November 30, 2023

Jolene Lozewski, P.G.
Geologist, Remedial Section A, Bureau A
Division of Environmental Remediation
New York State Department of Environmental Conservation
625 Broadway
Albany, New York 12233-7015

Re: Passive Soil Gas Sampling Work Plan in Operable Unit 1
United Stellar Industries
131 Sunnyside Boulevard, Plainview, New York
NYSDEC Site No. 130115

Dear Ms. Lozewski:

Roux Environmental Engineering and Geology, D.P.C. (Roux), on behalf of 131 Sunnyside LLC (Owner), has prepared this Passive Soil Gas Sampling Work Plan (Work Plan) in Operable Unit 1 (OU-1) for the United Stellar Industries Site located at 131 Sunnyside Boulevard, Plainview, New York (Site). The overall Site is identified as New York Department of Environmental Conservation (NYSDEC) Site No. 130115 and consists of Operable Units OU-1 on-Site and OU-2 off-Site.

Since 2002, various on- and off-Site investigations as well as remedial actions have been performed at the Site in response to chlorinated volatile organic compounds (CVOCs) detected in some on-Site soils, soil vapor, and perched groundwater water beneath the Site. The following sections in this Work Plan describe the Scope of Work (SOW) for proposed passive soil gas sampling in OU-1.

Scope of Work

Roux is proposing to conduct passive soil gas sampling from a total of 59 sampling locations, including 8 locations within the on-Site commercial building and 51 locations in the surrounding on-Site parking lot. Prior to sampling, Roux is proposing that the existing Vapor Recovery System (VRS), located within the on-Site commercial building, be shut off at least one week prior to the start of sampling to allow collection of representative samples. Once installed, the proposed passive soil gas samplers will need to remain in place for 7 to 14 consecutive days, totaling a maximum of three weeks for the current VRS to not be operational. The proposed sampling will occur within 30 days of NYSDEC approval.

The passive soil gas sampling methodology was discussed with the NYSDEC on a conference call on May 11, 2023. During the call, specifications for the passive soil gas samplers were requested by the NYSDEC, which were provided by Roux in an email dated May 16, 2023. The specifications are also included with this Work Plan as Attachment 1. This Work Plan will also cover potential passive soil gas sampling that may be needed to supplement the first round of sampling and/or additional sampling required by NYSDEC in the future.

The proposed passive soil gas sampling locations are presented in Figure 1. During sampling, one sample will be collected from each of the 59 proposed sample locations. The 59 samples will be analyzed using the following:

- Gas chromatography/mass spectrometry (GC/MS) instrumentation, following United States Environmental Protection Agency (USEPA) Method 8260C procedures for Target compound list (TCL) Volatile Organic Compounds (VOCs).

209 Shafter Street ■ Islandia, New York 11749 ■ +1.631.232.2600 ■ www.rouxinc.com
California ■ Illinois ■ Massachusetts ■ New Jersey ■ New York ■ Texas ■ Virginia

Quality assurance/quality control (QA/QC) samples, including two trip blanks and two field duplicates, will be collected and since the data will be used for screening purposes only, a Data Usability Summary Report (DUSR) will not be provided.

As part of the passive soil gas sampling, adsorbent samplers will be deployed directly beneath the asphalt and/or building slab in a grid layout (Figure 1). The interior and exterior passive soil gas samplers will be installed using a 1.5-inch diameter drill bit, advanced to a one-foot depth to create a pilot hole, which will be sleeved with a laboratory supplied sanitized metal pipe. The hole will then be extended to a three-foot depth using a 0.5-inch diameter drill bit (or comparable equipment). The samplers will be secured in place with an aluminum foil plug and surface patched with a thin (0.5-1 inch) layer of concrete. The samplers will need to remain in place for 7 to 14 days. Once the allotted sampling time has elapsed, the samplers will be retrieved, sealed, and shipped to the laboratory, Beacon Environmental Services, Inc., of Forest Hill, Maryland (Beacon), under standard chain of custody procedures.

Conditions in the field and/or building restraints may require adjustment of some sampling locations. Any proposed sample location that falls within an occupied tenant space will either be relocated or omitted. A sample log sheet will be maintained summarizing sample identification, date and time of sample collection, sampling depth, identity of samplers, sampling methods and devices, and chain of custody protocols. The VRS will be restarted following the completion of sampling.

The sample results are provided in units of mass and plotted on a color isopleth map to illustrate VOC distribution. The data generated during the passive soil gas survey will be used as screening level data to evaluate potential source areas at the Site.

Should you have any questions or require further information regarding this Work Plan, do not hesitate to contact the undersigned by telephone at (631) 232-2600 or by email at nclarke@rouxinc.com.

Sincerely,

ROUX ENVIRONMENTAL ENGINEERING AND GEOLOGY, D.P.C.

Jessica Lam
Project Geologist

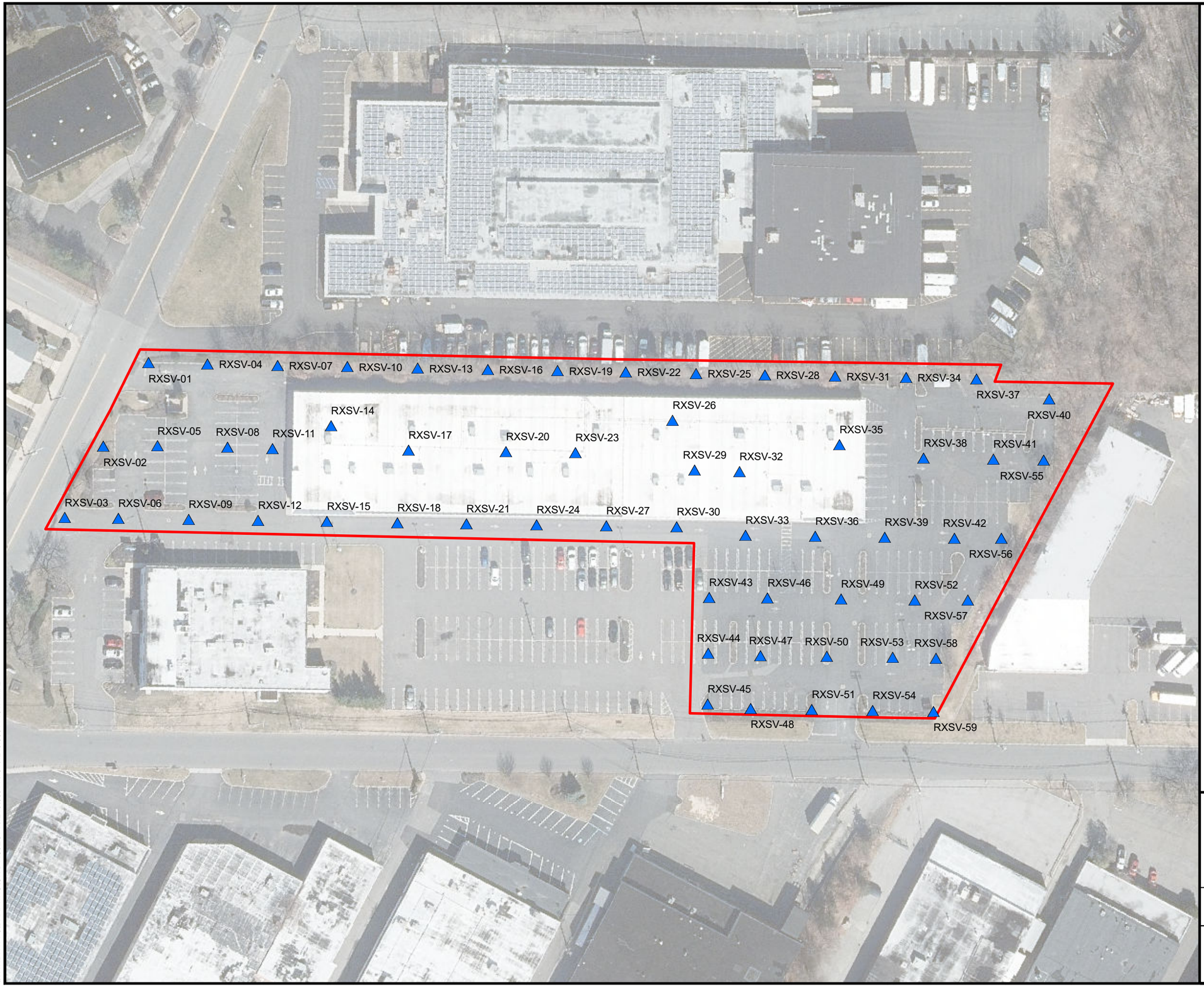
Noelle Clarke, P.E.
Principal Engineer

Joseph Duminuco, P.G.
Executive Vice President

Attachments

FIGURES

1. Proposed Passive Soil Gas Sampling Locations



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LEGEND

- PROPOSED PASSIVE SOIL GAS SAMPLE LOCATIONS
- OU-1 BOUNDARY

NOTES

1. AERIAL SOURCE: NYS OFFICE OF INFORMATION TECHNOLOGY SERVICES GIS PROGRAM OFFICE (GPO) WITH AN IMAGERY DATE OF SPRING 2020

80 0 80'

Title:

PROPOSED PASSIVE SOIL GAS SAMPLING LOCATIONS

UNITED STELLAR INDUSTRIES SITE
131 SUNNYSIDE BOULEVARD, PLAINVIEW, NEW YORK

Prepared for:

131 SUNNYSIDE LLC

ROUX

Compiled by: J.L.	Date: 08/31/23	FIGURE
Prepared by: M.S.R.	Scale: AS SHOWN	1
Project Mgr: N.C.	Project: 4243.0001Y000	
File: 4243.0001Y101.1.mxd		

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ATTACHMENT 1

Beacon Environmental Specifications

SOIL-GAS SAMPLERS AND ANALYTICAL SERVICES
Client Site
Plainview, NY

Background

Beacon Environmental (BEACON), a NELAP and DoD ELAP accredited laboratory and small business concern (NAICS 541380), has been invited by Roux to provide a Proposal and Cost Estimate for soil-gas services at the Client Site in Plainview, NY. The Proposal and Cost Estimate are based on information provided to BEACON by Roux.

Objective

Collection of passive soil-gas (PSG) samples from the shallow subsurface will provide data on the identity and relative concentrations of targeted volatile organic compounds (VOCs) which may be present, without generating waste from soil cuttings. This data will be used to identify source areas of contamination and to delineate the lateral extent of the contaminants.

Survey Design

Roux will determine actual sampling locations. At Roux's option, BEACON will assist in the development of the sampling plan.

Sampling Procedures

A small, easy-to-carry BESURE Sample Collection Kit™ containing sufficient equipment to collect at least 60 field samples will be provided to Roux personnel for collection of soil-gas samples following the protocols of BEACON's passive method. BEACON will ship the Field Kits via express delivery within two (2) business days following notice to proceed.

To install a PSG Sampler, an approximately 1 1/2" diameter hole is advanced to a one foot depth using a hammer drill and drill bit. The hole is then extended to a three-foot depth using a ½" diameter drill bit or comparable equipment. For those locations through asphalt/concrete surfacing, the upper 12 inches of the hole is sleeved with a pre-cleaned metal pipe provided in the Kit. Next, the PSG Sampler (which contains ***two sets of hydrophobic adsorbent cartridges***) is installed in the upper portion of the hole, which is sealed with an aluminum foil plug and covered with soil or for locations through asphalt/concrete surfacing with a thin concrete patch. The samplers are exposed to subsurface gas for approximately seven to 14 days, with the exact length of time appropriate to meet the objectives of the survey.

Each sampler is shipped to the site with a length of wire that is wrapped around the vial and twisted around the shoulder of the vial to expedite retrieval from the ground. Following the exposure period, the Samplers are retrieved and shipped to BEACON's laboratory for analysis. It is not necessary to use ice or preservatives during shipment; however, the samplers are sealed and shipped under chain-of-custody procedures. A trip blank, which will remain with the other PSG

samples during preparation, shipment, and storage, will be included with each batch of up to 30 field samples.

BEACON provides in the BESURE Sample Collection Kit™ pre-cleaned metal sleeves when sampling through impermeable surfacing to protect the Samplers. These sleeves prevent any horizontal migration of vapors in the more porous subgrade from influencing the soil-gas samplers. The metal sleeves are advanced below the subgrade and tapped into the underlying soils so that the Samplers will only be adsorbing compounds in soil gas that is moving vertically through the soils beneath, and not in the vapors that may be migrating laterally through the more porous subgrade. Other soil-gas vendors simply create a hole 2 to 3 feet deep, and leave their samplers unprotected to the horizontal migration of vapors in the subgrade. This easy-to-perform but important procedure of using the metal sleeves is critical to an accurate and reliable soil gas survey (see **Attachment 1**).

Note: The adsorbent cartridges used by BEACON are hydrophobic, which allows the samplers to be effective even in water-saturated conditions. Extensive empirical evidence, which is supported by a government study, has proven that hydrophobic adsorbents work perfectly well in high moisture conditions and should not be encased by a hydrophobic membrane.[1] The use of surrogates and internal standards by BEACON during the analysis of samples verifies that moisture is not a problem during the analysis of the samples. Therefore, water does not adversely impact adsorption of compounds in the field or the analysis of the samplers at the laboratory. An analytical method that does not use internal standards or surrogates during the analysis of each sample cannot provide proof of performance that the system was functioning properly for each sample.

A two-person team can install approximately 50 to 100 samplers per day depending on the number of sample locations that are covered with asphalt, concrete, or gravel surfacing. For retrieval of the Samplers, one person can retrieve approximately 50 samplers per day and patch the holes through the surfacing.


Installation of Samplers with BESURE Sample Collection Kit™

1 The Marines Project: A Laboratory Study of Diffusive Sampling/Thermal Desorption/Mass Spectrometry Techniques for Monitoring Personal Exposure to Toxic Industrial Chemicals, April 2002, Warren Hendricks, Methods Developments Team, Industrial Hygiene Chemistry Division, OSHA Salt Lake Technical Center, Salt Lake City, UT 84115-1802.

Sample Custody Procedures

A chain-of-custody accompanies the field samples at all times, from the time the samples are collected until final analysis. Field kits are shipped with tug-tight custody seals to ensure that samplers are not tampered with during transport. Once samples are received at BEACON's laboratory, the sample custodian receives the samples and logs the samples into the laboratory's Sample Receipt Log.

BEACON's laboratory is maintained in a safe and secure manner at all times. The facility is locked when not occupied and is monitored for fire and unauthorized access. BEACON personnel escort all visitors at all times while inside the facility.

Analytical Procedures

Soil gas samples will be analyzed by BEACON using gas chromatography/mass spectrometry (GC/MS) instrumentation, following EPA Method 8260C procedures and in accordance with the reporting requirements of ISO/IEC 17025. Samples will be analyzed for those compounds on the attached list, including total petroleum hydrocarbons (TPH). The laboratory will perform an ***initial calibration*** with a minimum of five-points for individual compounds. At the beginning of each 24-hour tune window, a BFB tune is performed and a method blank is run following the daily calibration. ***Internal standards and surrogates*** are included with each sample analysis. The laboratory's reported quantitation level (RQL) for each of the targeted compounds is 10 or 25 nanograms (ng) and the RQL for TPH is 5,000 ng; however, the demonstrated limit of quantitation (LOQ) is 10 ng for each compound. Other specific analytes may be targeted, if requested prior to analysis. Two sets of adsorbent cartridges are included in each Sampler for duplicate or confirmatory analysis. At Roux's option, BEACON will analyze ***field sample duplicates*** from selected sample locations identified on the chain-of-custody.

BEACON provides the highest level of accuracy and quality assurance and quality control (QA/QC) procedures for the analysis of soil gas samples in the industry. The table below summarizes these analytical procedures.

Description	Included
Analysis by thermal desorption-gas chromatography/mass spectrometry (TD-GC/MS) following EPA Method 8260C - ***accredited***	√
Analytical results based on a minimum of a 5-point initial calibration	√
MDLs are based on a seven replicate study with contiguous analyses	√
Internal standards and surrogates included with each run (100 nanograms per compound)	√
BFB tunes (5 to 50 nanograms through GC, per method)	√
Continuing calibration checks (50 nanograms per compound)	√
Method blanks	√

Notes: The low point on BEACON's initial calibration curve is 10 nanograms and the reporting limit for each of the compounds is 10 or 25 nanograms to assure that the low concentrations reported are accurate and defensible... as dictated by EPA Method 8260C.

