EA Engineering, Science and Technology
405 Highway 121, Building C, Suite 100
Lewisville, TX 75067
Attn: Mr. Luis Vega

Passive Soil Gas Survey – Analytical Report
Date: December 10, 2012
Beacon Project No. 2594

Project Reference:	Circle Court Ground Water Plume Superfund site, Willow Park, TX
Samplers Installed:	November 8, 2012
Samplers Retrieved:	November 19, 2012
Samples Received:	November 20, 2012
Analyses Completed:	November 21, 2012
Laboratory Data Issued:	November 28, 2012

EPA Method 8260C (Modified)
All samples were successfully analyzed using thermal desorption-gas chromatography/mass spectrometry (TD-GC/MS) instrumentation to target a custom compound list following EPA Method 8260C. Laboratory results are reported in nanograms (ng) of specific compound per sample.

Laboratory QA/QC procedures included internal standards, surrogates, and blanks based on EPA Method 8260C. Analyses and reporting were in accordance with BEACON's Quality Assurance Project Plan.

Reporting limits
The reporting limit (RL) for each compound is equal to the limit of quantitation (LOQ), which is 10 nanograms (ng), and the limit of detection (LOD) is 5 ng. **Table 1** provides survey results in nanograms per sampler by sample-point number and compound name; measurements below the LOQ but above the LOD are flagged with a "J." The LOQs (<10 ng) represent a baseline above which results exceed laboratory-determined limits of precision and accuracy. Any field sample measurements above the upper calibration standard are estimated; however, these values are reported without qualifiers because all reported measurements are relative to each other and are appropriate to meet the survey objectives of locating source areas and vapor intrusion pathways and defining the lateral extent of contamination.

Calibration Verification
The continuing calibration verification (CCV) values for the calibration check compounds were all within ±20% of the true values as defined by the initial five-point calibration and met the requirements specified in Beacon Environmental's Quality Assurance Project Plan.

Method Blanks/Trip Blanks
Laboratory method blanks are run with each sample batch to identify contamination present in the laboratory. If contamination is detected on a method blank, measurements of identical compounds in that sample batch are flagged in the laboratory report. The laboratory method blanks analyzed in connection with the present samples revealed no contamination.

The trip blank is a sampler prepared, transported, and analyzed with other samples but intentionally not exposed. Any target compounds identified on the trip blanks are reported in the laboratory data. The analysis of the trip blank (labeled Trip-1 in **Table 1**) reported none of the targeted compounds.

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Passive Soil-Gas Survey Notes

When sample locations are covered with or near the edge of an artificial surface (*e.g.*, asphalt or concrete), the concentrations of compounds in soil gas are often significantly higher than the concentrations would be if the surfacing were not present. Thus, a reading taken below or near an impermeable surface is much higher than it would be in the absence of such a cap. Therefore, the sample location conditions should be evaluated when comparing results between locations.

Survey findings are exclusive to this project and when the spatial relationships are compared with results of other BEACON Surveys it is necessary to incorporate survey and site information from both investigations (*e.g.*, depth to sources, soil types, porosity, soil moisture, presence of impervious surfacing, sample collection times). BEACON recommends the guidelines stated in **Attachment 1** to establish a relationship between reported soil-gas measurements and actual subsurface contaminant concentrations, which will indicate those measurements representing significant subsurface contamination.

BEACON's passive soil-gas samplers are prepared with two sets of adsorbent cartridges for subsequent duplicate or confirmatory sample analysis. At EA's request, duplicate analysis was performed for seven (7) field samples. The duplicate samples were designated with a "DUP" following the sample number. When comparing quantitative results, a duplicate correspondence should be considered when the relative percent difference (RPD) between the two samples is less than or equal to 100%. For the purpose of calculating correspondences, all non-detections should be assigned, as a baseline value, the CRQL for the specific contaminant. Based on these assumptions, a 100% correlation was found between the duplicate samples and their base samples.

Project Details

Samplers were deployed on November 8, 2012, and were retrieved on November 19, 2012. **Attachment 2** describes the field procedures used. Individual deployment and retrieval times will be found in the Field Deployment Report (**Attachment 3**).

Sixty nine (69) field samples, seven field sample (7) duplicates, and one (1) trip blank were received by BEACON on November 20, 2012. Adsorbent cartridges from the passive samplers were thermally desorbed, then analyzed using gas chromatography/mass spectrometry (GC/MS) equipment, in accordance with EPA Method 8260C (Modified), as described in **Attachment 4**. BEACON's laboratory analyzed each sample for the targeted compounds; analyses were completed on November 21, 2012. Following a laboratory review, results were provided to EA on November 28, 2012. The Chain-of-Custody form, which was shipped with the samples for this survey, is supplied as **Attachment 5**.

Sample locations are shown on **Figure 1**. The following table lists frequency of detections based on the number of field samples analyzed, the reporting limit, and the maximum value for each mapped compound. The table also includes the transformation and interpolation method for the compound distribution maps provided.

Figure No.	**2**	**3**
Compound	Cis-1,2-dichloroethene	Trichloroethene
Frequency	3	11
Reporting Limit (nanograms)	5	5
Max Value (nanograms)	686	16,265
Transformation Method	Log	Log
Interpolation Method	Kriging	Kriging

Attachments:

-1- Applying Results From Passive Soil-Gas Surveys
-2- Field Procedures
-3- Field Deployment Report
-4- Laboratory Procedures
-5- Chain-of-Custody Form

ALL DATA MEET REQUIREMENTS AS SPECIFIED IN THE BEACON ENVIRONMENTAL SERVICES, INC. QUALITY ASSURANCE PROJECT PLAN AND THE RESULTS RELATE ONLY TO THE SAMPLES REPORTED. BEACON ENVIRONMENTAL SERVICES IS ACCREDITED TO ISO 17025:2005, AND THE WORK PERFORMED WAS IN ACCORDANCE WITH ISO 17025 REQUIREMENTS. THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL, WITHOUT THE WRITTEN APPROVAL OF THE LABORATORY. RELEASE OF THE DATA CONTAINED IN THIS HARDCOPY DATA PACKAGE HAS BEEN AUTHORIZED BY THE LABORATORY DIRECTOR OR HIS SIGNEE, AS VERIFIED BY THE FOLLOWING SIGNATURES:

Steven C. Thornley
Laboratory Director

Patti J. Riggs
Quality Manager

Table 1

Beacon Environmental Services, Inc.
323 Williams Street
Bel Air, MD 21014 USA

Analysis by EPA Method 8260C (Modified)

Client Sample ID:	mb121120a	Trip-1	A1	A2	A3	A4
Project Number:		2594	2594	2594	2594	2594
Lab File ID:	A12112003	A12112005	A12112006	A12112007	A12112008	A12112009
Received Date:		11/20/2012	11/20/2012	11/20/2012	11/20/2012	11/20/2012
Analysis Date:	11/20/2012	11/20/2012	11/20/2012	11/20/2012	11/20/2012	11/20/2012
Analysis Time:	14:25	15:10	15:33	15:55	16:18	16:40
Matrix:			Soil Gas	Soil Gas	Soil Gas	Soil Gas
Units:	ng	ng	ng	ng	ng	ng
COMPOUNDS						
Vinyl Chloride	<10	<10	<10	<10	<10	<10
cis-1,2-Dichloroethene	<10	<10	<10	<10	<10	<10
Trichloroethene	<10	<10	<10	<10	<10	<10

Results in nanograms (ng). J = Values below limit of quantitation (LOQ) but above limit of detection (LOD). B = Detected in method blank.

