANALYSIS					
1	<1.0	<1.0	<1.0	<1.0	<10
1R	<1.0	<1.0	<1.0	<1.0	<10
14D	<1.0	<1.0	<1.0	<1.0	<10
14DR	<1.0	<1.0	<1.0	<1.0	<10
22	<1.0	<1.0	<1.0	<1.0	<10
22R	<1.0	<1.0	<1.0	<1.0	<10
31	<1.0	<1.0	<1.0	<1.0	<10
31R	<1.0	<1.0	<1.0	<1.0	<10

**CALCULATED USING THE SUM OF THE AREAS OF ALL INTEGRATED CHROMATOGRAM PEAKS AND THE INSTRUMENT RESPONSE FACTOR FOR TOLUENE*

TABLE 2 (CONT.)

ANALYTE CONCENTRATIONS VIA GC/FID (µg/l)

SAMPLE	BENZENE	TOLUENE	ETHYL-BENZENE	XYLENES	TOTAL FID VOLATILES**
REPORTING LIMIT	1.0	1.0	1.0	1.0	10
LABORATORY DUPLICATE ANALYSIS (CONT.)					
42	<1.0	<1.0	<1.0	<1.0	<10
42R	<1.0	<1.0	<1.0	<1.0	<10
52	<1.0	<1.0	<1.0	<1.0	<10
52R	<1.0	<1.0	<1.0	<1.0	<10
59	<1.0	<1.0	<1.0	<1.0	<10
59R	<1.0	<1.0	<1.0	<1.0	<10
64	<1.0	<1.0	<1.0	<1.0	<10
64R	<1.0	<1.0	<1.0	<1.0	<10
73	<1.0	<1.0	<1.0	<1.0	<10
73R	<1.0	<1.0	<1.0	<1.0	<10
82	<1.0	<1.0	<1.0	<1.0	<10
82R	<1.0	<1.0	<1.0	<1.0	<10
LABORATORY BLANKS					
14DB	<1.0	<1.0	<1.0	<1.0	<10
22B	<1.0	<1.0	<1.0	<1.0	<10
31B	<1.0	<1.0	<1.0	<1.0	<10
42B	<1.0	<1.0	<1.0	<1.0	<10
52B	<1.0	<1.0	<1.0	<1.0	<10
59B	<1.0	<1.0	<1.0	<1.0	<10
64B	<1.0	<1.0	<1.0	<1.0	<10
73B	<1.0	<1.0	<1.0	<1.0	<10
82B	<1.0	<1.0	<1.0	<1.0	<10

**CALCULATED USING THE SUM OF THE AREAS OF ALL INTEGRATED CHROMATOGRAM PEAKS AND THE INSTRUMENT RESPONSE FACTOR FOR TOLUENE*

TABLE 3

ANALYTE CONCENTRATIONS VIA GC/ECD (µg/l)

SAMPLE	t12DCE	TCE	PCE
REPORTING LIMIT	1.0	1.0	0.10
1	<1.0	<1.0	<0.10
2	<1.0	<1.0	<0.10
3	<1.0	<1.0	<0.10
4	<1.0	<1.0	<0.10
5	<1.0	<1.0	<0.10
6	<1.0	<1.0	<0.10
7	<1.0	<1.0	<0.10
8	<1.0	<1.0	<0.10
10	<1.0	<1.0	<0.10
11	<1.0	<1.0	<0.10
12	<1.0	<1.0	<0.10
13	<1.0	<1.0	<0.10
14	<1.0	<1.0	<0.10
15	<1.0	<1.0	<0.10
16	<1.0	<1.0	<0.10
17	<1.0	<1.0	<0.10
18	<1.0	<1.0	<0.10
19	<1.0	<1.0	<0.10
20	<1.0	<1.0	<0.10
21	<1.0	<1.0	<0.10
22	<1.0	<1.0	<0.10
23	<1.0	<1.0	<0.10
24	<1.0	<1.0	<0.10
25	<1.0	<1.0	<0.10
26	<1.0	<1.0	<0.10
27	<1.0	<1.0	<0.10
28	<1.0	<1.0	<0.10
29	<1.0	<1.0	<0.10
30	<1.0	<1.0	<0.10
31	<1.0	<1.0	0.23
32	<1.0	<1.0	0.14
33	<1.0	<1.0	0.11
34	<1.0	<1.0	0.12
35	<1.0	<1.0	<0.10