Lesser passive soil gas methods are known to base their results on an external calibration method and calibrate at quantities that are greater than an order of magnitude above their reporting limits, but refer to the process as being Method 8260 (*i.e.*, claim a reporting limit of 25 ng but have 250 ng or higher as the low-point of the calibration). These methods also do not include internal standards or surrogates with each analysis to provide proof of performance that the analytical system was functioning properly for each and every analysis and to provide consistent reference points for comparison of measured quantities.

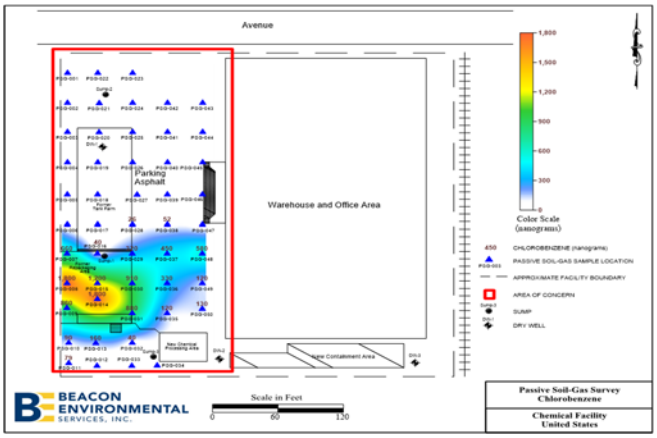
Analyses of the samples will be performed at BEACON's laboratory using state-of-the-art instruments that are listed below. The Markes thermal desorption instruments outperform older thermal desorption equipment used by other vendors, which cannot target as broad a range of compounds with as much sensitivity or accuracy.

- Markes International thermal desorption (TD) system with auto recollection and mass flow controller module,
- Agilent 7890 Gas Chromatograph (GC), and
- Agilent 5975 or 5977B Mass Spectrometer (MS).

Report

An analytical report (searchable PDF with table of contents) and EDD will be provided to Roux within seven (7) business days following the laboratory's receipt of samples. Within 10 business days of the laboratory's receipt of samples, a summary report with maps will be provided. The reports will contain:

narrative with the QA/QC program and findings,
laboratory data (in nanograms and ug/m^3, if requested),
a base map,
up to three color isopleth maps, and
Chain-of-Custody documentation.



Example Color Isopleth Map

To meet the reporting schedule, BEACON requests that Roux provide electronically by the date samples are received at the laboratory a scaled drawing of the site (e.g., AutoCad file or GIS Shapefiles) with final sample locations plotted and labeled, along with GPS data (SPCS or UTM with sub-meter accuracy), if available. If requested, BEACON will provide the color isopleth

maps as layers for use with CAD software or provide data files of the contours for use with GIS software. BEACON will provide post survey support to assist in interpreting the data.

Additional reporting options are available upon request, including BEACON reporting the data in units of concentration (ug/m^3) for each target compound. This option must be selected prior to sample analyses. The mass measured (ng) is converted to a concentration by dividing the mass (ng) by the sampler uptake rate (ml/min) and the sampling period (min), which is then multiplied by a value of 1,000 to convert ng/ml to ug/m^3.

$$C = 1000 \times M/(U \times t)$$

where:
- C = concentration ($\mu g/m^3$)
- M = mass (ng)
- U = uptake rate (ml/min),
- t = sampling time (minutes)

The Beacon sampler has verified uptake rates when sampling in air for a suite of chlorinated compounds and BTEX compounds. Uptake rates will be estimated using Graham's Law for the remaining target compounds. For soil gas sampling, the concentrations reported represent the concentration of the identified compounds under steady state (natural) conditions by passive sampling, as opposed to active sampling with a pump or evacuated canister that may create a momentary vacuum in the soil during the time of sampling.

If the soils at the site have low porosity, the formation itself could limit transport of soil gas to the samplers resulting in the reported concentration being biased low. However, the Beacon sampler has a low and controlled uptake rate to limit this bias from occurring. The reporting limit in concentration for each target compound is based on the exposure period.

If requested, BEACON can also report for each sample up to 10 tentatively identified compounds (TICs) for the largest non-targeted compounds present with an estimated mass greater than 25 ng and a match factor greater than 80.

As an additional option, a summary CLP data package will be included in the report that provides:

Form 2A (system monitoring compound recovery),
Form 3B (LCS/LCSD),
Form 3C (Field Sample Duplicates),
Form 4A (method blanks),
Form 5A (BFB performance check),
Form 6A (initial calibration data),
Form 7A (continuing calibration check), and
Form 8A (internal standard area and RT summary).

For data validation, BEACON can provide a Level IV data package that includes the CLP summary forms plus sequence summaries and raw data (chromatograms and mass spectra data).

Key Personnel and Relevant Experience

The principals of BEACON have many years of experience in characterizing sites for organic contaminants using innovative soil-gas sampling technologies. BEACON was founded in 1999 by Mr. Harry O'Neill, who is the company president and has managed and reviewed data from 1,000s of soil gas surveys. Prior to forming BEACON, Mr. O'Neill managed the soil-gas sampling program for Quadrel Services, Inc., an innovative company that lead the acceptance of passive soil-gas sampling at the national and international level. Mr. O'Neill was also the lead author of ASTM Standard D7758-2011, *Passive Soil Gas Sampling in the Vadose Zone for Source Identification, Spatial Variability Assessment, Monitoring, and Vapor Intrusion Evaluations*. Mr. Steve Thornley is the company's Laboratory Director, who is responsible for sample analyses and ensures that all project samples are analyzed and reported following the highest level of quality assurance procedures in the industry. Mr. Thornley has analyzed and reported data from more than 50,000 soil-gas samples and follows established analytical procedures that allow BEACON to provide accurate, reliable, and defensible data.

Following are a few references from clients who have applied BEACON's passive soil-gas services.

Hanford Reservation, WA

CH2M Hill Plateau Remediation Company (CHPRC)
Mark Byrnes (currently with Hanford Site Central Plateau Cleanup Company)
Richland, WA
Phone: 509-373-3996
Number of PSG samples: 400+

Passive soil-gas surveys were performed at the Hanford Reservation to delineate the extent of chlorinated and petroleum-related contaminants, primarily carbon tetrachloride (CTC). BEACON identified carbon tetrachloride contamination in soils at a 60-foot depth, with the passive soil gas samplers installed to a four-inch depth and the samplers remaining in the field for only three days. Data from the PSG surveys were used to efficiently optimize the placement of large scale soil vapor extraction remediation systems.

DoD Facility – Broad Area Site Investigation and Groundwater Plume Delineation

Tetra Tech
Ms. Kathy Monks
Colfax, CA
Phone: 530-470-0498
Number of PSG Samplers: 750+

A broad area investigation targeting over 30 VOCs and SVOCs using Beacon Passive Soil Gas Samplers was used to delineate the lateral extent of chlorinated and petroleum related compounds at a DoD facility on the west coast of the United States. Over 750 PSG Samplers plus QC samples were collected in one sampling event to conduct a high resolution site characterize (HSRC) to effectively determine where legacy contamination currently was present in order to determine optimal remediation strategies. Concentration

data (ug/m^3) were reported for assessing risks for vapor intrusion or for site workers during remediation activities.

US EPA Superfund Site

US EPA
Office of Land and Emergency Management
Mr. Tom Kady
Edison, NJ
Phone: 732-735-5822
Number of PSG samples: 242

As part of a high resolution site characterization (HRSC) plan, Beacon PSG Samplers were installed over a four (4) day period and, following an approximately 14 day exposure period, the samplers were retrieved over a three (3) day period. Following sample receipt at Beacon's laboratory, an analytical data package was provided in seven (7) business days. More than 30 VOCs and SVOCs were targeted, with Trichloroethene (TCE) being of primary concern. The sensitivity of the PSG investigation allowed the project managers to guide with confidence where membrane interface probe (MIP) samples were collected. The use of both PSG and MIP provided high confidence to the US EPA PM of the nature and extent of contamination and minimized where any additional sampling or remediation, resulting in significant cost savings.

Multiple US EPA Superfund Sites

US EPA Region VI
Mr. Vince Malott
Dallas, TX
Phone: 214-665-8313
Number of PSG samples: 900+

Passive soil gas samples were collected from Superfund sites and analyzed for petroleum and chlorinated compounds to identify source areas and delineate the lateral extent of the contamination. Samplers were installed in one-foot deep holes and were exposed for seven days. Survey results clearly defined areas of releases and contaminant migration pathways.

Groundwater Plume Delineation, NM

New Mexico Environment Department
Mr. Bill Pearson
Santa Fe, NM
Phone: 1-505-670-1295

Groundwater at the site is 70 to 80 feet below ground surface and is contaminated with chlorinated hydrocarbons. NMED installed several transects of BEACON's PSG Samplers to fill in data gaps between existing monitoring wells, track the groundwater plume, and guide the placement of additional monitoring wells. The geology consists of sands/gravels and large cobbles with hard packed soil at the near surface. Results from the survey clearly reflected the plume of PCE, TCE, and cis-1,2-Dichloroethene contamination in

groundwater and had excellent correlation with the monitoring well data that was previously collected.

Multiple Chlorinated and Petroleum Contaminated Sites

Ramboll
Mr. Matteo Capelli
Roma, Italy
Phone: +39 06 4521440
Number of samples: 1000+

Passive soil gas samples are routinely used by Ramboll to characterize sites in Europe to identify source areas, track groundwater plumes, and assess vapor intrusion pathways. The ability to cost effectively collect high quality data provides confidence in decision making and project direction while reducing clients' budgets. Shipments of sorbent samplers, which have a holding time of 30 days following sample collection, are sent to and from Europe without the need for ice or preservatives, with delivery typically requiring only one or two days.

Former manufactured gas plants (MGP) and active manufacturing facility

SLR Consulting
Mr. Gary Hirst
Melbourne, Victoria, Australia
Phone: 61 0 420 958 537
Number of PSG samples: 150 +

PSG samplers were deployed as a preliminary screening tool as part of a wider investigation program on several projects. The surveys successfully confirmed the location and extent of several suspected VOC and SVOC sources in both soil and groundwater. Target contaminants encompassed a broad range of those typical to gasworks (PAHs, Phenols, TPH, BTEX) and industrial sites (chlorinated hydrocarbons). PSG surveys were found to be a fast and inexpensive method of identifying source areas and providing a relative level of "significance" in terms of subsurface vapor sources. This resulted in increasing the effectiveness of intrusive investigations, and in some cases refined the methodologies. PSG surveys were also particularly useful in confirming the presence of shallow DNAPLs in the subsurface. Once sources were identified, follow up phases of PSG investigations were completed along suspected migration pathways to assist in the positioning of groundwater sample locations.

Beacon Proposal No. 230119R01
Target Compound List
Analysis by EPA Method 8260C

Vinyl Chloride	1,1,1,2-Tetrachloroethane
1,1-Dichloroethene	Chlorobenzene
Methylene Chloride	Ethylbenzene
1,1,2-Trichlorotrifluoroethane (Freon 113)	p & m-Xylene
trans-1,2-Dichloroethene	o-Xylene
Methyl-t-butyl ether (MTBE)	1,2,3-Trichloropropane
1,1-Dichloroethane	Isopropylbenzene
cis-1,2-Dichloroethene	1,3,5-Trimethylbenzene
Chloroform	1,2,4-Trimethylbenzene
1,2-Dichloroethane	1,3-Dichlorobenzene
1,1,1-Trichloroethane	1,4-Dichlorobenzene
Carbon Tetrachloride	1,2-Dichlorobenzene
Benzene	1,2,4-Trichlorobenzene
Trichloroethene (TCE)	Naphthalene
1,4-Dioxane	1,2,3-Trichlorobenzene
1,1,2-Trichloroethane	2-Methylnaphthalene
Toluene	
1,2-Dibromoethane (EDB)	TPH C_4-C_9
Tetrachloroethene (PCE)	TPH C_{10}-C_{15}

Note: All compounds are included in Beacon's accreditation for ISO/IEC 17025, NELAP, and DoD ELAP, except TPH. Additional compounds may be added to meet project specific requirements. The method is modified to use a 24-hour tune window to meet expedited site characterization project objectives.

The reporting quantitation level (RQL) for each compound is 10 or 25 nanograms (ng) and the RQL for TPH is 5,000 ng; however, the demonstrated limit of quantitation (LOQ) for each compound is 10 ng.

PASSIVE SOIL GAS SAMPLER REPORTING LIMITS

Limits of Quantitation (LOQs) based on Exposure Periods
When required, lower detection limits can be reported.

COMPOUND	CAS	Uptake Rate (ml/min)	1 Day LOQ (ug/m3)	3 Days LOQ (ug/m3)	7 Days LOQ (ug/m3)	14 Days LOQ (ug/m3)
Vinyl Chloride	75-01-4	0.81	8.57	2.86	1.22	0.61
1,1-Dichloroethene	75-35-4	0.33	21.04	7.01	3.01	1.50
Methylene Chloride	75-09-2	0.35	19.84	6.61	2.83	1.42
1,1,2-Trichlorotrifluoroethane (Fr.113)	76-13-1	0.89	7.80	2.60	1.11	0.56
trans-1,2-Dichloroethene	156-60-5	0.44	15.78	5.26	2.25	1.13
Methyl-t-butyl ether	1634-04-4	0.50	34.72	11.57	4.96	2.48
1,1-Dichloroethane	75-34-3	0.85	8.17	2.72	1.17	0.58
cis-1,2-Dichloroethene	156-59-2	0.53	13.10	4.37	1.87	0.94
Chloroform	67-66-3	0.35	19.84	6.61	2.83	1.42
1,2-Dichloroethane	107-06-2	0.56	12.40	4.13	1.77	0.89
1,1,1-Trichloroethane	71-55-6	1.05	6.61	2.20	0.94	0.47
Carbon Tetrachloride	56-23-5	0.43	16.32	5.44	2.33	1.17
Benzene	71-43-2	0.53	32.76	10.92	4.68	2.34
Trichloroethene	79-01-6	0.33	21.04	7.01	3.01	1.50
1,4-Dioxane	123-91-1	0.41	16.94	5.65	2.42	1.21
1,1,2-Trichloroethane	79-00-5	0.33	21.04	7.01	3.01	1.50
Toluene	108-88-3	0.40	43.40	14.47	6.20	3.10
1,2-Dibromoethane (EDB)	106-93-4	0.39	18.03	6.01	2.58	1.29
Tetrachloroethene	127-18-4	0.41	16.94	5.65	2.42	1.21
1,1,1,2-Tetrachloroethane	630-20-6	0.41	17.04	5.68	2.43	1.22
Chlorobenzene	108-90-7	0.85	8.17	2.72	1.17	0.58
Ethylbenzene	100-41-4	0.85	20.42	6.81	2.92	1.46
p & m-Xylene	108-38-3	0.88	19.73	6.58	2.82	1.41
o-Xylene	95-47-6	0.88	19.73	6.58	2.82	1.41
1,2,3-Trichloropropane	96-18-4	0.75	9.26	3.09	1.32	0.66
Isopropylbenzene	98-82-8	0.83	20.92	6.97	2.99	1.49
1,3,5-Trimethylbenzene	108-67-8	0.83	20.92	6.97	2.99	1.49
1,2,4-Trimethylbenzene	95-63-6	0.83	20.92	6.97	2.99	1.49
1,3-Dichlorobenzene	541-73-1	0.75	9.26	3.09	1.32	0.66
1,4-Dichlorobenzene	106-46-7	0.75	9.26	3.09	1.32	0.66
1,2-Dichlorobenzene	95-50-1	0.75	9.26	3.09	1.32	0.66
1,2,4-Trichlorobenzene	120-82-1	0.39	17.72	5.91	2.53	1.27
Naphthalene	91-20-3	0.80	8.68	2.89	1.24	0.62
1,2,3-Trichlorobenzene	87-61-6	0.39	17.72	5.91	2.53	1.27
2-Methylnaphthalene	91-57-6	0.76	9.14	3.05	1.31	0.65
TPH C4-C9		0.59	5,874	1,958	839	420
TPH C10-C15		0.69	5,032	1,677	719	359

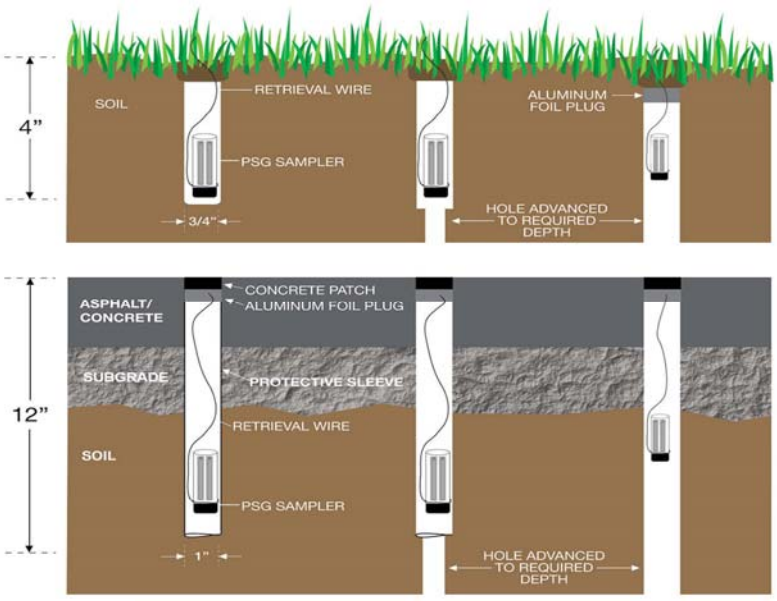
Attachment 1

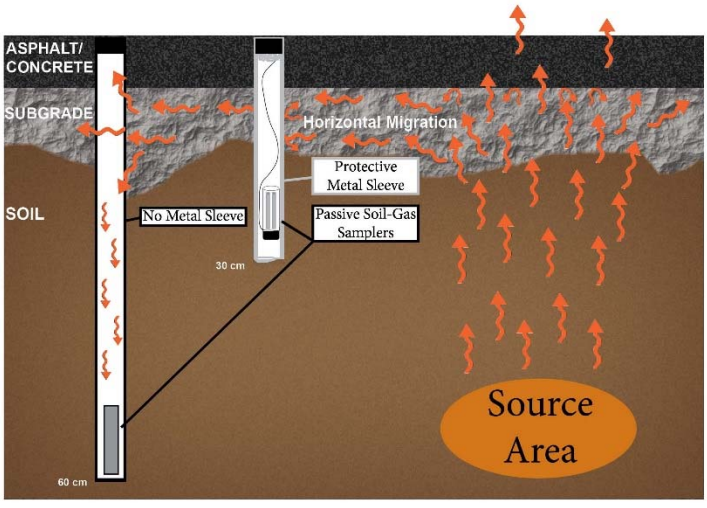
EFFECTIVE PASSIVE SOIL-GAS SAMPLING PROCEDURES

PSG Samplers need only be installed to a shallow depth in some applications because of the sensitivity of the method. However, the method is extremely versatile and installation procedures can be adapted to meet project objectives or client requirements.