Table 1

Beacon Environmental Services, Inc.
323 Williams Street
Bel Air, MD 21014 USA

Analysis by EPA Method 8260C (Modified)

Client Sample ID:	A5	A6	A7	A8	B1	B2
Project Number:	2594	2594	2594	2594	2594	2594
Lab File ID:	A12112010	A12112011	A12112012	A12112013	A12112014	A12112015
Received Date:	11/20/2012	11/20/2012	11/20/2012	11/20/2012	11/20/2012	11/20/2012
Analysis Date:	11/20/2012	11/20/2012	11/20/2012	11/20/2012	11/20/2012	11/20/2012
Analysis Time:	17:03	17:26	17:48	18:10	18:33	18:56
Matrix:	Soil Gas	Soil Gas	Soil Gas	Soil Gas	Soil Gas	Soil Gas
Units:	ng	ng	ng	ng	ng	ng
COMPOUNDS						
Vinyl Chloride	<10	<10	<10	<10	<10	<10
cis-1,2-Dichloroethene	<10	<10	<10	<10	**11**	<10
Trichloroethene	<10	<10	<10	**11**	**470**	<10

Results in nanograms (ng). J = Values below limit of quantitation (LOQ) but above limit of detection (LOD). B = Detected in method blank.

Table 1

Beacon Environmental Services, Inc.
323 Williams Street
Bel Air, MD 21014 USA

Analysis by EPA Method 8260C (Modified)

Client Sample ID:	B3	B4	B5	B6	B7	B8
Project Number:	2594	2594	2594	2594	2594	2594
Lab File ID:	A12112016	A12112017	A12112018	A12112019	A12112020	A12112021
Received Date:	11/20/2012	11/20/2012	11/20/2012	11/20/2012	11/20/2012	11/20/2012
Analysis Date:	11/20/2012	11/20/2012	11/20/2012	11/20/2012	11/20/2012	11/20/2012
Analysis Time:	19:19	19:42	20:05	20:28	20:51	21:14
Matrix:	Soil Gas	Soil Gas	Soil Gas	Soil Gas	Soil Gas	Soil Gas
Units:	ng	ng	ng	ng	ng	ng
COMPOUNDS						
Vinyl Chloride	<10	<10	<10	<10	<10	<10
cis-1,2-Dichloroethene	<10	<10	<10	<10	<10	<10
Trichloroethene	<10	<10	<10	<10	<10	<10

Results in nanograms (ng). J = Values below limit of quantitation (LOQ) but above limit of detection (LOD). B = Detected in method blank.

Table 1

Beacon Environmental Services, Inc.
323 Williams Street
Bel Air, MD 21014 USA

Analysis by EPA Method 8260C (Modified)

Client Sample ID:	C1	C2	C3	C4	C4.5	C5
Project Number:	2594	2594	2594	2594	2594	2594
Lab File ID:	A12112022	A12112023	A12112024	A12112025	A12112026	A12112027
Received Date:	11/20/2012	11/20/2012	11/20/2012	11/20/2012	11/20/2012	11/20/2012
Analysis Date:	11/20/2012	11/20/2012	11/20/2012	11/20/2012	11/20/2012	11/20/2012
Analysis Time:	21:36	21:59	22:21	22:44	23:06	23:29
Matrix:	Soil Gas	Soil Gas	Soil Gas	Soil Gas	Soil Gas	Soil Gas
Units:	ng	ng	ng	ng	ng	ng
COMPOUNDS						
Vinyl Chloride	<10	<10	<10	<10	<10	<10
cis-1,2-Dichloroethene	<10	<10	<10	<10	<10	<10
Trichloroethene	<10	<10	<10	<10	<10	<10

Results in nanograms (ng). J = Values below limit of quantitation (LOQ) but above limit of detection (LOD). B = Detected in method blank.

Table 1

Beacon Environmental Services, Inc.
323 Williams Street
Bel Air, MD 21014 USA

Analysis by EPA Method 8260C (Modified)

Client Sample ID:	C5.5	C6	C6.5	C7	C8	CD6.5
Project Number:	2594	2594	2594	2594	2594	2594
Lab File ID:	A12112028	A12112029	A12112030	A12112031	A12112032	A12112033
Received Date:	11/20/2012	11/20/2012	11/20/2012	11/20/2012	11/20/2012	11/20/2012
Analysis Date:	11/20/2012	11/21/2012	11/21/2012	11/21/2012	11/21/2012	11/21/2012
Analysis Time:	23:52	0:14	0:36	0:59	1:22	1:45
Matrix:	Soil Gas	Soil Gas	Soil Gas	Soil Gas	Soil Gas	Soil Gas
Units:	ng	ng	ng	ng	ng	ng
COMPOUNDS						
Vinyl Chloride	<10	<10	<10	<10	<10	<10
cis-1,2-Dichloroethene	<10	<10	<10	<10	<10	<10
Trichloroethene	<10	<10	<10	<10	<10	<10

Results in nanograms (ng). J = Values below limit of quantitation (LOQ) but above limit of detection (LOD). B = Detected in method blank.

Table 1

Beacon Environmental Services, Inc.
323 Williams Street
Bel Air, MD 21014 USA

Analysis by EPA Method 8260C (Modified)

Client Sample ID:	D1	D2	D3.5	D4	D4 DUP	D4.5
Project Number:	2594	2594	2594	2594	2594	2594
Lab File ID:	A12112034	A12112035	A12112036	A12112037	A12112038	A12112039
Received Date:	11/20/2012	11/20/2012	11/20/2012	11/20/2012	11/20/2012	11/20/2012
Analysis Date:	11/21/2012	11/21/2012	11/21/2012	11/21/2012	11/21/2012	11/21/2012
Analysis Time:	2:07	2:30	2:53	3:15	3:38	4:01
Matrix:	Soil Gas	Soil Gas	Soil Gas	Soil Gas	Soil Gas	Soil Gas
Units:	ng	ng	ng	ng	ng	ng
COMPOUNDS						
Vinyl Chloride	<10	<10	<10	<10	<10	<10
cis-1,2-Dichloroethene	<10	<10	<10	<10	<10	<10
Trichloroethene	<10	<10	**8 J**	<10	<10	<10

Results in nanograms (ng). J = Values below limit of quantitation (LOQ) but above limit of detection (LOD). B = Detected in method blank.

Table 1

Beacon Environmental Services, Inc.
323 Williams Street
Bel Air, MD 21014 USA

Analysis by EPA Method 8260C (Modified)

Client Sample ID:	D5.5	D6	D6 DUP	D6.5	D7	D8
Project Number:	2594	2594	2594	2594	2594	2594
Lab File ID:	A12112040	A12112041	A12112042	A12112043	A12112044	A12112045
Received Date:	11/20/2012	11/20/2012	11/20/2012	11/20/2012	11/20/2012	11/20/2012
Analysis Date:	11/21/2012	11/21/2012	11/21/2012	11/21/2012	11/21/2012	11/21/2012
Analysis Time:	4:23	4:46	5:08	5:30	5:53	6:16
Matrix:	Soil Gas	Soil Gas	Soil Gas	Soil Gas	Soil Gas	Soil Gas
Units:	ng	ng	ng	ng	ng	ng
COMPOUNDS						
Vinyl Chloride	<10	<10	<10	<10	<10	<10
cis-1,2-Dichloroethene	<10	<10	<10	<10	<10	<10
Trichloroethene	<10	<10	<10	<10	<10	<10

Results in nanograms (ng). J = Values below limit of quantitation (LOQ) but above limit of detection (LOD). B = Detected in method blank.