t12DCE = trans-1,2-dichloroethene

TCE = trichloroethene *PCE = tetrachloroethene*

TABLE 3 (CONT.)

ANALYTE CONCENTRATIONS VIA GC/ECD (µg/l)

SAMPLE	t12DCE	TCE	PCE
REPORTING LIMIT	1.0	1.0	0.10
36	<1.0	<1.0	<0.10
37	<1.0	<1.0	<0.10
38	<1.0	<1.0	<0.10
39	<1.0	<1.0	<0.10
40	<1.0	<1.0	<0.10
41	<1.0	<1.0	<0.10
42	<1.0	<1.0	<0.10
43	<1.0	<1.0	<0.10
44	<1.0	<1.0	<0.10
45	<1.0	<1.0	<0.10
46	<1.0	<1.0	<0.10
47	<1.0	<1.0	<0.10
48	<1.0	<1.0	<0.10
49	<1.0	<1.0	<0.10
50	<1.0	<1.0	<0.10
51	<1.0	<1.0	<0.10
52	<1.0	<1.0	<0.10
53	<1.0	<1.0	<0.10
54	<1.0	<1.0	<0.10
55	<1.0	<1.0	<0.10
56	<1.0	<1.0	<0.10
57	<1.0	<1.0	<0.10
58	<1.0	<1.0	<0.10
59	<1.0	<1.0	<0.10
60	<1.0	<1.0	<0.10
61	<1.0	<1.0	<0.10
62	<1.0	<1.0	<0.10
63	<1.0	<1.0	<0.10
64	<1.0	<1.0	<0.10
65	<1.0	<1.0	<0.10
66	<1.0	<1.0	0.11
67	<1.0	<1.0	<0.10
68	<1.0	<1.0	<0.10
69	<1.0	<1.0	0.11

t12DCE = trans-1,2-dichloroethene

TCE = trichloroethene *PCE = tetrachloroethene*

TABLE 3 (CONT.)

ANALYTE CONCENTRATIONS VIA GC/ECD (µg/l)

SAMPLE	t12DCE	TCE	PCE
REPORTING LIMIT	1.0	1.0	0.10
70	<1.0	<1.0	<0.10
71	<1.0	<1.0	<0.10
72	<1.0	<1.0	<0.10
73	<1.0	<1.0	<0.10
74	<1.0	<1.0	<0.10
75	<1.0	<1.0	<0.10
76	<1.0	<1.0	<0.10
77	<1.0	<1.0	<0.10
78	<1.0	<1.0	<0.10
79	<1.0	<1.0	<0.10
80	<1.0	<1.0	<0.10
81	<1.0	<1.0	<0.10
82	<1.0	<1.0	<0.10
83	<1.0	<1.0	<0.10
84	<1.0	<1.0	<0.10
85	<1.0	<1.0	<0.10
86	<1.0	<1.0	<0.10
87	<1.0	<1.0	<0.10
88	<1.0	<1.0	<0.10
89	<1.0	<1.0	<0.10
FIELD CONTROL SAMPLES			
01FB	<1.0	<1.0	<0.10
02FB	<1.0	<1.0	<0.10
03FB	<1.0	<1.0	<0.10
TRIP BLANKS			
01TB	<1.0	<1.0	<0.10
02TB	<1.0	<1.0	<0.10
03TB	<1.0	<1.0	<0.10
04TB	<1.0	<1.0	<0.10
05TB	<1.0	<1.0	<0.10
06TB	<1.0	<1.0	<0.10

t12DCE = trans-1,2-dichloroethene

TCE = trichloroethene *PCE = tetrachloroethene*

TABLE 3 (CONT.)