When a PSG Sampler is installed in the ground, the top of the hole is completely sealed by collapsing the soils above the Sampler or patching the drilled hole through the surfacing. Other vendors use a permeable cork to plug their installation hole, which allows subsurface gases to escape before the adsorbent captures the organic compounds (reducing sensitivity) *and* permits vapors from above the surface, as well as surface water, to enter the hole (false positives). BEACON's PSG Samplers are not susceptible to these influences because they are effectively sealed in the subsurface.

As mentioned above, BEACON's Samplers are versatile and for some projects a higher sensitivity is required because contaminants are present at low concentrations or soils are fairly impermeable. In these situations, the sampling hole is advanced to a greater depth using a hammer drill, slide hammer, or direct push equipment. *Because the soil vapors that enter the hole will migrate upwards in this newly created preferential pathway, it is not necessary to push the Sampler to the bottom of the hole.* Therefore, the Sampler can still be installed in the upper portion of the hole





Samplers installed through an impermeable surface are sleeved in pre-cleaned protective metal sleeves (provided by BEACON). These sleeves prevent any horizontal migration of vapors in the more porous subgrade from influencing the soil-gas Samplers. As the accompanying diagram shows, the metal sleeves are advanced below the subgrade and tapped into the underlying soils so that the Samplers will only be adsorbing compounds in soil gas that are moving vertically through the soils beneath, and not in the vapors that may be migrating laterally through the more porous subgrade. Other soil-gas vendors simply create a hole 2 to 3 feet deep, and leave their samplers unprotected to the horizontal migration of vapors in the subgrade. This easy-to-perform but important procedure is yet another reason why BEACON's method has achieved the reputation as being the most accurate and reliable soil gas technology available.

PERRY JOHNSON LABORATORY ACCREDITATION, INC.

Certificate of Accreditation

Perry Johnson Laboratory Accreditation, Inc.
has assessed the Organization of:

Beacon Environmental Services, Inc.
2203A Commerce Road, Forest Hill, MD 21050

(Hereinafter called the Organization) and hereby declares that Organization has met the requirements of ISO/IEC 17025:2017 General Requirements for the competence of Testing and Calibration Laboratories and the United States Department of Defense Environmental Laboratory Accreditation Program (DoD-ELAP) requirements identified within the DoD/DOE Quality Systems Manual (DoD/DOE QSM) Version 5.4 October 2021 and is accredited in accordance with the:

United States Department of Defense
Environmental Laboratory Accreditation Program
(DoD-ELAP)

This accreditation demonstrates the technical competence for the defined scope and the operation of a laboratory quality management system
(as outlined by the joint ISO-ILAC-IAF Communiqué dated April 2017):

Environmental Testing
(As detailed in the supplement)

Accreditation claims for such activities shall only be made from the addresses referenced within this certificate. This Accreditation is granted subject to the system rules governing the Accreditation referred to above, and the Organization hereby covenants with the Accreditation Body's duty to observe and comply with the said rules.

Initial Accreditation Date:	*Issue Date:*	*Expiration Date*
September 07, 2012	August 14, 2022	November 30, 2024

For PJLA

Tracy Szerszen
President

Accreditation No:	*Certificate No:*
72690	L22-563

Perry Johnson Laboratory Accreditation, Inc. (PJLA)
755 W. Big Beaver, Suite 1325
Troy, Michigan 48084

The validity of this certificate is maintained through ongoing assessments based on a continuous accreditation cycle. The validity of this certificate should be confirmed through the PJLA website: **www.pjlabs.com**

Certificate of Accreditation: Supplement

Beacon Environmental Services, Inc.
2203A Commerce Road, Forest Hill, MD 21050
Contact Name: Pete Kelly Phone: 410-838-8780

Accreditation is granted to the facility to perform the following testing:

	Code
Organic	
EPA 325B by Gas Chromatography Mass Spectrometry (GC/MS)	10277437
Air	
1,3-Butadiene	9318
Benzene	4375
Chloroprene (2-Chloro-1,3-Butadiene)	4525
Ethylbenzene	4765
m,p-Xylene	5240
o-Xylene (1,2-Xylene)	5250
Toluene	5140
EPA 8260C by Gas Chromatography Mass Spectrometry (GC/MS)	10307003
Air	
1,1,1,2-Tetrachloroethane	5105
1,1,1-Trichloroethane	5160
1,1,2,2-Tetrachloroethane	5110
1,1,2-Trichloro-1,2,2-Trifluoroethane (Trichlorotrifluoroethane, Freon 113)	5185
1,1,2-Trichloroethane	5165
1,1-Dichloroethane	4630
1,1-Dichloroethylene	4640
1,1-Dichloropropene	4670
1,2,3-Trichlorobenzene	5150
1,2,3-Trichloropropane (TCP)	5180
1,2,4-Trichlorobenzene	5155
1,2,4-Trimethylbenzene	5210
1,2-Dibromoethane (EDB, Ethylene Dibromide)	4585
1,2-Dichlorobenzene	4610
1,2-Dichloroethane (Ethylene Dichloride, EDC)	4635
1,2-Dichloropropane	4655
1,3,5-Trimethylbenzene	5215
1,3-Butadiene	9318
1,3-Dichlorobenzene (1,3-DCB)	4615
1,3-Dichloropropane	4660
1,4-Dichlorobenzene	4620
1,4-Dioxane (1,4-Diethyleneoxide, p-Dioxane)	4735
2,2-Dichloropropane	4665
2-Chlorotoluene	4535
2-Methylnaphthalene	6385
4-Chlorotoluene (p-Chlorotoluene)	4540
4-Isopropyltoluene (p-Isopropyltoluene, p-Cymene)	4910

Certificate of Accreditation: Supplement

Beacon Environmental Services, Inc.
2203A Commerce Road, Forest Hill, MD 21050
Contact Name: Pete Kelly Phone: 410-838-8780

Accreditation is granted to the facility to perform the following testing:

	Code
Organic	
EPA 8260C by Gas Chromatography Mass Spectrometry (GC/MS)	10307003
Air	
4-Methyl-2-Pentanone (Methyl Isobutyl Ketone (MIBK), Hexone)	4995
Acenaphthene	5500
Acenaphthylene	5505
Anthracene	5555
Benzene	4375
Benzo(a)Anthracene	5575
Biphenyl	6703
Bromobenzene	4385
Bromochloromethane	4390
Bromodichloromethane	4395
Bromoform	4400
Carbazole	5680
Carbon Disulfide	4450
Carbon Tetrachloride	4455
Chlorobenzene	4475
Chlorodibromomethane (Dibromochloromethane)	4575
Chloroethane (Ethyl chloride)	4485
Chloroform	4505
Chloroprene (2-Chloro-1,3-Butadiene)	4525
cis-1,2-Dichloroethylene	4645
cis-1,3-Dichloropropene	4680
Dibenzofuran	5905
Dibromomethane (Methylene Bromide)	4595
Dichlorodifluoromethane (Freon 12)	4625
Ethylbenzene	4765
Fluorene	6270
Hexachlorobutadiene	4835
Hexachloroethane	4840
Isopropylbenzene (Cumene)	4900
m,p-Xylene	5240
Methyl tert Butyl Ether (MTBE)	5000
Methylene Chloride (Dichloromethane)	4975
Naphthalene	5005
n-Butylbenzene	4435
n-Propylbenzene (1-phenylpropane)	5090
o-Xylene (1,2-Xylene)	5250

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Beacon Environmental Services, Inc.
2203A Commerce Road, Forest Hill, MD 21050
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Accreditation is granted to the facility to perform the following testing:

	Code
Organic	
EPA 8260C by Gas Chromatography Mass Spectrometry (GC/MS)	10307003
Air	
PCB-1 (2-Chlorobiphenyl, 2-Monochlorobiphenyl)	8915
Phenanthrene	6615
Pyrene	6665
sec-Butylbenzene	4440
Styrene	5100
tert-Butylbenzene	4445
Tetrachloroethene	5115
Toluene	5140
trans-1,2-Dichloroethylene	4700
trans-1,3-Dichloropropylene	4685
Trichloroethene (TCE, Trichloroethylene)	5170
Trichlorofluoromethane (Fluorotrichloromethane, Freon 11)	5175
Vinyl Chloride (Chloroethene)	5235
EPA TO-15 by Gas Chromatography Mass Spectrometry (GC/MS)	10248803
Air	
1,1,1,2-Tetrachloroethane	5105
1,1,1-Trichloroethane	5160
1,1,2,2-Tetrachloroethane	5110
1,1,2-Trichloro-1,2,2-Trifluoroethane (Trichlorotrifluoroethane, Freon 113)	5185
1,1,2-Trichloroethane	5165
1,1-Dichloroethane	4630
1,1-Dichloroethylene	4640
1,1-Dichloropropene	4670
1,2,3-Trichlorobenzene	5150
1,2,3-Trichloropropane (TCP)	5180
1,2,4-Trichlorobenzene	5155
1,2,4-Trimethylbenzene	5210
1,2-Dibromoethane (EDB, Ethylene Dibromide)	4585
1,2-Dichlorobenzene	4610
1,2-Dichloroethane (Ethylene Dichloride, EDC)	4635
1,2-Dichloropropane	4655
1,3,5-Trimethylbenzene	5215
1,3-Dichlorobenzene (1,3-DCB)	4615
1,3-Dichloropropane	4660
1,4-Dichlorobenzene	4620
1,4-Dioxane (1,4-Diethyleneoxide, p-Dioxane)	4735

Certificate of Accreditation: Supplement

Beacon Environmental Services, Inc.
2203A Commerce Road, Forest Hill, MD 21050
Contact Name: Pete Kelly Phone: 410-838-8780

Accreditation is granted to the facility to perform the following testing:

	Code
Organic	
EPA TO-15 by Gas Chromatography Mass Spectrometry (GC/MS)	10248803
Air	
2,2-Dichloropropane	4665
2-Chlorotoluene	4535
2-Methylnaphthalene	6385
4-Chlorotoluene (p-Chlorotoluene)	4540
4-Isopropyltoluene (p-Isopropyltoluene, p-Cymene)	4910
4-Methyl-2-Pentanone (Methyl Isobutyl Ketone (MIBK), Hexone)	4995
Benzene	4375
Bromobenzene	4385
Bromochloromethane	4390
Bromodichloromethane	4395
Bromoform	4400
Carbon Disulfide	4450
Carbon Tetrachloride	4455
Chlorobenzene	4475
Chlorodibromomethane (Dibromochloromethane)	4575
Chloroform	4505
cis-1,2-Dichloroethylene	4645
cis-1,3-Dichloropropene	4680
Dibromomethane (Methylene Bromide)	4595
Dichlorodifluoromethane (Freon 12)	4625
Ethylbenzene	4765
Hexachlorobutadiene	4835
Hexachloroethane	4840
Isopropylbenzene (Cumene)	4900
m,p-Xylene	5240
Methyl tert Butyl Ether (MTBE)	5000
Methylene Chloride (Dichloromethane)	4975
Naphthalene	5005
n-Butylbenzene	4435
n-Propylbenzene (1-phenylpropane)	5090
o-Xylene (1,2-Xylene)	5250
sec-Butylbenzene	4440
Styrene	5100
tert-Butylbenzene	4445
Tetrachloroethene	5115
Toluene	5140

Certificate of Accreditation: Supplement

Beacon Environmental Services, Inc.
2203A Commerce Road, Forest Hill, MD 21050
Contact Name: Pete Kelly Phone: 410-838-8780

Accreditation is granted to the facility to perform the following testing:

	Code
Organic	
EPA TO-15 by Gas Chromatography Mass Spectrometry (GC/MS)	10248803
Air	
trans-1,2-Dichloroethylene	4700
trans-1,3-Dichloropropylene	4685
Trichloroethene (TCE, Trichloroethylene)	5170
Trichlorofluoromethane (Fluorotrichloromethane, Freon 11)	5175
Vinyl Chloride (Chloroethene)	5235
EPA TO-17 by Gas Chromatography Mass Spectrometry (GC/MS)	10312206
Air	
1,1,1,2-Tetrachloroethane	5105
1,1,1-Trichloroethane	5160
1,1,2,2-Tetrachloroethane	5110
1,1,2-Trichloro-1,2,2-Trifluoroethane (Trichlorotrifluoroethane, Freon 113)	5185
1,1,2-Trichloroethane	5165
1,1-Dichloroethane	4630
1,1-Dichloroethylene	4640
1,1-Dichloropropene	4670
1,2,3-Trichlorobenzene	5150
1,2,3-Trichloropropane (TCP)	5180
1,2,4-Trichlorobenzene	5155
1,2,4-Trimethylbenzene	5210
1,2-Dibromoethane (EDB, Ethylene Dibromide)	4585
1,2-Dichlorobenzene	4610
1,2-Dichloroethane (Ethylene Dichloride, EDC)	4635
1,2-Dichloropropane	4655
1,3,5-Trimethylbenzene	5215
1,3-Butadiene	9318
1,3-Dichlorobenzene (1,3-DCB)	4615
1,3-Dichloropropane	4660
1,4-Dichlorobenzene	4620
1,4-Dioxane (1,4-Diethyleneoxide, p-Dioxane)	4735
2,2-Dichloropropane	4665
2-Chlorotoluene	4535
2-Methylnaphthalene	6385
4-Chlorotoluene (p-Chlorotoluene)	4540
4-Isopropyltoluene (p-Isopropyltoluene, p-Cymene)	4910
4-Methyl-2-Pentanone (Methyl Isobutyl Ketone (MIBK), Hexone)	4995
Acenaphthene	5500

Certificate of Accreditation: Supplement

Beacon Environmental Services, Inc.
2203A Commerce Road, Forest Hill, MD 21050
Contact Name: Pete Kelly Phone: 410-838-8780

Accreditation is granted to the facility to perform the following testing:

	Code
Organic	
EPA TO-17 by Gas Chromatography Mass Spectrometry (GC/MS)	10312206
Air	
Acenaphthylene	5505
Anthracene	5555
Benzene	4375
Benzo(a)Anthracene	5575
Biphenyl	6703
Bromobenzene	4385
Bromochloromethane	4390
Bromodichloromethane	4395
Bromoform	4400
Carbazole	5680
Carbon Disulfide	4450
Carbon Tetrachloride	4455
Chlorobenzene	4475
Chlorodibromomethane (Dibromochloromethane)	4575
Chloroethane (Ethyl chloride)	4485
Chloroform	4505
Chloroprene (2-Chloro-1,3-Butadiene)	4525
cis-1,2-Dichloroethylene	4645
cis-1,3-Dichloropropene	4680
Dibenzofuran	5905
Dibromomethane (Methylene Bromide)	4595
Dichlorodifluoromethane (Freon 12)	4625
Ethylbenzene	4765
Fluorene	6270
Hexachlorobutadiene	4835
Hexachloroethane	4840
Isopropylbenzene (Cumene)	4900
m,p-Xylene	5240
Methyl tert Butyl Ether (MTBE)	5000
Methylene Chloride (Dichloromethane)	4975
Naphthalene	5005
n-Butylbenzene	4435
n-Propylbenzene (1-phenylpropane)	5090
o-Xylene (1,2-Xylene)	5250
PCB-1 (2-Chlorobiphenyl, 2-Monochlorobiphenyl)	8915
Phenanthrene	6615

Certificate of Accreditation: Supplement

Beacon Environmental Services, Inc.
2203A Commerce Road, Forest Hill, MD 21050
Contact Name: Pete Kelly Phone: 410-838-8780

Accreditation is granted to the facility to perform the following testing:

	Code
Organic	
EPA TO-17 by Gas Chromatography Mass Spectrometry (GC/MS)	10312206
Air	
Pyrene	6665
sec-Butylbenzene	4440
Styrene	5100
tert-Butylbenzene	4445
Tetrachloroethene	5115
Toluene	5140
trans-1,2-Dichloroethylene	4700
trans-1,3-Dichloropropylene	4685
Trichloroethene (TCE, Trichloroethylene)	5170
Trichlorofluoromethane (Fluorotrichloromethane, Freon 11)	5175
Vinyl Chloride (Chloroethene)	5235

No Preparation methods on scope

Footnotes:

> Method codes are typically based on The NELAC Institute (TNI) Laboratory Accreditation Management System (LAMS) and are used to compare to the laboratory reported Performance Test (PT) results. Although the method code may not represent the specific method version, it is the method code used to represent the method/technology used to report PTs. (NC = No Code)

PERRY JOHNSON LABORATORY ACCREDITATION, INC.