Table 1

Beacon Environmental Services, Inc.
323 Williams Street
Bel Air, MD 21014 USA

Analysis by EPA Method 8260C (Modified)

Client Sample ID:	DE3	DE3.5	DE3.5 DUP	DE4	DE4.5	DE4.5 DUP
Project Number:	2594	2594	2594	2594	2594	2594
Lab File ID:	A12112046	A12112047	A12112048	A12112049	A12112050	A12112051
Received Date:	11/20/2012	11/20/2012	11/20/2012	11/20/2012	11/20/2012	11/20/2012
Analysis Date:	11/21/2012	11/21/2012	11/21/2012	11/21/2012	11/21/2012	11/21/2012
Analysis Time:	6:39	7:02	7:24	7:47	8:09	8:31
Matrix:	Soil Gas	Soil Gas	Soil Gas	Soil Gas	Soil Gas	Soil Gas
Units:	ng	ng	ng	ng	ng	ng
COMPOUNDS						
Vinyl Chloride	<10	<10	<10	<10	<10	<10
cis-1,2-Dichloroethene	<10	<10	<10	<10	<10	<10
Trichloroethene	**19**	**43**	**53**	**73**	<10	<10

Results in nanograms (ng). J = Values below limit of quantitation (LOQ) but above limit of detection (LOD). B = Detected in method blank.

Table 1

Beacon Environmental Services, Inc.
323 Williams Street
Bel Air, MD 21014 USA

Analysis by EPA Method 8260C (Modified)

Client Sample ID:	DE5	DE5.5	DE6	E1	E2	E3
Project Number:	2594	2594	2594	2594	2594	2594
Lab File ID:	A12112052	A12112053	A12112054	A12112055	A12112056	A12112057
Received Date:	11/20/2012	11/20/2012	11/20/2012	11/20/2012	11/20/2012	11/20/2012
Analysis Date:	11/21/2012	11/21/2012	11/21/2012	11/21/2012	11/21/2012	11/21/2012
Analysis Time:	8:54	9:16	9:38	10:01	10:23	10:46
Matrix:	Soil Gas	Soil Gas	Soil Gas	Soil Gas	Soil Gas	Soil Gas
Units:	ng	ng	ng	ng	ng	ng
COMPOUNDS						
Vinyl Chloride	<10	<10	<10	<10	<10	<10
cis-1,2-Dichloroethene	<10	<10	<10	<10	<10	<10
Trichloroethene	<10	<10	<10	<10	<10	**33**

Results in nanograms (ng). J = Values below limit of quantitation (LOQ) but above limit of detection (LOD). B = Detected in method blank.

Table 1

Beacon Environmental Services, Inc.
323 Williams Street
Bel Air, MD 21014 USA

Analysis by EPA Method 8260C (Modified)

Client Sample ID:	E3.5	E4	E5	E6	E7	mb121121a
Project Number:	2594	2594	2594	2594	2594	
Lab File ID:	A12112058	A12112059	A12112060	A12112061	A12112062	A12112103
Received Date:	11/20/2012	11/20/2012	11/20/2012	11/20/2012	11/20/2012	
Analysis Date:	11/21/2012	11/21/2012	11/21/2012	11/21/2012	11/21/2012	11/21/2012
Analysis Time:	11:08	11:31	11:53	12:15	12:38	14:10
Matrix:	Soil Gas	Soil Gas	Soil Gas	Soil Gas	Soil Gas	
Units:	ng	ng	ng	ng	ng	ng
COMPOUNDS						
Vinyl Chloride	<10	<10	<10	<10	<10	<10
cis-1,2-Dichloroethene	**686**	**19**	<10	<10	<10	<10
Trichloroethene	**16,265**	**683**	<10	<10	<10	<10

Results in nanograms (ng). J = Values below limit of quantitation (LOQ) but above limit of detection (LOD). B = Detected in method blank.

Table 1

Beacon Environmental Services, Inc.
323 Williams Street
Bel Air, MD 21014 USA

Analysis by EPA Method 8260C (Modified)

Client Sample ID:	E8	F1	F2	F3	F4	F4 DUP
Project Number:	2594	2594	2594	2594	2594	2594
Lab File ID:	A12112105	A12112106	A12112107	A12112108	A12112109	A12112110
Received Date:	11/20/2012	11/20/2012	11/20/2012	11/20/2012	11/20/2012	11/20/2012
Analysis Date:	11/21/2012	11/21/2012	11/21/2012	11/21/2012	11/21/2012	11/21/2012
Analysis Time:	14:55	15:17	15:40	16:03	16:25	16:48
Matrix:	Soil Gas	Soil Gas	Soil Gas	Soil Gas	Soil Gas	Soil Gas
Units:	ng	ng	ng	ng	ng	ng
COMPOUNDS						
Vinyl Chloride	<10	<10	<10	<10	<10	<10
cis-1,2-Dichloroethene	<10	<10	<10	<10	<10	<10
Trichloroethene	<10	<10	<10	**67**	<10	<10

Results in nanograms (ng). J = Values below limit of quantitation (LOQ) but above limit of detection (LOD). B = Detected in method blank.

Table 1

Beacon Environmental Services, Inc.
323 Williams Street
Bel Air, MD 21014 USA

Analysis by EPA Method 8260C (Modified)

Client Sample ID:	F5	F5 DUP	F6	F7	F8	G1
Project Number:	2594	2594	2594	2594	2594	2594
Lab File ID:	A12112111	A12112112	A12112113	A12112114	A12112115	A12112116
Received Date:	11/20/2012	11/20/2012	11/20/2012	11/20/2012	11/20/2012	11/20/2012
Analysis Date:	11/21/2012	11/21/2012	11/21/2012	11/21/2012	11/21/2012	11/21/2012
Analysis Time:	17:11	17:33	17:56	18:18	18:41	19:03
Matrix:	Soil Gas	Soil Gas	Soil Gas	Soil Gas	Soil Gas	Soil Gas
Units:	ng	ng	ng	ng	ng	ng
COMPOUNDS						
Vinyl Chloride	<10	<10	<10	<10	<10	<10
cis-1,2-Dichloroethene	<10	<10	<10	<10	<10	<10
Trichloroethene	<10	<10	<10	<10	<10	<10

Results in nanograms (ng). J = Values below limit of quantitation (LOQ) but above limit of detection (LOD). B = Detected in method blank.

Table 1

Beacon Environmental Services, Inc.
323 Williams Street
Bel Air, MD 21014 USA

Analysis by EPA Method 8260C (Modified)

Client Sample ID:	G2	G3	G4	G4 DUP	G5	G6
Project Number:	2594	2594	2594	2594	2594	2594
Lab File ID:	A12112117	A12112118	A12112119	A12112120	A12112121	A12112122
Received Date:	11/20/2012	11/20/2012	11/20/2012	11/20/2012	11/20/2012	11/20/2012
Analysis Date:	11/21/2012	11/21/2012	11/21/2012	11/21/2012	11/21/2012	11/21/2012
Analysis Time:	19:26	19:49	20:11	20:34	20:56	21:19
Matrix:	Soil Gas	Soil Gas	Soil Gas	Soil Gas	Soil Gas	Soil Gas
Units:	ng	ng	ng	ng	ng	ng
COMPOUNDS						
Vinyl Chloride	<10	<10	<10	<10	<10	<10
cis-1,2-Dichloroethene	<10	<10	<10	<10	<10	<10
Trichloroethene	<10	<10	<10	<10	<10	<10

Results in nanograms (ng). J = Values below limit of quantitation (LOQ) but above limit of detection (LOD). B = Detected in method blank.