ANALYTE CONCENTRATIONS VIA GC/ECD (µg/l)

SAMPLE	t12DCE	TCE	PCE
REPORTING LIMIT	1.0	1.0	0.10
LABORATORY DUPLICATE ANALYSIS			
1	<1.0	<1.0	<0.10
1R	<1.0	<1.0	<0.10
14D	<1.0	<1.0	<0.10
14DR	<1.0	<1.0	<0.10
22	<1.0	<1.0	<0.10
22R	<1.0	<1.0	<0.10
31	<1.0	<1.0	0.23
31R	<1.0	<1.0	0.25
42	<1.0	<1.0	<0.10
42R	<1.0	<1.0	<0.10
52	<1.0	<1.0	<0.10
52R	<1.0	<1.0	<0.10
59	<1.0	<1.0	<0.10
59R	<1.0	<1.0	<0.10
64	<1.0	<1.0	<0.10
64R	<1.0	<1.0	<0.10
73	<1.0	<1.0	<0.10
73R	<1.0	<1.0	<0.10
82	<1.0	<1.0	<0.10
82R	<1.0	<1.0	<0.10
FIELD DUPLICATE ANALYSIS			
8	<1.0	<1.0	<0.10
8D	<1.0	<1.0	<0.10
14	<1.0	<1.0	<0.10
14D	<1.0	<1.0	<0.10

t12DCE = trans-1,2-dichloroethene

TCE = trichloroethene *PCE = tetrachloroethene*

TABLE 3 (CONT.)

ANALYTE CONCENTRATIONS VIA GC/ECD (µg/l)

SAMPLE	t12DCE	TCE	PCE
REPORTING LIMIT	1.0	1.0	0.10
FIELD DUPLICATE ANALYSIS (cont.)			
19	<1.0	<1.0	<0.10
19D	<1.0	<1.0	<0.10
30	<1.0	<1.0	<0.10
30D	<1.0	<1.0	<0.10
37	<1.0	<1.0	<0.10
37D	<1.0	<1.0	<0.10
53	<1.0	<1.0	<0.10
53D	<1.0	<1.0	<0.10
69	<1.0	<1.0	0.11
69D	<1.0	<1.0	<0.10
76	<1.0	<1.0	<0.10
76D	<1.0	<1.0	<0.10
LABORATORY BLANKS			
14DB	<1.0	<1.0	<0.10
22B	<1.0	<1.0	<0.10
31B	<1.0	<1.0	<0.10
42B	<1.0	<1.0	<0.10
52B	<1.0	<1.0	<0.10
59B	<1.0	<1.0	<0.10
64B	<1.0	<1.0	<0.10
73B	<1.0	<1.0	<0.10
82B	<1.0	<1.0	<0.10

t12DCE = trans-1,2-dichloroethene

TCE = trichloroethene *PCE = tetrachloroethene*

FIELD PROCEDURES

Prior to the start of each day's sampling activities and between each sample location, the following decontamination procedure was carried out. This procedure was prescribed and directed by **ABB-ES**. Drill bits were decontaminated by first rinsing with well water, then washing with Alconox (a biodegradable, laboratory grade detergent) and well water. The bits were then rinsed with isopropyl alcohol and finally with deionized water.

A hole was made to a depth of 24 inches using a hammer drill with a 2-inch diameter, carbide-tipped bit. The passive sampling vial was taken from its sealed aluminum bag and placed open end down into a holding device made of PVC material. The holding device protects the vial and prevents the hole from collapsing. The holding device was inserted into the hole and the surface sealed off with aluminum foil wadding and a thin cap of hydraulic cement.