Certificate of Accreditation

Perry Johnson Laboratory Accreditation, Inc. has assessed the Organization of:

Beacon Environmental Services, Inc.

2203A Commerce Road, Forest Hill, Maryland 21050

(Hereinafter called the Organization) and hereby declares that Organization has met the requirements of ISO/IEC 17025:2005) "General requirements for the competence of testing and calibration laboratories" and the Field Sampling and Measurement Organization Sector Volume 1 "General Requirements for Field Sampling and Measurement Organizations" (FSMO-V1-2014) and is accredited in accordance with the:

TNI National Environmental Field Activities Program (NEFAP)

This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system
(as outlined by the joint ISO-ILAC-IAF Communiqué dated April 2017):

This accreditation demonstrates the technical competence for the defined scope:

Environmental Field Sampling (Air and Emissions)

(As detailed in the supplement)

Accreditation claims for such activities shall only be made from the addresses referenced within this certificate. This Accreditation is granted subject to the system rules governing the Accreditation referred to above, and the Organization hereby covenants with the Accreditation Body's duty to observe and comply with the said rules.

For PJLA:

Tracy Szerszen
President

Initial Accreditation Date:	*Issue Date:*	*Expiration Date:*
September 7, 2012	August 14, 2022	November 30, 2024

Accreditation No.:	*Certificate No.:*
72690	L22-564

Perry Johnson Laboratory Accreditation, Inc. (PJLA)
755 W. Big Beaver, Suite 1325
Troy, Michigan 48084

The validity of this certificate is maintained through ongoing assessments based on a continuous accreditation cycle. The validity of this certificate should be confirmed through the PJLA website: www.pjlabs.com

Certificate of Accreditation: Supplement

TNI National Environmental Field Activities Program (NEFAP)

PJLA

Beacon Environmental Services, Inc.

2203A Commerce Road, Forest Hill, Maryland 21050
Contact Name: Harry O'Neill Phone: 410-838-8780

Accreditation is granted to the facility to perform the following field sampling:

FIELD OF SAMPLING/TEST	ITEMS, MATERIALS OR PRODUCTS SAMPLED/TESTED	SPECIFIC TESTS OR PROPERTIES MEASURED	SPECIFICATION, STANDARD METHOD OR TECHNIQUE USED
Passive Soil Gas Sampling	Air	Volatile Organic Compounds	Beacon SOP 10 – Collection and Return Shipment of Passive Soil Gas Samplers SOP 1 PSG Sampler Manufacturing SOP 4 PSG Sampler Shipment
Passive Indoor/Ambient Air Sampling	Air	Volatile Organic Compounds	Beacon SOP 11 - Passive Diffusion Samplers with Sorbent Tubes SOP 6 Sorbent Tube Shipment SOP 16 Sorbent Tube Preparation
Fugitive and Area Sources Sampler	Air	Volatile Organic Compounds	Method 325A- Deployment and VOC Sample Collection
Soil Gas and Indoor/Ambient Air Sampling with Pumps	Air	Organics	Thermal Desorption GC/MSD, EPA Method TO-17

State of Utah

Department of Health and Human Services

Environmental Laboratory Certification Program

Accreditation is hereby granted to

Beacon Environmental Services, Inc.

2203A Commerce Road, Suite 1
Forest Hill, MD 21050

Has conformed with the
2016 TNI Standard
Scope of accreditation is limited to the
State of Utah accredited fields that accompany
this Certificate

EPA Number: MD01091
Expiration Date: 12/31/2023
Certificate Number: MD010912022-12

Kristin Brown
Program Manager

NELAP RECOGNIZED TNI ACCREDITATION BODY

Continued accredited status depends on successful ongoing participation in the program.

Utah Department of Health & Human Services

State of Utah
SPENCER J. COX
Governor
DEIDRE HENDERSON
Lieutenant Governor

Department of Health Human Services
TRACY S. GRUBER
Executive Director
NATE CHECKETTS
Deputy Director
DR. MICHELLE HOFMANN
Executive Medical Director
DAVID LITVAK
Deputy Director
NATE WINTERS
Deputy Director

EPA Number: *MD01091* **Attachment to Certificate Number: MD010912022-12**

Beacon Environmental Services, Inc.

Program/Matrix: *Air & Emissions (Air & Emissions)*

	Start Date	Expires	AB
Method EPA 325B	**Year: 2013**	**Method Code: 10277437**	
1,3-Butadiene	01/01/23	12/31/23	UT
Benzene	01/01/23	12/31/23	UT
Chloroprene (2-Chloro-1,3-butadiene)	01/01/23	12/31/23	UT
Ethylbenzene	01/01/23	12/31/23	UT
m+p-xylene	01/01/23	12/31/23	UT
o-Xylene	01/01/23	12/31/23	UT
Toluene	01/01/23	12/31/23	UT
Method EPA 8260C	**Year: 2006**	**Method Code: 10307003**	
1,1,1,2-Tetrachloroethane	01/01/23	12/31/23	UT
1,1,1-Trichloroethane	01/01/23	12/31/23	UT
1,1,2,2-Tetrachloroethane	01/01/23	12/31/23	UT
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	01/01/23	12/31/23	UT
1,1,2-Trichloroethane	01/01/23	12/31/23	UT
1,1-Dichloroethane	01/01/23	12/31/23	UT
1,1-Dichloroethylene	01/01/23	12/31/23	UT
1,1-Dichloropropene	01/01/23	12/31/23	UT
1,2,3-Trichlorobenzene	01/01/23	12/31/23	UT
1,2,3-Trichloropropane	01/01/23	12/31/23	UT
1,2,4-Trichlorobenzene	01/01/23	12/31/23	UT
1,2,4-Trimethylbenzene	01/01/23	12/31/23	UT
1,2-Dibromoethane (EDB, Ethylene dibromide)	01/01/23	12/31/23	UT
1,2-Dichloro-1,1,2,2-tetrafluoroethane (Freon-114)	01/01/23	12/31/23	UT
1,2-Dichlorobenzene (o-Dichlorobenzene)	01/01/23	12/31/23	UT
1,2-Dichloroethane (Ethylene dichloride)	01/01/23	12/31/23	UT
1,2-Dichloropropane	01/01/23	12/31/23	UT
1,3,5-Trimethylbenzene	01/01/23	12/31/23	UT
1,3-Butadiene	01/01/23	12/31/23	UT
1,3-Dichlorobenzene	01/01/23	12/31/23	UT
1,3-Dichloropropane	01/01/23	12/31/23	UT
1,4-Dichlorobenzene	01/01/23	12/31/23	UT
1,4-Dioxane (1,4- Diethyleneoxide)	01/01/23	12/31/23	UT
1-Methylnaphthalene	01/01/23	12/31/23	UT
1-Propene (Propylene)	01/01/23	12/31/23	UT
2,2-Dichloropropane	01/01/23	12/31/23	UT
2-Butanone (Methyl ethyl ketone, MEK)	01/01/23	12/31/23	UT

Beacon Environmental Services, Inc.

	Start Date	Expires	AB
Program/Matrix: ***Air & Emissions (Air & Emissions)***			
2-Chlorobiphenyl (BZ-1)	01/01/23	12/31/23	UT
2-Chlorotoluene	01/01/23	12/31/23	UT
2-Methylnaphthalene	01/01/23	12/31/23	UT
4-Chlorotoluene	01/01/23	12/31/23	UT
4-Ethyltoluene	01/01/23	12/31/23	UT
4-Isopropyltoluene (p-Cymene,p-Isopropyltoluene)	01/01/23	12/31/23	UT
4-Methyl-2-pentanone (MIBK)	01/01/23	12/31/23	UT
Acenaphthene	01/01/23	12/31/23	UT
Acenaphthylene	01/01/23	12/31/23	UT
Acetone	01/01/23	12/31/23	UT
Anthracene	01/01/23	12/31/23	UT
Benzene	01/01/23	12/31/23	UT
Benzo(a)anthracene	01/01/23	12/31/23	UT
Benzyl chloride	01/01/23	12/31/23	UT
Biphenyl	01/01/23	12/31/23	UT
Bromobenzene	01/01/23	12/31/23	UT
Bromochloromethane	01/01/23	12/31/23	UT
Bromodichloromethane	01/01/23	12/31/23	UT
Bromoform	01/01/23	12/31/23	UT
Carbazole	01/01/23	12/31/23	UT
Carbon disulfide	01/01/23	12/31/23	UT
Carbon tetrachloride	01/01/23	12/31/23	UT
Chlorobenzene	01/01/23	12/31/23	UT
Chlorodibromomethane	01/01/23	12/31/23	UT
Chloroethane (Ethyl chloride)	01/01/23	12/31/23	UT
Chloroform	01/01/23	12/31/23	UT
Chloroprene (2-Chloro-1,3-butadiene)	01/01/23	12/31/23	UT
cis-1,2-Dichloroethylene	01/01/23	12/31/23	UT
cis-1,3-Dichloropropene	01/01/23	12/31/23	UT
Cyclohexane	01/01/23	12/31/23	UT
Dibenzofuran	01/01/23	12/31/23	UT
Dibromomethane (Methylene bromide)	01/01/23	12/31/23	UT
Dichlorodifluoromethane (Freon-12)	01/01/23	12/31/23	UT
Ethanol	01/01/23	12/31/23	UT
Ethyl acetate	01/01/23	12/31/23	UT
Ethylbenzene	01/01/23	12/31/23	UT
Fluorene	01/01/23	12/31/23	UT
Hexachlorobutadiene	01/01/23	12/31/23	UT
Hexachloroethane	01/01/23	12/31/23	UT
Isopropyl alcohol (2-Propanol, Isopropanol)	01/01/23	12/31/23	UT
Isopropylbenzene	01/01/23	12/31/23	UT
m+p-xylene	01/01/23	12/31/23	UT
Methyl bromide (Bromomethane)	01/01/23	12/31/23	UT
Methyl chloride (Chloromethane)	01/01/23	12/31/23	UT
Methyl tert-butyl ether (MTBE)	01/01/23	12/31/23	UT
Methylene chloride (Dichloromethane)	01/01/23	12/31/23	UT
Naphthalene	01/01/23	12/31/23	UT
n-Butylbenzene	01/01/23	12/31/23	UT

Beacon Environmental Services, Inc.

	Start Date	Expires	AB
Program/Matrix: ***Air & Emissions (Air & Emissions)***			
n-Heptane	01/01/23	12/31/23	UT
n-Hexane	01/01/23	12/31/23	UT
n-Propylbenzene	01/01/23	12/31/23	UT
o-Xylene	01/01/23	12/31/23	UT
Phenanthrene	01/01/23	12/31/23	UT
Pyrene	01/01/23	12/31/23	UT
sec-Butylbenzene	01/01/23	12/31/23	UT
Styrene	01/01/23	12/31/23	UT
tert-Butylbenzene	01/01/23	12/31/23	UT
Tetrachloroethylene (Perchloroethylene)	01/01/23	12/31/23	UT
Tetrahydrofuran (THF)	01/01/23	12/31/23	UT
Toluene	01/01/23	12/31/23	UT
trans-1,2-Dichloroethylene	01/01/23	12/31/23	UT
trans-1,3-Dichloropropylene	01/01/23	12/31/23	UT
Trichloroethene (Trichloroethylene)	01/01/23	12/31/23	UT
Trichlorofluoromethane (Fluorotrichloromethane, Freon 11)	01/01/23	12/31/23	UT
Vinyl chloride (chloroethene)	01/01/23	12/31/23	UT
Method EPA TO-17	**Revision: 2**	**Method Code: 10312206**	
1,1,1,2-Tetrachloroethane	01/01/23	12/31/23	UT
1,1,1-Trichloroethane	01/01/23	12/31/23	UT
1,1,2,2-Tetrachloroethane	01/01/23	12/31/23	UT
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	01/01/23	12/31/23	UT
1,1,2-Trichloroethane	01/01/23	12/31/23	UT
1,1-Dichloroethane	01/01/23	12/31/23	UT
1,1-Dichloroethylene	01/01/23	12/31/23	UT
1,1-Dichloropropene	01/01/23	12/31/23	UT
1,2,3-Trichlorobenzene	01/01/23	12/31/23	UT
1,2,3-Trichloropropane	01/01/23	12/31/23	UT
1,2,4-Trichlorobenzene	01/01/23	12/31/23	UT
1,2,4-Trimethylbenzene	01/01/23	12/31/23	UT
1,2-Dibromoethane (EDB, Ethylene dibromide)	01/01/23	12/31/23	UT
1,2-Dichloro-1,1,2,2-tetrafluoroethane (Freon-114)	01/01/23	12/31/23	UT
1,2-Dichlorobenzene (o-Dichlorobenzene)	01/01/23	12/31/23	UT
1,2-Dichloroethane (Ethylene dichloride)	01/01/23	12/31/23	UT
1,2-Dichloropropane	01/01/23	12/31/23	UT
1,3,5-Trimethylbenzene	01/01/23	12/31/23	UT
1,3-Butadiene	01/01/23	12/31/23	UT
1,3-Dichlorobenzene	01/01/23	12/31/23	UT
1,3-Dichloropropane	01/01/23	12/31/23	UT
1,4-Dichlorobenzene	01/01/23	12/31/23	UT
1,4-Dioxane (1,4- Diethyleneoxide)	01/01/23	12/31/23	UT
1-Methylnaphthalene	01/01/23	12/31/23	UT
1-Propene (Propylene)	01/01/23	12/31/23	UT
2,2-Dichloropropane	01/01/23	12/31/23	UT
2-Butanone (Methyl ethyl ketone, MEK)	01/01/23	12/31/23	UT
2-Chlorobiphenyl (BZ-1)	01/01/23	12/31/23	UT
2-Chlorotoluene	01/01/23	12/31/23	UT
2-Methylnaphthalene	01/01/23	12/31/23	UT

Beacon Environmental Services, Inc.