Table 1

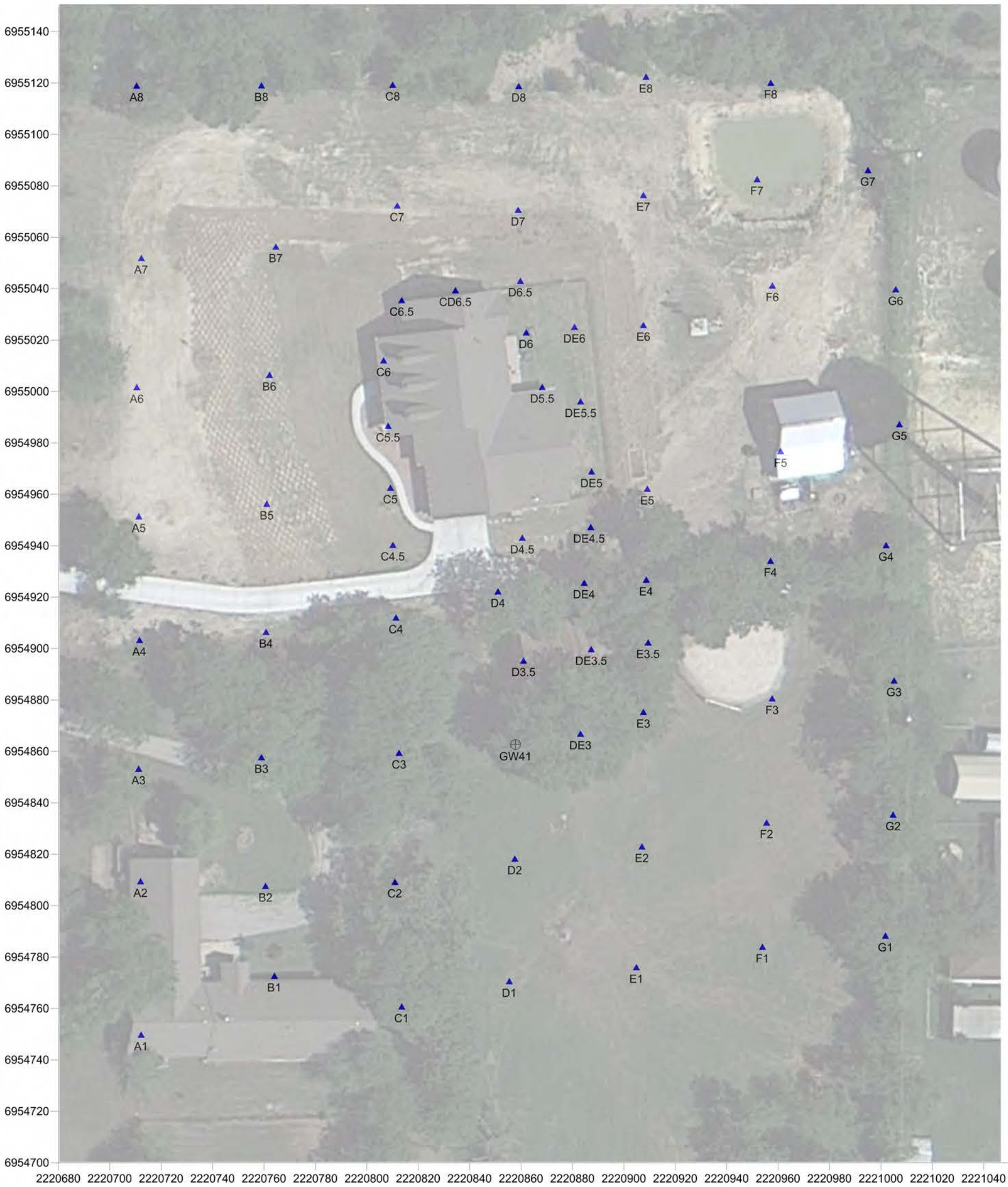
Beacon Environmental Services, Inc.
323 Williams Street
Bel Air, MD 21014 USA

Analysis by EPA Method 8260C (Modified)

Client Sample ID:	G7
Project Number:	2594
Lab File ID:	A12112123
Received Date:	11/20/2012
Analysis Date:	11/21/2012
Analysis Time:	21:42
Matrix:	Soil Gas
Units:	ng

COMPOUNDS	
Vinyl Chloride	<10
cis-1,2-Dichloroethene	<10
Trichloroethene	<10

Results in nanograms (ng). J = Values below limit of quantitation (LOQ) but above limit of detection (LOD). B = Detected in method blank.



LEGEND

D2 PASSIVE SOIL-GAS SAMPLE LOCATION

Scale in Feet

0 40 80

System: Texas State Plane 1983
Zone: North Central Zone
Datum: NAD 1983
Coordinate Units: Feet

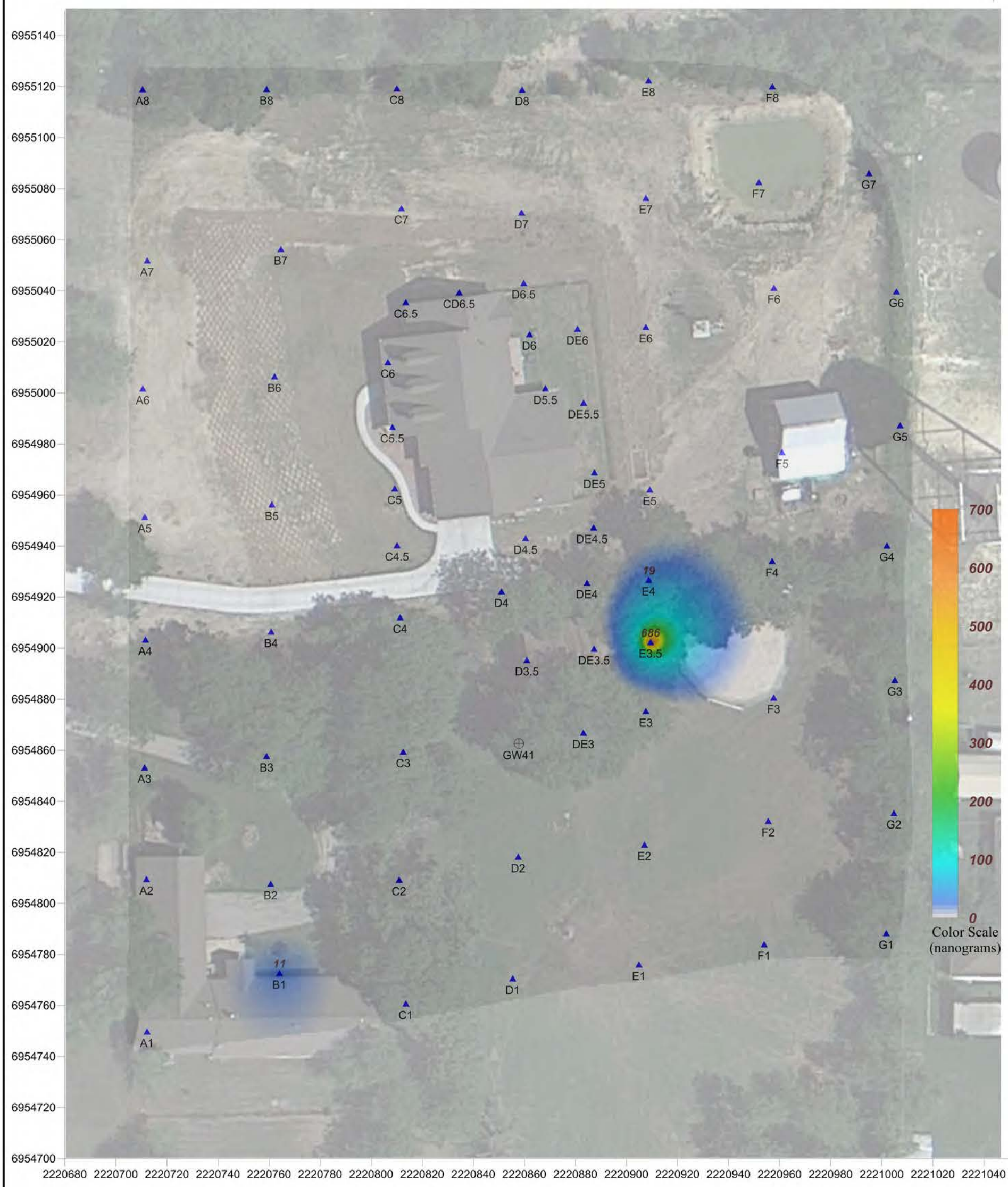
BEACON ENVIRONMENTAL SERVICES, INC.