The passive sampling vials were left in the ground for 3 days to allow equilibration with surrounding soil vapors. Following retrieval of the sample vial, a cap and teflon-faced butyl rubber septa were placed on the vial and crimped to form a seal. Prior to capping, the vials were maintained in an open end down position. The vials were then packaged, labeled, and stored for laboratory analysis. All sampling holes were backfilled with bentonite and the surface repaired with like material upon completion of the sampling.

LABORATORY PROCEDURES

The analytical equipment was calibrated using a 3-point instrument-response curve and injection of known concentrations of the target analytes. Retention times of the standards were used to identify the peaks in the chromatograms of the field samples, and their response factors were used to calculate the analyte concentrations.

Total FID Volatiles values were generated by summing the areas of all integrated chromatogram peaks and calculated using the instrument response factor for toluene. Injection peaks, which also contain the light hydrocarbon methane, were excluded to avoid the skewing of Total FID Volatiles values due to injection disturbances and biogenic methane. For samples with low hydrocarbon concentrations, the calculated Total FID Volatiles concentration is occasionally lower than the sum of the individual analytes. This is because the response factor used for the Total FID Volatiles calculation is a constant, whereas the individual analyte response factors are compound specific. It is important to understand that the Total FID Volatiles levels reported are relative, not absolute, values.

DETECTABILITY & TERMINOLOGY

Detectability

The soil gas survey data presented in this report are the result of precise sampling and measurement of contaminant concentrations in the vadose zone. Analyte detection at a particular location is representative of vapor, dissolved, and/or liquid phase contamination at that location. The presence of detectable levels of target analytes in the vadose zone is dependent upon several factors, including the presence of vapor-phase hydrocarbons or dissolved or liquid concentrations adequate to facilitate volatilization into the unsaturated zone.

Terminology

In order to prevent misunderstanding of certain terms used in **TARGET**'s reports, the following clarifications are offered:

Analyte refers to any of the hydrocarbons standardized for quantification in the chromatographic analysis.

Anomaly refers to an area where hydrocarbons were measured in excess of what would normally be considered "natural" or "background" levels.

Elevated and **significant** are used to describe concentrations of analytes which indicate the existence of a potential problem in the soil or ground water.

Feature is used in reference to a discernible pattern in the contoured data. It denotes a contour form rather than a definite or separate chemical occurrence.

Indicates is used when evidence dictates a unique conclusion. **Suggests** is used when several explanations of certain evidence are possible, but one in particular seems more likely. As a result, "indicates" carries a higher degree of confidence in a conclusion than does "suggests."

Occurrence is used to indicate an area where chemical compounds are present in sufficient concentrations to be detected by the analysis of soil vapors. The term is not indicative of any specific mode of occurrence (vapor, dissolved, etc.), and does not necessarily indicate or suggest the presence of "free product" or "phase-separated hydrocarbons."

Reporting Limit refers to the minimum concentration reported for each analyte.

Vadose zone represents the unsaturated zone between the ground water table and the ground surface.

The terms "**low**", "**moderate**" and "**high**", when applied to Total FID Volatile petroleum hydrocarbons, are relative terms based on **TARGET**'s analysis of thousands of soil gas samples from hundreds of sites. Because site conditions and sampling techniques vary, specific action levels cannot be set for soil gas. Decisions regarding the necessity for further action should be based upon comparisons of samples of soil or ground water with the regulatory action levels set for these media. Less than 100 μg/l can be considered very low. Levels between 0 and 1000 μg/l can be considered typical "background" levels often observed at fuel handling facilities. "Moderate" levels include concentrations in the range of 25,000 to 50,000 μg/l. Levels greater than 100,000 μg/l are deemed "high", while those greater than 750,000 μg/l are considered to be very high.

The same terms when applied to chlorinated hydrocarbons refer to much lower levels. This is partially due to the fact that individual analytes rather than chlorinated "totals" are being discussed, and partially due to the generally more serious nature of contamination by these compounds. Concentrations less than 1-2 μg/l are considered relatively low and those around 10-20 μg/l are considered moderate. High values include levels greater than 100 μg/l, while concentrations over 1000 μg/l are considered extremely high.