	Start Date	Expires	AB
Program/Matrix: ***Air & Emissions (Air & Emissions)***			
4-Chlorotoluene	01/01/23	12/31/23	UT
4-Ethyltoluene	01/01/23	12/31/23	UT
4-Isopropyltoluene (p-Cymene,p-Isopropyltoluene)	01/01/23	12/31/23	UT
4-Methyl-2-pentanone (MIBK)	01/01/23	12/31/23	UT
Acenaphthene	01/01/23	12/31/23	UT
Acenaphthylene	01/01/23	12/31/23	UT
Acetone	01/01/23	12/31/23	UT
Anthracene	01/01/23	12/31/23	UT
Benzene	01/01/23	12/31/23	UT
Benzo(a)anthracene	01/01/23	12/31/23	UT
Benzyl chloride	01/01/23	12/31/23	UT
Biphenyl	01/01/23	12/31/23	UT
Bromobenzene	01/01/23	12/31/23	UT
Bromochloromethane	01/01/23	12/31/23	UT
Bromodichloromethane	01/01/23	12/31/23	UT
Bromoform	01/01/23	12/31/23	UT
Carbazole	01/01/23	12/31/23	UT
Carbon disulfide	01/01/23	12/31/23	UT
Carbon tetrachloride	01/01/23	12/31/23	UT
Chlorobenzene	01/01/23	12/31/23	UT
Chlorodibromomethane	01/01/23	12/31/23	UT
Chloroethane (Ethyl chloride)	01/01/23	12/31/23	UT
Chloroform	01/01/23	12/31/23	UT
Chloroprene (2-Chloro-1,3-butadiene)	01/01/23	12/31/23	UT
cis-1,2-Dichloroethylene	01/01/23	12/31/23	UT
cis-1,3-Dichloropropene	01/01/23	12/31/23	UT
Cyclohexane	01/01/23	12/31/23	UT
Dibenzofuran	01/01/23	12/31/23	UT
Dibromomethane (Methylene bromide)	01/01/23	12/31/23	UT
Dichlorodifluoromethane (Freon-12)	01/01/23	12/31/23	UT
Ethanol	01/01/23	12/31/23	UT
Ethyl acetate	01/01/23	12/31/23	UT
Ethylbenzene	01/01/23	12/31/23	UT
Fluorene	01/01/23	12/31/23	UT
Hexachlorobutadiene	01/01/23	12/31/23	UT
Hexachloroethane	01/01/23	12/31/23	UT
Isopropyl alcohol (2-Propanol, Isopropanol)	01/01/23	12/31/23	UT
Isopropylbenzene	01/01/23	12/31/23	UT
m+p-xylene	01/01/23	12/31/23	UT
Methyl bromide (Bromomethane)	01/01/23	12/31/23	UT
Methyl chloride (Chloromethane)	01/01/23	12/31/23	UT
Methyl tert-butyl ether (MTBE)	01/01/23	12/31/23	UT
Methylene chloride (Dichloromethane)	01/01/23	12/31/23	UT
Naphthalene	01/01/23	12/31/23	UT
n-Butylbenzene	01/01/23	12/31/23	UT
n-Heptane	01/01/23	12/31/23	UT
n-Hexane	01/01/23	12/31/23	UT
n-Propylbenzene	01/01/23	12/31/23	UT

Beacon Environmental Services, Inc.

	Start Date	Expires	AB
Program/Matrix: ***Air & Emissions (Air & Emissions)***			
o-Xylene	01/01/23	12/31/23	UT
Phenanthrene	01/01/23	12/31/23	UT
Pyrene	01/01/23	12/31/23	UT
sec-Butylbenzene	01/01/23	12/31/23	UT
Styrene	01/01/23	12/31/23	UT
tert-Butylbenzene	01/01/23	12/31/23	UT
Tetrachloroethylene (Perchloroethylene)	01/01/23	12/31/23	UT
Tetrahydrofuran (THF)	01/01/23	12/31/23	UT
Toluene	01/01/23	12/31/23	UT
trans-1,2-Dichloroethylene	01/01/23	12/31/23	UT
trans-1,3-Dichloropropylene	01/01/23	12/31/23	UT
Trichloroethene (Trichloroethylene)	01/01/23	12/31/23	UT
Trichlorofluoromethane (Fluorotrichloromethane, Freon 11)	01/01/23	12/31/23	UT
Vinyl chloride (chloroethene)	01/01/23	12/31/23	UT

The Utah Environmental Laboratory Certification Program (ELCP) encourages clients and data users to verify the most current certification letter for the authorized method.

The analytes by method which a laboratory is authorized to perform at any given time will be those indicated in the most recent certificate letter. The most recent certification letter supersedes all previous certification or authorization letters. It is the certified laboratory's responsibility to review this letter for discrepancies. The certified laboratory must document any discrepancies in this letter and send notice to this bureau within 15 days of receipt. This certificate letter will be recalled in the event your laboratory's certification is revoked.

The State of Washington Department of Ecology

Beacon Environmental
Forest Hill, MD

has complied with provisions set forth in Chapter 173-50 WAC and is hereby recognized by the Department of Ecology as an ACCREDITED LABORATORY for the analytical parameters listed on the accompanying Scope of Accreditation.

This certificate is effective May 24, 2023 and shall expire May 23, 2024.

Witnessed under my hand on May 23, 2023.

Rebecca Wood
Lab Accreditation Unit Supervisor

Laboratory ID
C1085

WASHINGTON STATE DEPARTMENT OF ECOLOGY

ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM

SCOPE OF ACCREDITATION

Beacon Environmental

Forest Hill, MD

is accredited for the analytes listed below using the methods indicated. Full accreditation is granted unless stated otherwise in a note. EPA is the U.S. Environmental Protection Agency. SM is "Standard Methods for the Examination of Water and Wastewater." SM refers to EPA approved method versions. ASTM is the American Society for Testing and Materials. USGS is the U.S. Geological Survey. AOAC is the Association of Official Analytical Chemists. Other references are described in notes.

Matrix/Analyte	Method	Notes
Air		
1,1,1,2-Tetrachloroethane	EPA TO-17 Rev. 2 (1999)	1
1,1,1-Trichloroethane	EPA TO-17 Rev. 2 (1999)	1
1,1,2,2-Tetrachloroethane	EPA TO-17 Rev. 2 (1999)	1
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	EPA TO-17 Rev. 2 (1999)	1
1,1,2-Trichloroethane	EPA TO-17 Rev. 2 (1999)	1
1,1'-Biphenyl (BZ-0)	EPA TO-17 Rev. 2 (1999)	1
1,1-Dichloroethane	EPA TO-17 Rev. 2 (1999)	1
1,1-Dichloroethylene	EPA TO-17 Rev. 2 (1999)	1
1,1-Dichloropropene	EPA TO-17 Rev. 2 (1999)	1
1,2,3-Trichlorobenzene	EPA TO-17 Rev. 2 (1999)	1
1,2,3-Trichloropropane	EPA TO-17 Rev. 2 (1999)	1
1,2,4-Trichlorobenzene	EPA TO-17 Rev. 2 (1999)	1
1,2,4-Trimethylbenzene	EPA TO-17 Rev. 2 (1999)	1
1,2-Dibromoethane (EDB, Ethylene dibromide)	EPA TO-17 Rev. 2 (1999)	1
1,2-Dichlorobenzene	EPA TO-17 Rev. 2 (1999)	1
1,2-Dichloroethane	EPA TO-17 Rev. 2 (1999)	1
1,2-Dichloropropane	EPA TO-17 Rev. 2 (1999)	1
1,3,5-Trimethylbenzene	EPA TO-17 Rev. 2 (1999)	1
1,3-Dichlorobenzene	EPA TO-17 Rev. 2 (1999)	1
1,3-Dichloropropane	EPA TO-17 Rev. 2 (1999)	1
1,4-Dichlorobenzene	EPA TO-17 Rev. 2 (1999)	1
1,4-Dioxane (1,4- Diethyleneoxide)	EPA TO-17 Rev. 2 (1999)	1
2,2-Dichloropropane	EPA TO-17 Rev. 2 (1999)	1
2-Chlorobiphenyl	EPA TO-17 Rev. 2 (1999)	1
2-Chlorotoluene	EPA TO-17 Rev. 2 (1999)	1
2-Methylnaphthalene	EPA TO-17 Rev. 2 (1999)	1

Matrix/Analyte	Method	Notes
Air		
4-Chlorotoluene	EPA TO-17 Rev. 2 (1999)	1
4-Isopropyltoluene (p-Cymene)	EPA TO-17 Rev. 2 (1999)	1
4-Methyl-2-pentanone (MIBK)	EPA TO-17 Rev. 2 (1999)	1
Acenaphthene	EPA TO-17 Rev. 2 (1999)	1
Acenaphthylene	EPA TO-17 Rev. 2 (1999)	1
Acetone	EPA TO-17 Rev. 2 (1999)	1
Anthracene	EPA TO-17 Rev. 2 (1999)	1
Benzene	EPA TO-17 Rev. 2 (1999)	1
Benzo(a)anthracene	EPA TO-17 Rev. 2 (1999)	1
Bromobenzene	EPA TO-17 Rev. 2 (1999)	1
Bromochloromethane	EPA TO-17 Rev. 2 (1999)	1
Bromodichloromethane	EPA TO-17 Rev. 2 (1999)	1
Bromoform	EPA TO-17 Rev. 2 (1999)	1
Carbazole	EPA TO-17 Rev. 2 (1999)	1
Carbon disulfide	EPA TO-17 Rev. 2 (1999)	1
Carbon tetrachloride	EPA TO-17 Rev. 2 (1999)	1
Chlorobenzene	EPA TO-17 Rev. 2 (1999)	1
Chlorodibromomethane	EPA TO-17 Rev. 2 (1999)	1
Chloroethane	EPA TO-17 Rev. 2 (1999)	1
Chloroform	EPA TO-17 Rev. 2 (1999)	1
cis & trans-1,2-Dichloroethene	EPA TO-17 Rev. 2 (1999)	1
cis-1,2-Dichloroethylene	EPA TO-17 Rev. 2 (1999)	1
cis-1,3-Dichloropropene	EPA TO-17 Rev. 2 (1999)	1
Dibenzofuran	EPA TO-17 Rev. 2 (1999)	1
Dibromomethane	EPA TO-17 Rev. 2 (1999)	1
Dichlorodifluoromethane	EPA TO-17 Rev. 2 (1999)	1
Ethylbenzene	EPA TO-17 Rev. 2 (1999)	1
Fluorene	EPA TO-17 Rev. 2 (1999)	1
Hexachlorobutadiene	EPA TO-17 Rev. 2 (1999)	1
Hexachloroethane	EPA TO-17 Rev. 2 (1999)	1
Isopropylbenzene	EPA TO-17 Rev. 2 (1999)	1
m+p-xylene	EPA TO-17 Rev. 2 (1999)	1
Methyl bromide (Bromomethane)	EPA TO-17 Rev. 2 (1999)	1
Methyl chloride (Chloromethane)	EPA TO-17 Rev. 2 (1999)	1
Methyl tert-butyl ether (MTBE)	EPA TO-17 Rev. 2 (1999)	1
Methylene chloride	EPA TO-17 Rev. 2 (1999)	1
Naphthalene	EPA TO-17 Rev. 2 (1999)	1

Matrix/Analyte	Method	Notes
Air		
n-Butylbenzene	EPA TO-17 Rev. 2 (1999)	1
n-Propylbenzene	EPA TO-17 Rev. 2 (1999)	1
o-Xylene	EPA TO-17 Rev. 2 (1999)	1
Phenanthrene	EPA TO-17 Rev. 2 (1999)	1
Pyrene	EPA TO-17 Rev. 2 (1999)	1
sec-Butylbenzene	EPA TO-17 Rev. 2 (1999)	1
Styrene	EPA TO-17 Rev. 2 (1999)	1
tert-Butylbenzene	EPA TO-17 Rev. 2 (1999)	1
Tetrachloroethylene (Perchloroethylene)	EPA TO-17 Rev. 2 (1999)	1
Toluene	EPA TO-17 Rev. 2 (1999)	1
trans-1,2 Dichloroethylene	EPA TO-17 Rev. 2 (1999)	1
trans-1,3-Dichloropropylene	EPA TO-17 Rev. 2 (1999)	1
Trichloroethene (Trichloroethylene)	EPA TO-17 Rev. 2 (1999)	1
Trichlorofluoromethane	EPA TO-17 Rev. 2 (1999)	1
Vinyl chloride	EPA TO-17 Rev. 2 (1999)	1
Xylene (total)	EPA TO-17 Rev. 2 (1999)	1

Accredited Parameter Note Detail

(1) Accreditation based in part on recognition of Utah NELAP accreditation.

Authentication Signature
Rebecca Wood, Lab Accreditation Unit Supervisor

05/23/2023
Date

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER

Expires 12:01 AM April 01, 2024
Issued April 01, 2022
Revised March 30, 2023

CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

Issued in accordance with and pursuant to section 502 Public Health Law of New York State

MR. STEVEN THORNLEY
BEACON ENVIRONMENTAL SERVICES
2203A COMMERCE RD. SUITE 1
FOREST HILL, MD 21050

NY Lab Id No: 12097

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2016) for the category ENVIRONMENTAL ANALYSES AIR AND EMISSIONS
All approved analytes are listed below:

Polynuclear Aromatics	
Naphthalene	EPA TO-17
Purgeable Aromatics	
Benzene	EPA TO-17
Ethyl benzene	EPA TO-17
m/p-Xylenes	EPA TO-17
o-Xylene	EPA TO-17
Toluene	EPA TO-17
Purgeable Halocarbons	
1,1,1-Trichloroethane	EPA TO-17
1,1-Dichloroethane	EPA TO-17
1,1-Dichloroethene	EPA TO-17
1,2-Dichloroethane	EPA TO-17
Carbon tetrachloride	EPA TO-17
Chloroform	EPA TO-17
cis-1,2-Dichloroethene	EPA TO-17
Methylene chloride	EPA TO-17
Tetrachloroethene	EPA TO-17
trans-1,2-Dichloroethene	EPA TO-17
Trichloroethene	EPA TO-17
Vinyl chloride	EPA TO-17

Serial No.: 66759

BESURE
SAMPLE COLLECTION KIT™

Instructions for PSG Sampler Deployment, Retrieval and Return to Beacon Environmental

Following are instructions for the BeSure Sample Collection Kit™ for the deployment and retrieval of Beacon Passive Soil Gas Samplers. Before going into the field, confirm you have everything you need by checking the enclosed PSG Kit Inventory sheet. If at any time you have questions or need additional assistance, please call us at **1-410-838-8780**.

IMPORTANT: TRIP BLANKS ARE TO REMAIN CLOSED AT ALL TIMES
NO SMOKING WHILE HANDLING SAMPLES

DO NOT INSTALL A SECOND SAMPLER TO COLLECT A DUPLICATE!

Duplicate analysis can be performed for any field sample because each sampler contains two sets of adsorbent cartridges. To select field sample duplicates, note them on the CoC; a second (co-located) sample is not necessary. Add a second entry to the CoC with the field sample ID followed by “D” or “Dup” (i.e., PSG-08-Dup is the duplicate for PSG-08). There is an additional per sample charge for analysis of any duplicates.

NOTE: Do not deploy Samplers within 10 feet of a monitoring well, penetrometer, hydropunch shaft, or other intrusive sampling apparatus that could potentially create a preferential pathway for gases.

Sampler Deployment

Need help? Call 1-410-838-8780
or email help@beacon-usa.com

PSG KIT INSTRUCTIONS

SOIL / VEGETATION

1 Use a hammer drill and drill bits to create the soil vapor pathway. Drill a 1 1/4 inch to 1 1/2 inch diameter hole to a depth of 12-14 inches. Using a 1/2-inch drill bit, drill a hole to a depth of 36 inches.

See diagram on pg. 4

2 Place the sampling kit and these materials within easy access:

- 12-inch length of pipe
- Pipe cutter
- Tapping dowel
- Hammer
- Sampling cap
- Aluminum foil
- Beacon Sampler

3 Lower the pipe into the hole and push or tap the pipe 1/2 inch below grade using the tapping dowel and a hammer. If necessary, first cut the pipe so that it is flush or just below grade before tapping the pipe into the hole.

4 Remove a Beacon Sampler and unwind the retrieval wire wrapped around it, leaving a small coil of wire at the end. Extend the wire so that the Sampler will easily go into the pipe.

ASPHALT / CONCRETE

DoD ELAP/ISO 17025 Accredited Laboratory, TNI NEFAP Accredited Field Sampling Organization, Accreditation No. 72690

Sampler Deployment

Need help? Call 1-410-838-8780
or email help@beacon-usa.com

SOIL / VEGETATION

5 Replace the solid white shipping cap with a Sampling Cap (black cap with screened hole). Place the solid cap in the Cap Storage container.

IMPORTANT: Make sure the black sampling cap is on the vial before installing the sampler.

6 Lower the Sampler, open-end down, into the metal pipe approximately four inches so that the retrieval wire sticks out of the hole.

7 Make sure the end of the retrieval wire remains above the surface.

IF ASPHALT / CONCRETE
Hook the end of the wire (with small coil) and hang it over the top and outside of the pipe.

8 Cover and plug the open end of the pipe with a balled-up wad of aluminum foil, pressing it tightly on top of the pipe with the tapping dowel so it forms a flattened seal on the pipe approximately 1/4 inch below grade.