323 Williams Street, Bel Air, MD, 21014, USA 1-410-838-8780

Beacon Project No. 2594, December 2012

Figure 1
Passive Soil-Gas Survey
Sample Locatoins

Circle Court GW Plume Superfund Site
Willow Park, TX



System: Texas State Plane 1983
Zone: North Central Zone
Datum: NAD 1983
Coordinate Units: Feet

LEGEND

1,000 NANOGRAMS/SAMPLER

▲ D2 PASSIVE SOIL-GAS SAMPLE LOCATION

Scale in Feet

0 40 80

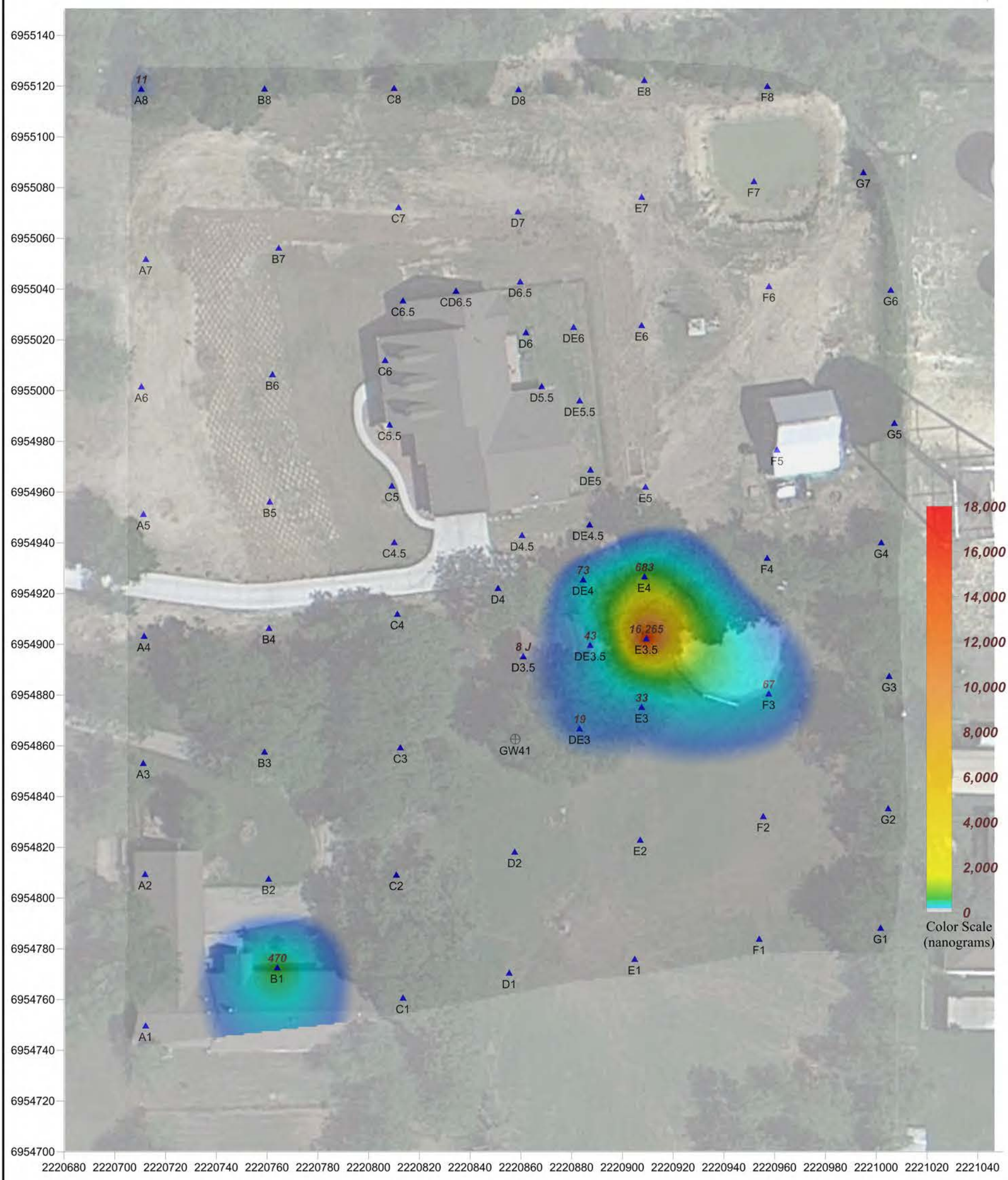
BEACON ENVIRONMENTAL SERVICES, INC.

323 Williams Street, Bel Air, MD, 21014, USA 1-410-838-8780

Beacon Project No. 2594, December 2012

Figure 2
Passive Soil-Gas Survey
cis-1,2-Dichloroethene

Circle Court GW Plume Superfund Site
Willow Park, TX



System: Texas State Plane 1983
Zone: North Central Zone
Datum: NAD 1983
Coordinate Units: Feet

LEGEND

1,000 NANOGRAMS/SAMPLER

▲ D2 PASSIVE SOIL-GAS SAMPLE LOCATION

Scale in Feet

0 40 80

BEACON ENVIRONMENTAL SERVICES, INC.

323 Williams Street, Bel Air, MD, 21014, USA 1-410-838-8780

Beacon Project No. 2594, December 2012

Figure 3
Passive Soil-Gas Survey
Trichloroethene

Circle Court GW Plume Superfund Site
Willow Park, TX

Attachments

Attachment 1

APPLYING RESULTS FROM PASSIVE SOIL-GAS SURVEYS

The utility of soil-gas surveys is directly proportional to their accuracy in reflecting and representing changes in the subsurface concentrations of source compounds. Passive soil-gas survey results are the mass collected from the vapor-phase emanating from the source(s). The vapor-phase is merely a fractional trace of the source(s) and, as a matter of convenience, the units used in reporting detection values from passive soil-gas surveys are smaller than those employed for source-compound concentrations.

Passive soil gas data are reported in mass of compounds identified per sample location (e.g., nanograms (ng) or micrograms (µg) per sampler). Results from a passive soil gas survey typically are then used to guide where follow-on intrusive samples should be collected to obtain corresponding concentrations of the contaminants in soil, soil gas, and/or groundwater, as well as eliminate those areas where intrusive samples are not required. It is not practical to report passive soil gas data as concentration because the sampler's uptake rates of the compounds are often greater than the replenishment rates of the compounds around the sampler, which results in low bias measurements, and the replenishment rates will be dependent on several factors that include, at a minimum, soil gas concentrations, soil porosity and permeability, and soil moisture level.

Whatever the relative concentrations of source and associated soil gas, best results are realized when the ratio of soil-gas measurements to actual subsurface concentrations remains as close to constant as the real world permits. It is the reliability and consistency of this ratio, not the particular units of mass (*e.g.*, nanograms) that determine usefulness. Thus, BEACON emphasizes the necessity of conducting — at minimum — follow-on intrusive sampling in areas that show relatively high soil-gas measurements to obtain corresponding concentrations of soil and groundwater contaminants. These correspondent values furnish the basis for approximating a relationship. For extrapolating passive soil gas results to vapor intrusion evaluations, we recommend a minimum of three passive soil gas locations be converted to a shallow vapor well then sampled using an active soil gas method. Once a relationship is established, it can be used in conjunction with the remaining soil-gas measurements to estimate subsurface contaminant concentrations across the survey field. (See www.beacon-usa.com/passivesoilgas.html, Publication 1: *Mass to Concentration Tie-In for PSG Surveys* and Publication 4: *Groundwater and PSG Correlation*.) It is important to keep in mind, however, that specific conditions at individual sample points, including soil porosity and permeability, depth to contamination, and perched ground water, can have an impact on soil-gas measurements at those locations.

When passive soil-gas surveys are utilized as described above, the data provide information that can yield substantial savings in drilling costs and in time. They furnish, among other things, a checklist of compounds expected at each survey location and help to determine how and where drilling budgets can most effectively be spent. Passive soil-gas surveys can also be used as a remediation or general site monitoring tool that can be implemented on a quarterly, semi-annual or annual basis.

Attachment 2

FIELD PROCEDURES FOR PASSIVE SOIL-GAS SURVEYS

The following field procedures are routinely used during a BEACON Passive Soil-Gas Survey. Modifications can be and are incorporated from time to time in response to individual project requirements. In all instances, BEACON adheres to EPA-approved Quality Assurance and Quality Control practices.

A. Field personnel carry a BESURE Sample Collection Kit™ and support equipment to the site and deploy the passive samplers in a prearranged survey pattern. A passive sampler consists of a borosilicate glass vial containing hydrophobic adsorbent cartridges with a length of wire attached to the vial for retrieval. Although samplers require only one person for emplacement and retrieval, the specific number of field personnel required depends upon the scope and schedule of the project. Each Sampler emplacement generally takes less than two minutes.

B. At each survey point a field technician clears vegetation as needed and, using a hammer drill with a 1″- to 1½″-diameter bit, creates a hole 12 to 14 inches deep. [Note: For locations covered with asphalt, concrete, or gravel surfacing, the field technician drills a 1″- to 1½″-diameter hole through the surfacing to the soils beneath]. The technician then, using a hammer drill with a ½″ diameter bit, creates a hole three-feet deep. The hole is then sleeved with a 1″-diameter metal sleeve.

C. The technician then removes the solid plastic cap from a sampler and replaces it with a Sampling Cap (a plastic cap with a hole covered by screen meshing). The technician inserts the sampler, with the Sampling Cap end facing down, into the hole (**see attached figure**). The sampler is then covered with an aluminum foil plug and soils for uncapped locations or, for capped locations, an aluminum foil plug and a concrete patch. The sampler's location, time and date of emplacement, and other relevant information are recorded on the Field Deployment Form.

D. One or more trip blanks are included as part of the quality-control procedures.

E. Once all the samplers have been deployed, field personnel schedule sampler recovery and depart, taking all other equipment and materials with them.

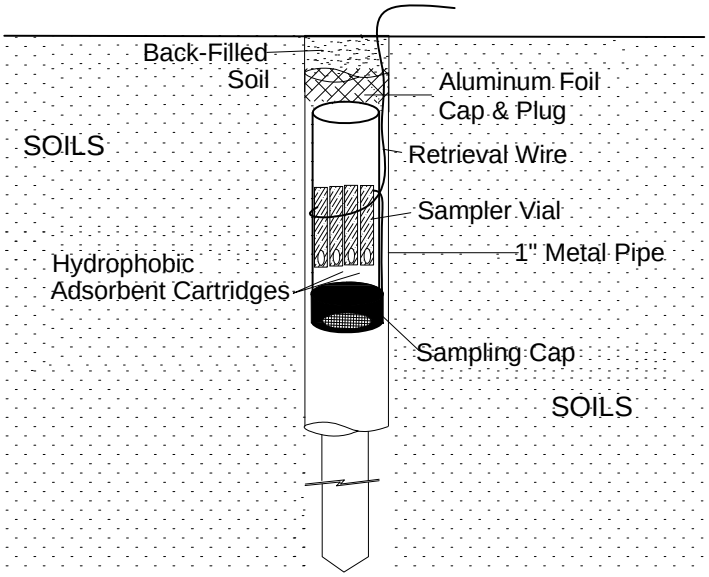
F. Field personnel retrieve the samplers at the end of the exposure period. At each location, a field technician withdraws the sampler from its hole, removes the retrieval wire, and wipes the outside of the vial clean using gauze cloth; following removal of the Sampling Cap, the threads of the vial are also cleaned. A solid plastic cap is screwed onto the vial and the sample location number is written on the label. The technician then records sample-point location, date, time, etc. on the Field Deployment Form.

G. Sampling holes are refilled with soil, sand, or other suitable material. If samplers have been installed through asphalt or concrete, the hole is filled to grade with a plug of cold patch or cement.

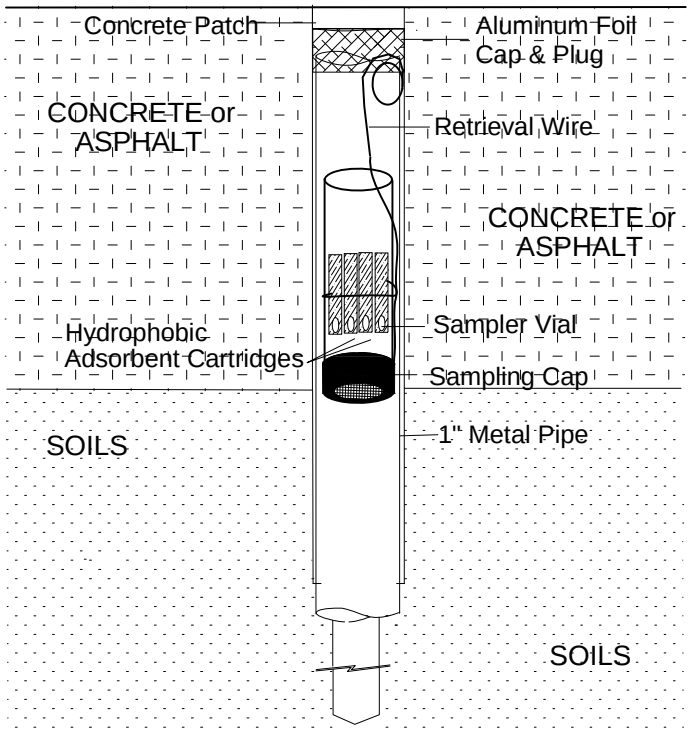
H. Following retrieval, field personnel ship or transport the passive samplers to BEACON's laboratory.

BEACON'S PASSIVE SOIL-GAS SAMPLER

DEPLOYMENT THROUGH SOILS



DEPLOYMENT THROUGH AN ASPHALT/CONCRETE CAP



Attachment 3

Field Deployment Report

PASSIVE SOIL-GAS SURVEY
FIELD DEPLOYMENT REPORT

Project Information	
Beacon Project No.:	2594
Site Name:	Circle Court Ground Water Plume Superfund Site
Site Location:	Willow Park, TX

BEACON ENVIRONMENTAL SERVICES, INC.
323 Williams Street, Suite D, Bel Air, MD 21014 (800) 878-5510

Client Information	
Company Name:	EA Engineering, Science, and Technology, Inc.
Office Location:	Lewisville, TX
Samples Collected By:	JAS Jason Stroup

FIELD SAMPLE ID	Date Emplaced / Time Emplaced	Date Retrieved / Time Retrieved	Sampling Hole Depth (inches)	FIELD NOTES (e.g., asphalt/concrete/gravel, description of sample location, PID/FID readings)
	11/8/12	11/19/12		
✓A8	0855	0955	20	~~soil~~ JAS native soil and ~~cla~~ JAS ~~caliche~~ rock
✓A7	0901	0954	32	" "
✓A6	0903	0953	22	" "
✓A5	0905	0952	32	" "
✓A4	0907	0949	27	" "
✓A3	0909	0945	25	" "
✓A2	0913	0943	25	" "
✓A1	0915	0941	29"	" "
✓C1	0918	1007	JAS H 15	Near home
✓B1	0921	1006	15	" "
✓B2	0922	1004	32	native soil and rock
✓B3	0924	1003	14	near home
✓B4	0928	1001	15	" "
✓C2	0932	1008	15	" "
✓C3	0934	1009	15	" "

PASSIVE SOIL-GAS SURVEY
FIELD DEPLOYMENT REPORT

Project Information	
Beacon Project No.:	2594
Site Name:	Circle Court Ground Water Plume Superfund Site
Site Location:	Willow Park, TX