ASPHALT / CONCRETE

DoD ELAP/ISO 17025 Accredited Laboratory, TNI NEFAP Accredited Field Sampling Organization, Accreditation No. 72690

Sampler Deployment

SOIL / VEGETATION

9 Cover the hole to grade with local soils or sand, leaving the end of the wire exposed above the surface of the ground. Use a hammer to collapse/pack the soil above the sampler. Coil the wire and lay it flat on the ground surface.

IF ASPHALT / CONCRETE
Cover the hole to grade with a 1/4 inch thick concrete patch. (If it is thicker it will be difficult to remove during retrieval.)

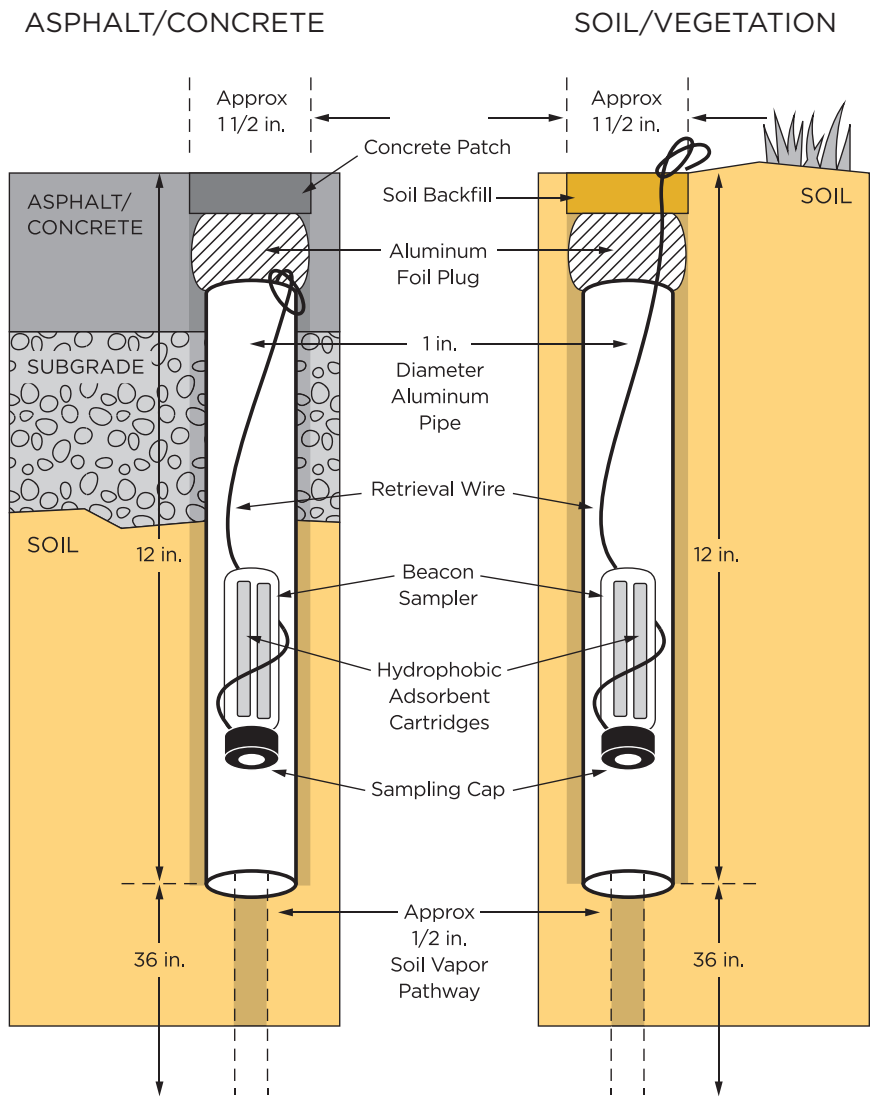
IMPORTANT: Only use Dry Concrete Mortar Mix. Do Not use Premixed Patching Compounds. They contain solvents.

10 Close the Field Kit and record the following info on the Chain-of-Custody: location ID, date/time of deployment (to the nearest minute) and other relevant information.

Repeat steps 1-10 until all samplers have been installed.

After deploying all samplers, place each Trip Blank in an Individual Sampler Bag. Store the Trip Blank(s) in the Return Shipment Bag(s) until retrieval. Make sure there is 1 Trip Blank in each Return Shipment Bag.

ASPHALT / CONCRETE



DoD ELAP/ISO 17025 Accredited Laboratory, TNI NEFAP Accredited Field Sampling Organization, Accreditation No. 72690

Sampler Retrieval

Need help? Call 1-410-838-8780
or email help@beacon-usa.com

PSG KIT INSTRUCTIONS

SOIL / VEGETATION

1 Place the sampling kit and these materials within easy access:

- Small screwdriver
- Wire cutters
- White solid Shipping Cap
- Towel
- Gauze cloth
- Individual Sampler Bag
- Return Shipment Bag

IF ASPHALT / CONCRETE

- Hammer & chisel

2 Clear the soil and gently remove the aluminum foil plug using a small screwdriver, if necessary. Retrieve the Sampler from the hole by gently pulling the wire.

IF ASPHALT / CONCRETE
Remove the concrete plug with the hammer and chisel. Carefully remove the aluminum foil plug using the screwdriver. Retrieve the Sampler from the hole by gently pulling the wire.

3 Clean the sides of the Sampler with the towel and remove the black Sampling Cap. Do not return the used Sampling Caps.

Transport vials (green labels) are only used if a Sampler is broken during retrieval. If this occurs, transfer all contents from the broken Sampler to the transport vial.

4 Cut ALL wire from the Sampler using wire cutters, and clean the vial threads completely with the gauze cloth.

ASPHALT / CONCRETE

DoD ELAP/ISO 17025 Accredited Laboratory, TNI NEFAP Accredited Field Sampling Organization, Accreditation No. 72690

Sampler Retrieval

Need help? Call 1-410-838-8780
or email help@beacon-usa.com

SOIL / VEGETATION

5 Firmly screw the solid cap onto the vial. Use a ballpoint pen to write the sample ID on the cap's label.

IMPORTANT: Do not use a Sharpie to mark the caps. It can contaminate the samples.

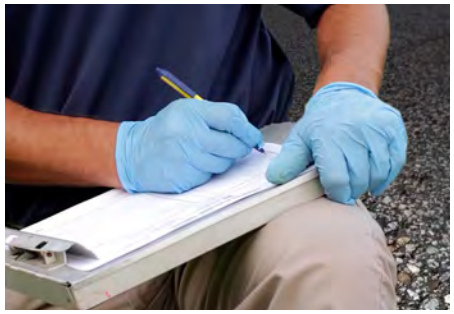
6 Place the sealed and labeled Beacon Sampler into the individual Sampler Bag. Write the sample ID on the white block on the bag using a ballpoint pen. Place the individually bagged and labeled sampler into the larger bag labeled "Return Shipment Bag."

7 Close the Field Kit and on the Chain-of-Custody, record the ID, date/time of retrieval (to the nearest minute) and other relevant information.

Move to next location. Repeat steps 1-6, until all Samplers are retrieved. Patch or back-fill holes as necessary.

8 To prepare for return shipment, verify that all Samplers are stored in the Return Shipment Bag, containing an adsorbent pak and a Trip Blank.

ASPHALT / CONCRETE



DoD ELAP/ISO 17025 Accredited Laboratory, TNI NEFAP Accredited Field Sampling Organization, Accreditation No. 72690

Sampler Retrieval

SOIL / VEGETATION

9 Seal the Return Shipment Bag and place it in the upper tray of the Field Kit and place the provided tools and materials below the tray, in the lower compartment (blocks, extra samplers, tools, etc.)

IMPORTANT: Do not return used sampling caps, used pipe, or wire with the field kit. They may bias the samplers.

10 Close the Field Kit, and secure it with the provided Custody Seal. Sign and date the Chain-of-Custody. Take a picture, scan or make a photocopy for your records.

11 Package the Field Kit into the original shipment box. Place the Chain of Custody on top of the kit. Seal the box, affix a FedEx Airbill and send to the address noted below:

Beacon Environmental
Attn: Sample Receiving
2203A Commerce Road, Suite 1
Forest Hill, Maryland 21050, USA
1-410-838-8780

IMPORTANT: Do not use styrene peanuts, newspaper or other packing materials. They may contaminate the samples.

For questions or assistance
Call 1-410-838-8780 or
email help@beacon-usa.com

ASPHALT / CONCRETE

FAQs

Does Beacon receive samples on Weekends? No. If possible, store the samples in a clean environment until Monday and then ship.

How large of a diameter hole should I make? The preferred diameter is 3-4 cm. If you must make a hole larger than 4 cm, please contact Beacon.

Can I install samplers in the rain?
Beacon's sorbent is hydrophobic. The only issues with precipitation are:

1. if the vadose zone is saturated and vapors are not able to migrate
2. if there is so much rain during install that the holes are being filled with water

In these situations, please contact Beacon to discuss.

Can I install samplers in gravel?
Yes, make sure that you clear away enough surface gravel until you reach soil that will stay open as you create your hole. If this is not possible, please contact Beacon to discuss options.

Tips

- Remember to remove all the wire during retrieval. There should be no wire on the Beacon Sampler.
- Return all extra Samplers, tools, wood blocks, and unused pipe to avoid replacement fees.
- Note any duplicates on the CoC.

DoD ELAP/ISO 17025 Accredited Laboratory, TNI NEFAP Accredited Field Sampling Organization, Accreditation No. 72690

BESURE
SAMPLE COLLECTION KIT™

PSG KIT INVENTORY

Qty	Inventory Items
	BEACON SAMPLERS
	TRIP BLANKS (Blue Label)
	TRANSPORT VIALS (Green Label)
	SAMPLING CAPS IN CONTAINER
	CAP STORAGE CONTAINERS
	12-INCH LENGTHS OF PIPE
	GAUZE CLOTHS
	3 X 4 INCH PLASTIC SAMPLER BAGS
	12 X 12 INCH PLASTIC RETURN SHIPMENT BAGS
	TAPPING DOWELS

You will also need the following items:

- PIN FLAGS, WOODEN STAKES OR OTHER LOCATION MARKERS
- FLAGGING TAPE
- NITRILE GLOVES
- CLIPBOARD AND BALLPOINT PEN
- BOX OF ALUMINUM FOIL
- HAMMER
- ELECTRIC ROTARY HAMMER DRILL
- 1 1/4 - 1 1/2 INCH DRILL BIT WITH AT LEAST 12 INCHES OF CUTTING LENGTH
- 1/2 INCH DRILL BIT WITH **30 to 36** INCHES OF CUTTING LENGTH
- PIPE WRENCH (to dislodge drill bits if stuck)
- SMALL SCREWDRIVER
- CLEAN TOWEL

Something missing?
Call 1-410-838-8780 or email
help@beacon-usa.com

IMPORTANT: Return all extra Samplers, tools, wood blocks, and unused pipe to avoid replacement fees.

If sampling through asphalt or concrete:

Do not use pre-mixed patching compounds for the temporary patching of sample holes; these products contain solvents and will bias the results

You will need:

- DRY CONCRETE MORTAR MIX, SMALL PAIL, WATER AND A SMALL PLASTIC PUTTY KNIFE (for temporary patching of the sample holes).
- HAMMER AND CHISEL (to remove the temporary patch)
- ASPHALT COLD PATCH OR CEMENT (for final repair)

For Lab Use Only – Shipment Verification	
Prepared by / Date	Checked by / Date

DoD ELAP/ISO 17025 Accredited Laboratory, TNI NEFAP Accredited Field Sampling Organization, Accreditation No. 72690

BEACON ENVIRONMENTAL
2203A Commerce Rd, Suite 1
Forest Hill, MD 21050, USA
Need help? Call 1-410-838-8780
or email help@beacon-usa.com

PASSIVE SOIL GAS SAMPLES CHAIN-OF-CUSTODY

Project Information	Client Information	
Site Name:	Company Name:	Project Manager:
	Office Location:	Client PO:
Site Location:	Submitted by:	Turn around time (check one):
	Email:	☐ Normal ☐ Rush (specify) _____ days

Field Sample ID	Start Date	Start Time	Stop Date	Stop Time	Sampling Hole Depth ☐ cm ☐ inches	Surface Type (Soil, Asphalt, Concrete, Gravel)	Optional Information (Location Description, Sample Condition, PID / FID Readings, etc)

Special Instructions:

Relinquished by (signature):	Date / Time:	Received by (signature):	Date / Time:
Relinquished by (signature):	Date / Time:	Received by (signature):	Date / Time:
For Lab Use Only	Beacon Job No:	Beacon Proposal:	Analytical Method:
Courier Name:	Shipment Condition:	Custody Seal Intact: ☐ Yes ☐ No ☐ n/a	Custody Seal No:

Beacon Environmental

PROPRIETARY INFORMATION **CONTROLLED DOCUMENT**

Title: GC/MS Sample Analysis for Passive Soil Gas Samples following EPA Method 8260C and 8260D	**SOP No. 18 Rev.** 22 Page 1 of 43
Reviewers: Kenny Ifeacho Kenny Ifeacho Digitally signed by Kenny Ifeacho Date: 2023.06.06 10:43:40 -04'00'	**Control #:**
Final Approval: Steve Thornley Steven C Thornley Digitally signed by Steven C Thornley:A0109B30000016C6E9D9C6A0000125B Date: 2023.06.06 10:41:51 -04'00'	**Date Approved**: 6/6/2023 **Date Reviewed:** 6/6/2023

Last Reviewed: 6/6/2023

TABLE OF CONTENTS]

1 REVISION HISTORY (For Revision .01 or higher)

Version 18/01
- Changed 8260B to 8260C as the method followed.
- Included 8260C in the reference section.

Version 18/02
- Added instructions on file naming to discern between analysis on the same day performed on different instruments.

Version 18/03
- Updated the BFB ratio chart to the 8260C version

Version 18/04
- Updated %RSDs for RRF to reflect requirements of 8260C
- Updated calibration verification %D from 30 to 20.

Version 18/05
- Added quality control table into section 12.2

Version 18/06
- Added sample purging wet log into section 10.3

Version 18/07
- expanded section 11.2

Version 18/08
- Revised to meet requirements of DoD Quality Systems Manual

Version 18/09
- Reformatted sections and improved chronological sequence of procedures

Version 18/10
- Revised language on CCVs, included typical surrogates and system check compounds, and added language on electronic audit trails

Version 18/11
- Revised method nomenclature.
- Section 4: Added LOD/LOQ information

- 15.2.1: Added requirement to save calibration curve information with method and instrument identification

- 16.1.2: Added information on DoD requirements for QA/QC samples.
- 17.2.3: Added information for documenting surrogates that fail to meet QA/QC criteria.
- Section 20: Added information on coding QA/QC samples that fail QA/QC criteria.

Version 18/12

- Section 16.1.2, Revised requirement for DoD batch size
- Addition of Table 5, Troubleshooting
- Updated where LOD/LOQ files are stored
- Updated internal standard acceptance criteria

Version 18/13

- Add information on source of calibration and calibration verification standards, and concentrations of standards to Section 15.1.

Version 18/14

- Added information on transfers from sample receipt to sample analysis, DoD QSM ELAP Rev. 5 requirements for the method blanks (Section 14.1.3), and added Appendix A and B (DoD Quality Control Requirements and LCS control limits)

Version 18/15

- Revised sections 13.2, 13.2.1, 13.3.1, 13.3.2, 14.1.1, 14.1.2, 14.1.3, 14.1.4, 14.1.5, 15.1, 15.1.2, 15.1.10, 15.2, 15.5, 15.6.4, 16.1.3, 16.1.5, 16.2.5, 16.2.6, 16.4, 16.5.6, 16.6.

Version 18/16

Adjusted section 13.3.3 adding detailed steps on how to purge PSG samples.
Removed references to System performance check compound and Calibration check compound (Obsolete)

Version 18/17

Edit to section 20 table 3 to refer to section 14 table 2 & table 3 for BFB tuning criteria

Version 18/18

General edits to sec. 14.1.5, 15.1,15.6.4, 16.4.5,17.1.4 & added TOC, added Appendic C & D, Fixed paragraph numbering

Version 18/19

Updated 15.6.6 describing the Markes software method versioning and sequence history, and updated purge time to a minimum of 60 minutes, removed read & understood section, updated standards.

Version 18/20

General clarifications, Added 4000, 10000 and 20000 ug/mL standards to section 12.1 stock standards, section 15.1.1 and section 15.2.3 Calibration Sequence, added canc calc to calculation section, update TOC.

Version 18/21

Updated calibration levels and stock standards in section 13.1 and 16.2.3, updated reference, updated 8260D requirements, updated TOC.

Version 18/22

Updated Analyte list Table 1 to include all compounds with DLs and LR

2 IDENTIFICATION of the TEST METHOD

Sample analyses are performed at Beacon Environmental Services, Inc. laboratory using the Markes International thermal desorption instruments, which uses the patented Diff-Lok® caps to provide accurate and reliable data. Markes International instruments have been designed by scientists who developed EPA Method TO-17 for the analysis of adsorbent tubes. Beacon Environmental uses this equipment, connected to a gas chromatograph and mass spectrometer for the analysis of passive soil gas samples. The analytical method followed is based on U. S. EPA Method 8260C/D as described in the Solid Waste Manual (SW-846). Method 8260C and 8260D.

3 APPLICATION MATRIX or MATRICES

This application targets compounds in air sampled on solid absorbents.

4 DETECTION LIMIT

The most recent detection limit (DL) study will be found in the following folder: C:\BEACON\GCMS\cal dl lod loq pt dup\precision accuracy. DL/LOD/LOQ studies are performed quarterly, and the most recent results are in the same file as the DL study information.

5 SCOPE and APPLICATION

This method is designed to detect volatile organic compounds in air samples, using U.S. EPA Method 8260c. A representative list of volatile organic compounds is shown in **Table 1**; however, this does not include all of the volatile and semi-volatile compounds analyzed by Beacon Environmental.

6 RESPONSIBILITIES

6.1 Laboratory Director:

- Responsible for the technical operation of the laboratory.
- Provides supervision to all laboratory personnel to ensure adherence to lab-documented procedures.
- Maintain instruments and material used for analysis

6.2 Quality Manager:

- Responsible for the quality system and its implementation.
- Provides final decision on all laboratory policy and/or resources.

6.3 Chemist:

- Responsible for sample receipt.
- Responsible for any sample preparation required.
- Responsible for sample analysis in accordance with this SOP.
- Responsible for Standard preparation.
- Responsible for Sample analysis and quantitation.

7 Responsible for Data entry, QC review and sample qualification.

8 SUMMARY of the TEST METHOD

8.1 Analysis by thermal desorption-gas chromatography/mass spectrometry (TD-GC/MS) following EPA Method 8260C and 8260D.

8.1.1 Analytical results based on at least a five-point initial calibration.

8.1.2 Internal standards and surrogates included with each analysis.

8.1.3 System daily tunes.

8.1.4 Daily continuing calibration checks.

8.1.5 Method blanks.

8.1.6 Duplicate field samples.

8.1.7 Laboratory Control Samples

Table 1. Analyte List

Standard Calibration Mix					
Compound	**CAS No.**	**DL (ng)**	**LOD (ng)**	**LOQ (ng)**	**LR (ng)**
1,1,1,2-Tetrachloroethane	630-20-6	2.5	5	10	1000
1,1,1-Trichloroethane	71-55-6	2.5	5	10	1000
1,1,2,2-Trichloroethane	79-34-5	2.5	5	10	1000
1,1,2-Trichloroethane	79.00-5	2.5	5	10	1000
1,1,2-Trichlorotrifluoroethane (F113)	76-13-1	2.5	5	10	1000
1,1-Dichloroethane	75-71-8	2.5	5	10	1000
1,1-Dichloroethene	75-35-4	2.5	5	10	1000
1,1-Dichloropropene	563-58-6	2.5	5	10	200
1,2,3-Trichlorobenzene	87-61-6	2.5	5	10	200
1,2,3-Trichloropropane	96-18-4	2.5	5	10	1000
1,2,4-Trichlorobenzene	120-82-1	2.5	5	10	1000
1,2,4-Trimethylbenzene	95-63-6	2.5	5	10	1000
1,2-Dibromo-3-chloropropane	96-12-8	2.5	5	10	200
1,2-Dibromoethane (EDB)	75-34-3	2.5	5	10	1000
1,2-Dichlorobenzene	95-50-1	2.5	5	10	1000
1,2-Dichloroethane	106-93-4	2.5	5	10	1000
1,2-Dichloropropane	78-87-5	2.5	5	10	200
1,3,5-Trimethylbenzene	108-67-8	2.5	5	10	1000
1,3-Dichlorobenzene	541-73-1	2.5	5	10	1000
1,3-Dichloropropane	142-28-9	2.5	5	10	200
1,4-Dichlorobenzene	106-46-7	2.5	5	10	1000
1,4-Difluorobenzene	540-36-3	2.5	5	10	200
1,4-Dioxane	123-91-1	2.5	5	10	1000

2,2-Dichloropropane	594-20-7	2.5	5	10	200
2-Butanone	78-93-3	2.5	5	10	200
2-Chlorotoluene	95-49-8	2.5	5	10	200
2-Hexanone	591-78-6	2.5	5	10	200
2-Methylnaphthalene	91-57-6	2.5	5	10	1000
4-Chlorotoluene	106-43-4	2.5	5	10	200
4-Methyl-2-pentanone	108-10-1	2.5	5	10	200
Acenaphthene	83-32-9	2.5	5	10	200
Acenaphthylene	208-96-8	2.5	5	10	200
Acetone	67-64-1	2.5	5	10	200
Benzene	71-43-2	2.5	5	10	2000/10000(1)
Biphenyl	92-52-4	2.5	5	10	200
Bromobenzene	108-86-1	2.5	5	10	200
Bromochloromethane	74-97-5	2.5	5	10	200
Bromodichloromethane	75-27-4	2.5	5	10	200
Bromoform	75-25-2	2.5	5	10	200
Bromomethane	74-83-9	2.5	5	10	200
Carbazole	86-74-8	2.5	5	10	200
Carbon disulfide	75-15-0	2.5	5	10	200
Carbon tetrachloride	56-23-5	2.5	5	10	1000
Chlorobenzene	108-90-7	2.5	5	10	1000
Chloroethane	75-00-3	2.5	5	10	200
Chloroform	67-66-3	2.5	5	10	2000/10000(1)
Chloromethane	74-87-3	2.5	5	10	200
Cis-1,2-Dichloroethene	156-59-2	2.5	5	10	2000/10000(1)
Cis-1,2-Dichloropropene	10061-01-5	2.5	5	10	200
Dibenzofuran	132-64-9	2.5	5	10	200
Dibromochloromethane	124-48-1	2.5	5	10	200
Dibromomethane	106-93-4	2.5	5	10	200
Dichlorodifluoromethane	75-71-8	2.5	5	10	200
Ethyl benzene	100-41-4	2.5	5	10	2000/10000(1)
Fluorene	86-73-7	2.5	5	10	200
Hexachlorobutadiene	87-68-3	2.5	5	10	200
Hexachloroethane	67-72-1	2.5	5	10	200
Isopropyl benzene	98-82-8	2.5	5	10	1000
Methylene Chloride	75-09-2	2.5	5	10	200
Methyl-t-butyl ether (MTBE)	1634-04-4	2.5	5	10	1000
Naphthalene	91-20-3	2.5	5	10	1000

n-Butyl benzene	104-51-8	2.5	5	10	200
n-Decane	124-18-5	2.5	5	10	200
n-Dodecane	112-40-3	2.5	5	10	200
n-Heptane	142-82-5	2.5	5	10	200
n-Hexane	110-54-3	2.5	5	10	200
n-Nonane	11-84-2	2.5	5	10	200
n-Octane	111-65-9	2.5	5	10	200
n-Pentadecane	629-62-9	2.5	5	10	200
n-Pentane	109-66-0	2.5	5	10	200
n-Propyl benzene	103-65-1	2.5	5	10	200
n-Tetradecane	629-62-9	2.5	5	10	200
n-Tridecane	629-50-5	2.5	5	10	200
n-Undecane	1120-21-4	2.5	5	10	200
o-Xylene	95-47-6	2.5	5	10	2000/10000(1)
P & m xylenes	179601-23-1	2.5	5	10	2000/10000(1)
p-Isopropyl toluene	99-87-6	2.5	5	10	200
Sec-butyl benzene	135-98-8	2.5	5	10	200
Styrene	100-42-5	2.5	5	10	200
Tert-butylbenzene	100-42-5	2.5	5	10	200
Tetrachloroethene	127-18-4	2.5	5	10	2000/10000(1)
Toluene	108-88-3	2.5	5	10	2000/10000(1)
Trans-1,2-Dichloroethene	156-60-5	2.5	5	10	2000/10000(1)
Trans-1,3-Dichloropropene	10061-02-6	2.5	5	10	200
Trichloroethene	79-01-6	2.5	5	10	2000/10000(1)
Trichlorofluoromethane (Freon 11)	75-69-4	2.5	5	10	200
Vinyl Chloride	75-01-4	2.5	5	10	1000
Fluorobenzene (ISTD)	462-06-6	NA	NA	NA	NA
Chlorobenzene-d5 (ISTD)	108-90-7	NA	NA	NA	NA
1,4-Dichlorobenzene-d4 (ISTD)	106-46-7	NA	NA	NA	NA
1,2-DCA-d4 (SURR)	17060-07-0	2.5	5	10	2000/10000(1)
Toluene d8 (SURR)	2037-26-5	2.5	5	10	2000/10000(1)
p-Bromofluorobenzene (surr)	460-00-4	2.5	5	10	2000/10000(1)
(1) Instrument Dependent					

Calibration Mix 2					
Compound	**CAS No.**	**DL (ng)**	**LOD (ng)**	**LOQ (ng)**	**LR (ng)**
1,2-Dichlorotetrafluoroethane	76-14-2	2.5	5	10	200
1,3-Butadiene	106-99-0	2.5	5	10	200
1-Methylnaphthalene	90-12-0	2.5	5	10	200

4-Ethyltoluene	622-96-8	2.5	5	10	200
Cyclohexane	110-82-7	2.5	5	10	200
Ethanol	64-17-5	2.5	5	10	200
Ethyl acetate	141-78-6	2.5	5	10	200
Isopropanol (2-propanol)	67-63-0	2.5	5	10	200
Propylene	115-07-1	2.5	5	10	200
Tetrahydrofuran	109-99-9	2.5	5	10	200
Toluene d8 (SURR)	2037-26-5	2.5	5	10	200
1,2-DCA-d4 (SURR)	17060-07-0	2.5	5	10	200
p-Bromofluorobenzene (surr)	460-00-4	2.5	5	10	200
Fluorobenzene (ISTD)	462-06-6	NA	NA	NA	NA
1,4-Dichlorobenzene-d4 (ISTD)	106-46-7	NA	NA	NA	NA
Chlorobenzene-d5 (ISTD)	108-90-7	NA	NA	NA	NA

Calibration Mix 3					
Compound	**CAS No.**	**DL (ng)**	**LOD (ng)**	**LOQ (ng)**	**LR (ng)**
Benzyl chloride	100-44-7	2.5	5	10	200
Fluorobenzene (ISTD)	462-06-6	NA	NA	NA	NA
Chlorobenzene-d5 (ISTD)	108-90-7	NA	NA	NA	NA
1,4-Dichlorobenzene-d4 (ISTD)	106-46-7	NA	NA	NA	NA

PAH Calibration Mix					
Compound	**Cas Number**	**DL (ng)**	**LOD (ng)**	**LOQ (ng)**	**LR (ng)**
Acenaphthene	83-32-9	2.5	5	10	100
Acenaphthylene	208-96-8	2.5	5	10	100
Anthracene	120-12-7	2.5	5	10	100
Benzo(a)anthracene	56-55-3	2.5	5	10	100
Biphenyl	92-52-4	2.5	5	10	100
Carbazole	86-74-8	2.5	5	10	100
2-Chlorobiphenyl	2051-60-7	2.5	5	10	100
Dibenzofuran	132-64-9	2.5	5	10	100
Fluorene	86-73-7	2.5	5	10	100
Phenanthrene	85-01-8	2.5	5	10	100
Pyrene	129-00-0	2.5	5	10	100
See SOP 74 for further details					

Chloroprene/Butadiene Calibration Mix

Compound	CAS No.	DL (ng)	LOD (ng)	LOQ (ng)	LR (ng)
1,3-Butadiene	106-99-0	0.5	1	2	200
Chloroprene	126-99-8	0.5	1	2	200
Toluene d8 (SURR)	2037-26-5	0.5	1	2	200
1,2-DCA-d4 (SURR)	17060-07-0	0.5	1	2	200
p-Bromofluorobenzene (surr)	460-00-4	0.5	1	2	200
Fluorobenzene (ISTD)	462-06-6	NA	NA	NA	NA
1,4-Dichlorobenzene-d4 (ISTD)	106-46-7	NA	NA	NA	NA
Chlorobenzene-d5 (ISTD)	108-90-7	NA	NA	NA	NA
See SOP 76 for further Details					

9 DEFINITIONS

9.1 Definitions

- Analytes – target compounds within the method
- Aliquot –a portion removed from the solute
- Calibration Check\Continuing Calibration Verification (BS/LCS/CCV)– using a solution from the original calibration to check response with initial calibration
- Dynamic Dilution – performed using a special method that collects a split of the sample while dumping/or collecting the split. Typically done after the primary analysis of a sample identifies the sample requires a dilution because high concentration analytes were identified during the primary analysis
- Initial Calibration – a five-point calibration of varied masses ranging from 2.5 to 10000 nanograms per injection (see section 12).
- Laboratory Control Samples (LCSD/ICV) – a second source standard also used for calibration verification
- Method Blank (BLK/ICB/CCB) – an injection from a blank tube, spiked only with internal standards and surrogate compounds
- Packed Tube – normally stainless steel tubes, 3.5 inches long by 0.25 inches outside diameter, which contain one or more adsorbents
- Percent Difference –

Percent Difference (%D) Calculate the percent difference in the RRF of the daily RRF (24-hour) compared to the mean RRF in the most recent initial calibration. Calculate the %D for each target compounds using the following equation

$$\%D = \frac{RRF_c - \overline{RRF_i}}{\overline{RRF_i}} \times 100$$

where: RRF_c = RRF of the compound in the continuing calibration standard.

$\overline{RRF_i}$ = Mean RRF of the compound in the most recent initial calibration.

- Relative Response Factor - $RRF = A_x C_{is} / A_{is} C_x$

Where: RRF = Relative response factor.
A_x = Area of the primary ion for the compound to be measured, counts.
A_{is} = Area of the primary ion for the internal standard, counts.
C_{is} = Mass of internal standard spiking mixture,
C_x = Mass of the compound in the calibration standard

- %Relative Standard Deviation – Using the RRFs from the initial calibration, calculates the %RSD for all the target compounds using the following equations:

$$\%RSD = [(SD_{RRF})/(\overline{RRF})] * 100$$

$$SD_{RRF} = \sqrt{\sum_{i=1}^{N} \frac{((RRF_i - \overline{RRF})^2)}{N-1}}$$

Where: SD_{RRF} = Standard deviation of initial response factors (per compound).
RRF_i = Relative response factor at a concentration level i.
$\overline{RRF}$ = mean of initial relative response factors (per compound).

- Surrogate – compounds typically not identified in samples, which behave like the target analytes. These compounds are monitored to determine if the sample injection had any problem; along with the internal standards, surrogates offer an additional level of monitoring control.

9.2 Acronyms

- BFB – Bromofluorobenzene
- cal – calibration
- CAS- Chemical Abstract Service
- CCV – Continuing Calibration Verification
- COC – Chain of Custody
- CC – Continuing Calibration
- %D- Percent Difference
- DoD- Department of Defense
- EPA – Environmental Protection Agency
- GC/MS – Gas Chromatography / Mass Spectrometry
- He - Helium
- ICV – Initial Calibration Verification (2nd Source)
- IS – Internal Standard
- LCS/BS – Laboratory control sample
- LLOQ- Lower limit of quantitation
- LOD- Limit of Detection
- LOQ- Limit of Quantitation
- LB/MB/BLK/ICB/CCB: Laboratory/Method Blank, Initial/Continuing Calibration Blank

- MDL – Method Detection Limit
- min - minute
- ng – nanogram
- ng/µL – Nanogram per micro liter
- PPE – Personnel Protective Equipment
- QA – Quality Assurance
- QC – Quality Control
- RD- Relative Difference
- RF – Response Factor
- RFF – Relative Response Factor
- RPD – Relative Percent Difference
- RSD – Relative Standard Deviation
- SD – Standard Deviation
- SOP – Standard Operating Procedure
- SPCC-CCC – System Performance Check and Calibration Check Compound
- SURR – Surrogate
- TD-GC/MS- Thermal Desorption Gas Chromatography / Mass Spectrometry
- TPH- Total Petroleum Hydrocarbons
- UHP – Ultra High Purity
- µL – microliter

10 INTERFENCES

10.1 Minimizing Artifact Interference. The following information is summarized from reference 24.5, EPA TO-17.

10.1.1 Stringent sorbent conditioning (see latest revision of SOPs 1 and 16), careful tube capping and storage procedures are essential for minimizing artifacts. System and sorbent conditioning must be carried out using more stringent conditions of temperature, gas flow and time than those required for sample analysis.