BEACON ENVIRONMENTAL SERVICES, INC.
323 Williams Street, Suite D, Bel Air, MD 21014 (800) 878-5510

Client Information	
Company Name:	EA Engineering, Science, and Technology, Inc.
Office Location:	Lewisville, TX
Samples Collected By:	JAS Jason Stroup

FIELD SAMPLE ID	Date Emplaced / Time Emplaced	Date Retrieved / Time Retrieved	Sampling Hole Depth (inches)	FIELD NOTES (*e.g.*, asphalt/concrete/gravel, description of sample location, PID/FID readings)
	11/8/12			
✓C4	0936	1011	28	native soil and rock
✓C4.5	0939	1013	15	near home
✓C5	0941	1014	15	" "
✓C5.5	0944	1015	15	" "
✓C6	0946	1016	15	" "
✓C6.5	0947	1017	15	" "
✓CD6.5	0952	1102	15	" "
✓D6.5	0953	1024	15	" "
✓E6	0956	1059	15	" "
✓DE5	1001	1025	15	" "
✓DE5.5	1003	1026	15	" "
✓D5.5	1006	1027	15	" "
✓D6	1008	1028	15	" "
✓DE6	JAS ~~110~~ 1010	1029	15	" "
✓E5	1015	1058	15	" "

PASSIVE SOIL-GAS SURVEY
FIELD DEPLOYMENT REPORT

Project Information	
Beacon Project No.:	2594
Site Name:	Circle Court Ground Water Plume Superfund Site
Site Location:	Willow Park, TX

BEACON ENVIRONMENTAL SERVICES, INC.
323 Williams Street, Suite D, Bel Air, MD 21014 (800) 878-5510

Client Information	
Company Name:	EA Engineering, Science, and Technology, Inc.
Office Location:	Lewisville, TX
Samples Collected By:	JAS Jason Strup

FIELD SAMPLE ID	Date Emplaced / Time Emplaced	Date Retrieved / Time Retrieved	Sampling Hole Depth (inches)	FIELD NOTES (*e.g.*, asphalt/concrete/gravel, description of sample location, PID/FID readings)
	11/8/17			
✓DE4.5	1021	1056	15	Near home
✓D4.5	1023	1032	15	" "
✓D4	1025	1034	15	" "
✓D3.5	1027	1036	15	" "
✓DE3.5	1030	1043	32	Native Soil and Rock
✓DE3	1033	1045	32	" "
✓E3	1035	1047	13	" "
✓B5	1046	0959	32	" "
✓B6	1048	0958	28	" "
✓B7	1050	0957	32	" "
✓B8	1052	0957	32	" "
✓C8	1053	1021	32	" "
✓C7	1055	1018	32	" "
✓D7	1105	1023	32	" "
✓D8	1108	1027	30	" "

PASSIVE SOIL-GAS SURVEY
FIELD DEPLOYMENT REPORT

Project Information	
Beacon Project No.:	2594
Site Name:	Circle Court Ground Water Plume Superfund Site
Site Location:	Willow Park, TX

BEACON ENVIRONMENTAL SERVICES, INC.
323 Williams Street, Suite D, Bel Air, MD 21014 (800) 878-5510

Client Information	
Company Name:	EA Engineering, Science, and Technology, Inc.
Office Location:	Lewisville, TX
Samples Collected By:	JAS Jason Stump

FIELD SAMPLE ID	Date Emplaced / Time Emplaced	Date Retrieved / Time Retrieved	Sampling Hole Depth (inches)	FIELD NOTES (e.g., asphalt/concrete/gravel, description of sample location, PID/FID readings)
	11/9/12			
✓E8	1110	1103	32	native soil and Rock
✓F8	1112	1104	32	" " "
✓G7	1115	1106	32	" "
✓G6	1117	1108	32	" "
✓F6	1119	1107	32	" "
✓F7	1120	1105	20	" "
✓E7	1123	1100	30	" "
✓F5	1135	1109	32	" "
✓G5	1150	1115	32	" "
✓G4	1153	1112	32	" "
✓F4	1157	1110	32	" "
✓E4	1201	1052	15	near home
✓DE4	1204	1054	15	" "
✓E3.5	1208	1049	28	native soil and Rock
✓G3	1217	1119	32	" "

PASSIVE SOIL-GAS SURVEY
FIELD DEPLOYMENT REPORT

Project Information	
Beacon Project No.:	2594
Site Name:	Circle Court Ground Water Plume Superfund Site
Site Location:	Willow Park, TX

BEACON ENVIRONMENTAL SERVICES, INC.
323 Williams Street, Suite D, Bel Air, MD 21014 (800) 878-5510

Client Information	
Company Name:	EA Engineering, Science, and Technology, Inc.
Office Location:	Lewisville, TX
Samples Collected By:	JAS Jason Strong

FIELD SAMPLE ID	Date Emplaced / Time Emplaced	Date Retrieved / Time Retrieved	Sampling Hole Depth (inches)	FIELD NOTES (*e.g.*, asphalt/concrete/gravel, description of sample location, PID/FID readings)
	11/8/12			
✓G2	1226	1122	32	native Soil and Rock
✓G1	1230	1122	32	" "
✓F1	1234	1123	32	" "
✓F2	1236	1124	32	" "
✓F3	1238	1125	32	" "
✓E2	1241	1127	32	" "
✓E1	1243	1127	32	" "
✓D1	1248	1128	32	" "
✓D2	1252	1130	32	" "

Attachment 4

LABORATORY PROCEDURES FOR PASSIVE SOIL-GAS SAMPLES

Following are laboratory procedures used with BEACON Passive Soil-Gas Surveys, a screening technology for expedited site investigation. After exposure, adsorbent cartridges from the passive samplers are analyzed using U.S. EPA Method 8260C as a guidance document, a capillary gas chromatographic/mass spectrometric method, modified to accommodate high temperature thermal desorption of the adsorbent cartridges and to meet the objecitves of reporting semi-quantitative data. This procedure is summarized as follows:

A. The adsorbent cartridges are loaded with internal standards and surrogates prior to loading the autosampler with the cartridges. The loaded cartridges are purged in a helium flow. Then the cartridges are thermally desorbed in a helium flow onto a focusing trap. Any analytes in the helium stream are adsorbed onto a focusing trap.

B. Following trap focusing, the trap is thermally desorbed onto a Rxi-624Sil MS 20m, 0.18 mm ID, 1.00 micron filament thickness capillary column.

C. The GC/MS is scanned between 35 and 270 Atomic Mass Units (AMU) at 3.12 scans per second.

D. BFB tuning criteria and the initial five-point calibration procedures are those stated in method SW846-8260C. System performance and calibration check criteria are met prior to analysis of samples. A laboratory method blank is analyzed after the daily standard to determine that the system is contaminant-free.

E. The instrumentation used for these analyses includes:

- Agilent 6890-5973a Gas Chromatograph/Mass Spectrometer;
- Markes Unity thermal desorber;
- Markes UltrA autosampler; and
- Markes Mass Flow Controller Modules

Attachment 5

Chain-of-Custody Form

CHAIN-OF-CUSTODY
PASSIVE SOIL-GAS SAMPLES

Project Information	
Beacon Project No.:	2594
Site Name:	Circle Court Ground Water Plume Superfund Site
Site Location:	Willow Park, TX
Analytical Method:	EPA Method 8260C
Target Compounds:	Beacon Project Number 2594 Target Compound List

BEACON ENVIRONMENTAL SERVICES, INC.
323 Williams Street, Suite D, Bel Air, MD 21014 (800) 878-5510

Client Information	
Company Name:	EA Engineering, Science, and Technology, Inc.
Office Location:	Lewisville, TX
Samples Submitted By:	Jason Stroup
Contact Phone No.:	214-578-8182

Field Sample ID	Comments (only necessary if problem or discrepancy)			
	Notes	Date	Time	Initial
A8		11/19/12	0955	JAS
A7		11/19/12	0954	JAS
A6		11/19/12	0953	JAS
A5		11/19/12	0952	JAS
A4		11/19/12	0949	JAS
A3		11/19/12	0945	JAS
A2		11/19/12	0943	JAS
A1		11/19/12	0941	JAS
C1		11/19/12	1007	JAS
B1		11/19/12	1006	JAS
B2		11/19/12	1004	JAS
B3		11/19/12	1003	JAS
B4		11/19/12	1001	JAS
C2		11/19/12	1008	JAS
C3		11/19/12	1009	JAS
C4		11/19/12	1011	JAS
C4.5		11/19/12	1013	JAS
C5		11/19/12	1014	JAS
C5.5		11/19/12	1015	JAS
C6		11/19/12	1016	JAS

Shipment of Field Kit to Site — Custody Seal # 17350247 **Intact?** (Y) N

Relinquished by:	Date/Time	Courier	Received by:	Date/Time
Kenny Ipeacho	10-31-2012 / 1700 Hours	FedEx	JA Jason Stroup	11/2/12 1030

Shipment of Field Kit to Laboratory — Custody Seal # 17350248 **Intact?** (Y) N

Relinquished by:	Date/Time	Courier	Received by:	Date/Time
JA	11/19/12 / 1630	Fed EX	Kenny Ipeacho	11-20-2012 / 1000 Hours

CHAIN-OF-CUSTODY
PASSIVE SOIL-GAS SAMPLES

Project Information	
Beacon Project No.:	2594
Site Name:	Circle Court Ground Water Plume Superfund Site
Site Location:	Willow Park, TX
Analytical Method:	EPA Method 8260C
Target Compounds:	Beacon Project Number 2594 Target Compound List

BEACON ENVIRONMENTAL SERVICES, INC.
323 Williams Street, Suite D, Bel Air, MD 21014 (800) 878-5510

Client Information	
Company Name:	EA Engineering, Science, and Technology, Inc.
Office Location:	Lewisville, TX
Samples Submitted By:	Jason Strong
Contact Phone No.:	214-578-8182

Field Sample ID	Comments (only necessary if problem or discrepancy) Notes	Date	Time	Initial
C6.5		11/19/12	1017	JAS
CD6.5		11/19/12	1102	JAS
D6.5		11/19/12	1024	JAS
E6		11/19/12	1059	JAS
DE5		11/19/12	1025	JAS
DE5.5		11/19/12	1026	JAS
D5.5		11/19/12	1027	JAS
D6 Duplicate		11/19/12	1028	JAS
DE6		11/19/12	1029	JAS
E5		11/19/12	1058	JAS
DE4.5 Duplicate		11/19/12	1056	JAS
D4.5		11/19/12	1032	JAS
D4 Duplicate		11/19/12	1034	JAS
D3.5		11/19/12	1036	JAS
DE3.5 Duplicate		11/19/12	1043	JAS
DE3		11/19/12	1045	JAS
E3		11/19/12	1047	JAS
B5		11/19/12	0959	JAS
B6		11/19/12	0958	JAS
B7		11/19/12	0957	JAS

Shipment of Field Kit to Site — Custody Seal # 17350247 **Intact?** (Y) N

Relinquished by:	Date/Time	Courier	Received by:	Date/Time
Kenny Ifeacho	10-31-2012 / 1700 Hours	FedEx	Jason Strong	11/~~12~~ 2/12 1030

Shipment of Field Kit to Laboratory — Custody Seal # 17350248 **Intact?** (Y) N

Relinquished by:	Date/Time	Courier	Received by:	Date/Time
	11/19/12 / 1630	FedEx	Kenny Ifeacho	11-20-2012 / 1000 hours

CHAIN-OF-CUSTODY
PASSIVE SOIL-GAS SAMPLES

Project Information	
Beacon Project No.:	2594
Site Name:	Circle Court Ground Water Plume Superfund Site
Site Location:	Willow Park, TX
Analytical Method:	EPA Method 8260C
Target Compounds:	Beacon Project Number 2594 Target Compound List

BEACON ENVIRONMENTAL SERVICES, INC.
323 Williams Street, Suite D, Bel Air, MD 21014 (800) 878-5510

Client Information	
Company Name:	EA Engineering, Science, and Technology, Inc.
Office Location:	Lewisville, TX
Samples Submitted By:	Jason Stroup
Contact Phone No.:	214-578-8182

Field Sample ID	Comments (only necessary if problem or discrepancy) Notes	Date	Time	Initial
B8		11/19/12	0957	JAS
C8		11/19/12	1021	JAS
C7		11/19/12	1018	JAS
D7		11/19/12	1023	JAS
D8		11/19/12	1022	JAS
E8		11/19/12	1103	JAS
F8		11/19/12	1104	JAS
G7		11/19/12	1106	JAS
G6		11/19/12	1108	JAS
F6		11/19/12	1107	JAS
F7		11/19/12	1105	JAS
E7		11/19/12	1100	JAS
F5 Duplicate		11/19/12	1109	JAS
G5		11/19/12	1115	JAS
G4 Duplicate		11/19/12	1112	JAS
F4 Duplicate		11/19/12	1110	JAS
E4		11/19/12	1052	JAS
DE4		11/19/12	1054	JAS
E3.5		11/19/12	1048	JAS
G3		11/19/12	1119	JAS

Shipment of Field Kit to Site — Custody Seal # 17350247 Intact? (Y) N

Relinquished by:	Date/Time	Courier	Received by:	Date/Time
Kenny Ipeacho	10-31-2012 / 1700 Hours	FedEx	Jason Stroup	11/2/12 1030

Shipment of Field Kit to Laboratory — Custody Seal # 17350248 Intact? (Y) N

Relinquished by:	Date/Time	Courier	Received by:	Date/Time
	11/19/12 /1630	Fed EX	Kenny Ipeacho	11-20-2012 /1000 Hours

CHAIN-OF-CUSTODY
PASSIVE SOIL-GAS SAMPLES

Project Information	
Beacon Project No.:	2594
Site Name:	Circle Court Ground Water Plume Superfund Site
Site Location:	Willow Park, TX
Analytical Method:	EPA Method 8260C
Target Compounds:	Beacon Project Number 2594 Target Compound List

BEACON ENVIRONMENTAL SERVICES, INC.
323 Williams Street, Suite D, Bel Air, MD 21014 (800) 878-5510

Client Information	
Company Name:	EA Engineering, Science, and Technology, Inc.
Office Location:	Lewisville, TX
Samples Submitted By:	Jason Stroup
Contact Phone No.:	214-578-8182

Field Sample ID	Comments (only necessary if problem or discrepancy) Notes	Date	Time	Initial
G2		11/19/12	1122	JAS
G1		11/19/12	1122	JAS
F1		11/19/12	1123	JAS
F2		11/19/12	1124	JAS
F3		11/19/12	1125	JAS
E2		11/19/12	1127	JAS
E1		11/19/12	1127	JAS
D1		11/19/12	1128	JAS
D2		11/19/12	1130	JAS
		~~JAS 11/19/12~~		
		~~JAS 11/19/12~~		

Shipment of Field Kit to Site — Custody Seal # 17350247 Intact? (Y) N

Relinquished by:	Date/Time	Courier	Received by:	Date/Time
Kenny Ipeacho	10-31-2012 / 1700 Hours	FedEx	Jason Stroup	11/2/12 1030

Shipment of Field Kit to Laboratory — Custody Seal # 17350248 Intact? (Y) N

Relinquished by:	Date/Time	Courier	Received by:	Date/Time
	11/19/12 / 1630	FedEX	Kenny Ipeacho	11-20-2012 / 1000 Hours

Page 4 of 4