10.1.2 A reasonable objective is to reduce artifacts to 10% or less of individual analyte masses retained during sampling.

10.1.3 Typical artifact levels for sorbent samplers can range from 0.01 ng and 0.1 ng for carbonaceous sorbents and Tenax®, respectively. Artifact levels for Chromosorb® Century series and other porous polymer sorbents is around 10 ng. These types of sorbents can still be used for air monitoring at low ppb levels if selective or mass spectrometer detectors are used or if the blank profile of the sampler demonstrates that none of the sorbent artifacts interfere analytically with the compounds of interest.

11 SAFETY

11.1 Personnel Protective Equipment

- Gloves
- Safety Glasses

11.2 Safety

- All analysts are trained to operate the TD-GC/MS equipment
- All analysts are trained in safe chemical handling procedure

12 EQUIPMENT and SUPPLIES

12.1 Materials

- Sorbent samplers
- Multiple adsorbent bed packed tubes
- 0.5µL, 5, 10, 25, 50, 100, 200, 500 and 1000 µL Micro syringes

12.2 Equipment

- Agilent 7890a/5977B GC/MS with ChemStation Software
- Markes Autosecure Thermal Desorption System with Recollection
- Stop Watch
- Calibration Solution Loading Rig
- Diff-Lok® Caps
- Sample Spiking Rig
- Agilent ADM Flow Meter

12.3 Computer/Software:

- Markes Instrument Control software v 2.0.7
- Agilent Mass Hunter GC/MS Data Acquisition Software V 10.1.49
- Agilent Environmental Chemstation F.01.03.2365

13 REAGENTS and STANDARDS

13.1 Stock Standards

13.1.1 Calibration Stock Standards:

Concentration (ug/ml)	Absolute Standards Part Number
5	64878
10	64879
20	64880
50	64881
100	64882

200	64883
400	64884
1000	65970
2000	65971
4000	65787
10000	65786
20000	65785

- Calibration: Spike with 0.5ul of each standard
- CCV/LCS: 0.5ul of 100ng calibration standard = 50ng true value

13.1.2 Second Source Stock Standard (ICV/LCSD):

Concentration (ug/ml)	Absolute Standards Part Number
100	64885

- 0.5ul of 100ng = 50ng true value
  (Contains the same compounds as the calibration mix)

13.1.3 Internal Standards/Surrogates Standard:

13.1.3.1 Stock

Concentration (ug/ml)	Absolute Standards Part Number
2000	92026

13.1.3.2 Working ISTD/SURR Standard:

Stock Conc. (ug/ml)	Amount Stock (ul)	Final Volume (ul)	Working Conc. (ng)
2000	100	1000	200

- Diluted with methanol

13.1.4 BFB (Tune):

Concentration (ug/ml)	Absolute Standards Part Number
2500	19167
Or	
2000	20002

13.2 Methanol, reagent grade ACS or equivalent

13.3 Carrier Gases

Use inert, 99.999 percent or higher purity helium as a carrier gas. Oxygen and organic filters must be installed in the carrier lines supplying the analytical system according to the manufacturer's instructions. Keep records of filter and oxygen scrubber replacement.

14 SAMPLE COLLECTION, PRESERVATION, SHIPMENT and STORAGE

14.1 Sample Receipt

14.1.1 See the latest revision of SOP 14 and SOP 65.

14.2 Samples are analyzed in the order they are received. Samplers have a holding time of 30 days from the time of sample collection. Samples are normally analyzed within five days of receipt and held at ambient temperatures to minimize the exposure to freons present in all refrigerators and placed in a freezer after analysis for storage.

14.3 Once samples have been properly documented as received, they must be purged for at least 60-minutes prior to analysis. This step is to minimize the effects of matrix effect (humidity from the site).

15 QUALITY CONTROL and ACCEPTANCE CRITERIA

15.1 QUALITY ACCEPTANCE CRITERIA FOR METHOD

15.1.1 BFB: loaded with 0.5µL BFB standard solution (2500ng/µL) placed in auto sampler tray (next sequential position) loaded into the Markes AutoSampler. Tuning criteria is provided in Tables 2 and 3.

15.1.2 Continuing Calibration Verification (Laboratory Control Sample/BS) loaded into the Markes autosampler (next sequential position) -- The calculated %D for the RRF for each compound in the calibration table shall be less than 20% unless otherwise specified.

15.1.3 Method Blank (Laboratory Blank/BLK): (next sequential position)-- no target analytes above reporting limit (DoD requirement: the method blank will be considered contaminated if the concentration of any target analyte (chemical of concern) in the blank exceeds ½ the LOQ and is greater than 1/10th the amount measured in any associated sample, whichever is greater).

15.1.4 LCSD/ICV (Second Source): (next sequential position)--Second source standard of target compounds, %D for recovery limits are 70%-130% (80-120% for DoD). Comparing the LCS to the CCV can qualify the LCS as an LCSD and may be

evaluated as such, this is also the same solution with which the initial calibration verification is performed.

15.1.5 Continuing Calibration Verification (CCV) for DoD analysis, analyzed after last sample in batch. The calculated %D for the RRF for each compound in the calibration table shall be less than 20% unless otherwise specified.

Table 2. BFB (4-Bromofluorobenzene) Mass Intensities [a]

m/z	Required Intensity (relative abundance)
50	15-40% of m/z 95
75	30-60% of m/z 95
95	Base peak, 100% relative abundance
96	5-9% of m/z 95
173	Less than 2% of m/z 174
174	Greater than 50% of m/z 95
175	5-9% of m/z 174
176	Greater than 95% but less than 101% of m/z 174
177	5-9% of m/z 176

[a] The criteria in this table are intended to be used as default criteria for quadrupole instrumentation if optimized manufacturer's operating conditions are not available. Alternate tuning criteria may be employed (e.g. CLP or Method 524.2) provided that method performance is not adversely affected. See section 11.3.1.

Table 3. Alternate Criteria for BFB Tuning [a]

Mass	Ion Abundance Criteria
50	8-40% of m/e 95
75	30-60% of m/e 95
95	Base peak, 100% relative abundance
96	5-9% of m/e 95
173	Less than 2% of m/e 174
174	50-120% of m/e 95
175	4-9% of m/e 174
176	93-101% of m/e 174
177	5-9% of m/e 176

[a] All ion abundance must be normalized to m/z 95, the nominal base peak, even though the abundance of m/z 174 may be up to 120% of that of m/z 95.

15.1.6 Samples: starting at next sequential position-- internal standards must be within 50% to 200% of the CC run for the sample group or corrective measures need to be taken and recorded in the corrective action log.

NOTE: Passive soil gas analyses generate detections above the upper limit of the initial calibration (10000 ng). When concentration data is required, run recollection tubes until compound detecxtions are within calibration range. If just mass data is requires and dilutions are not required 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.

16 CALIBRATION and STANDARIZATION

16.1 General Calibration Requirements

16.1.1 If an initial calibration is not performed on the day samples are analyzed, the validity of the original calibration must be verified prior to sample analysis by analysis of an LCS, LB, & LCSD. All initial instrument calibrations must be verified with a standard obtained from a second manufacturer or lot if the lot can be demonstrated from the manufacturer as prepared independently from other lots (ICV, CALV, and/or LCSD). Traceability shall be to a national standard, when commercially available. Calibration and calibration verification standards are commercially purchased, from Absolute Standards, at concentrations of 2.5, 5, 10, 25, 50, 100, 200, 400, 600, 800, 1000, 2,000, 4,000 and 10,000 nanograms. (DoD quality control requirements can be found in Appendix A and LCS limits in Appendix B)

16.1.2 Sample results must be quantitated from the initial instrument calibration, and cannot be quantitated from any continuing calibration verification unless required by regulation, method or program.

16.1.3 A minimum of a five-point calibration range is required, more points being used is standard.

16.1.4 Calibration must be verified for each compound requested by the client.

16.1.5 Instrument continuing calibration verification must be performed:

1) at the beginning and end of each analytical batch (except, if an internal standard is used, only one CCV (LCS) needs to be performed at the beginning of the analytical batch) (DoD: CCV at beginning and end of each batch);
2) whenever it is expected that the analytical system may be out of calibration or might not meet the verification acceptance criteria; or
3) if the time period for calibration or the most previous CCV has expired.

16.1.6 If CCVs are run at specific sample intervals, the count of these samples is not included as part of the client's environmental batch of samples.

16.1.7 Sufficient raw data records are retained to permit reconstruction of the continuing instrument calibration verification, e.g., test method, instrument, analysis date, each analyte name, concentration and response, calibration curve or response factor, or unique equations or coefficients used to convert instrument responses into concentrations.

16.1.8 CCV records must explicitly connect the verification data to the initial instrument calibration, either by inclusion in the sample log sequence or other means.

16.1.9 Criteria for the acceptance of continuing instrument calibration verification must be established, e.g., relative percent difference.

16.1.10 The following criteria must be met:

1) the concentration of the CCV standard shall be between the low calibration standard and the midpoint of the calibration range and
2) the baseline for evaluating the CCV is the initial calibration curve, except for the evaluation of retention times in organic chromatographic methods, which may be based on comparison with the retention times in the initial ICV.

The source of the CCV (LCS) standard should be the same as the source for the initial calibration standard(s).

16.1.11 If the continuing calibration verification results obtained do not meet the established acceptance criteria, then corrective action is performed. The prescribed corrective actions include remaking the standard and rerunning the CCV; however, if that fails to produce a second consecutive (immediate) calibration verification within acceptance criteria, then the stock standard solutions are checked to see if they have expired. If they have expired, then they are replaced and the CCV solution is remade and a third rerun of the CCV is performed. If they haven't expired, then inspecting and possibly cleaning the ion source is necessary. If none of the previous corrective actions fix the failing CCV, a new initial instrument calibration with new stock standards must be performed.

16.1.12 If the CCV fails to pass acceptance criteria, all CCVs and samples analyzed since the last successful calibration verification must be reanalyzed. (DoD: If a CCV fails, two additional CCV's can be immediately analyzed (immediately is defined as starting a consectutive pair within 1 hour, and no samples can be analyzed between the failed and the two additional CCV's). If both CCV's pass, analysis can proceed. If either fails, corrective action must be taken (See Appendix B).

If reanalysis is not possible, the client must be notified prior to reporting data associated with a noncompliant CCV.

If this data are reported, the data must be qualified and explained in the case narrative.

If two CCVs are routinely analyzed, then both CCVs must be evaluated. If either CCV fails, corrective actions will be performed, and all samples analyzed since last acceptable calibration verification must be reanalyzed.

16.1.13 Reportable sample analyses may not occur until the GC/MSD system is calibrated or calibration verified. If reportable samples are analyzed using a system that is not calibrated, or verified as in control, any reportable results are flagged. Data associated with unacceptable calibration verification may be fully useable under the following special conditions:

1) When the acceptance criteria for the continuing calibration verification are exceeded high, i.e., high bias, and there are associated samples that are non-detects, then those non-detects may be reported. Otherwise the samples affected by the unacceptable calibration verification must be reanalyzed after a new calibration curve has been established, evaluated and accepted.

2) When the acceptance criteria for the continuing calibration verification are exceeded low, *i.e.*, low bias, then those sample results may be reported if they exceed a maximum regulatory limit/decision level. Otherwise the samples affected by the unacceptable verification must be reanalyzed after prescribed corrective actions have been successfully taken.

16.1.14 If a calibration causes a set of correction factors, it is the responsibility of the Laboratory Director to verify that copies of the correction factors are correctly updated in any relevant analytical instrument (including the software of that instrument, as needed).

16.2 INITIAL CALIBRATION

16.2.1 Spiking Calibration Standards:

Note: See the latest revision of SOP 46, 'Quality Control Evaluations' for calibration and calibration verification general requirements.

16.2.2 Calibration (and calibration verification) standards are purchased commercially, from Absolute Standards (see section 12.1)

16.2.3 Calibration sequence:

Element Name	Stock	Stock Conc. (ug/ml)	Amount Spiked (ul)	Final Concentration (ng)
SEQ-TUN1	20002	2000	0.2	---
SEQ-CAL1	64878	5	0.5	2.5
SEQ-CAL2	64879	10	0.5	5
SEQ-CAL3	64880	20	0.5	10
SEQ-CAL4	64881	50	0.5	25
SEQ-CAL5	64882	100	0.5	50
SEQ-CAL6	64883	200	0.5	100
SEQ-CAL7	64884	400	0.5	200
SEQ-CAL8	65970	1000	0.5	500
SEQ-CAL9	65971	2000	0.5	1000

SEQ-CALA	65787	4000	0.5	2000
SEQ-CALB	65786	10000	0.5	5000
SEQ-CALC	65785	20000	0.5	10000
SEQ-ICV1	64885	100	0.5	50
SEQ-ICB1	ISTD/SURR Sub-Stock	200	0.5	100
DL	64878	5	0.5	2.5
DL	64878	5	0.5	2.5
LOD	64879	10	0.5	5
LOD	64879	10	0.5	5
LOD	64879	10	0.5	5
LOD	64879	10	0.5	5
LOQ (LLOQ)	64880	20	0.5	10
LOQ (LLOQ)	64880	20	0.5	10
LOQ (LLOQ)	64880	20	0.5	10
LOQ (LLOQ)	64880	20	0.5	10

Note: Not all 14 calibration standards are required.

16.2.4 Attach tube to the "Sample Spiking Rig"

16.2.5 Finger-tighten the tube until "snug"

16.2.6 Draw 0.5µL aliquot from appropriate standard

16.2.7 Inject aliquot through loading rig injection port onto the face of the retaining gauze of the tube

16.2.8 Purge aliquot into packed tube for at least 30 seconds and keep the time consistent using stopwatch with alarm (this step has been successful with purge times up to 5 minutes, 30 seconds is adequate). The gas flow should be set to 40 $^{ml}/_{min}$ and verified with a glass ball rotameter (this is equivalent to 90ml/min of Hydrogen).

16.2.9 Attach Diff-Lok® caps

16.2.10 Place in Auto Sampler tray in appropriate sequential position with the grooved end on the right side of the tray for analysis

16.2.11 Once all the QA/QC and field sample tubes have been loaded with the appropriate solution and all blanks and field samples have been loaded with ISTD/SURR standard, create auto sampler sequence as described below.

16.2.12 See latest revision of SOP 59, 'Calibrations in Element' and SOP 46, 'Quality Control Evaluations'.

16.2.13 Upon completion of a passing curve the method is named with the EPA method, 8260c, the mass spectrometer used, and the date.

16.2.14 Total Petroleum Hydrocarbons (TPH) – calibration of these summations are based on a macro written and recommended by Agilent Technologies, which is the analytical hardware manufacturer and associated software developer. This macro calculates a sum of the total ion chromatogram (TIC) inside the stated retention window for the specific carbon ranges reported by Beacon Environmental (*i.e.*, C_5-C_9 or C_{10} to C_{15}). To estimate a TPH response factor, the TIC for each

calibration level is used to correspond to an estimated total value for compounds that elute in that retention window.

TPH values on environmental samples are only an estimate and secondary analytical review of chromatograms and ion spectral results can, and often do, eliminate estimated TPH values calculated by the macro because of misidentified TPH results that are not of petroleum origin. For Beacon Environmental to report TPH values a typical petroleum chromatographic pattern must be visually obvious or individual petroleum-related individual compounds must be verified at measurements above the reporting limit.

16.3 CONTINUING CALIBRATION VERIFICATION – an initial source standard with all target analytes is run prior to the method blank for each sample batch. The %D for each compound in this analysis must be equal to or less than 20% of the initial calibration unless otherwise specified to meet project data quality objectives.

16.4 Internal Standards

The recommended internal standards are fluorobenzene, chlorobenzene-d5, and 1,4-dichlorobenzene-d4.

16.5 Surrogates and Check Standards

Surrogates are added to all samples, both quality control and environmental samples.

Below are the compounds typically used; however, the actual compounds used may change based on method or project requirements.

Surrogates include, as appropriate:

- 1,2-DCA d4
- Toluene d8
- Bromofluorobenzene

16.6 Quality Control

16.6.1 When initial instrument calibration procedures are referenced in the test method, then the referenced material must be retained by the laboratory and be available for review.

16.6.2 Sufficient records must be kept to permit a complete audit trail of the initial instrument calibration, e.g., calibration date, test method, instrument, analysis date, each analyte name, analyst's initials or signature, concentration and

response, calibration curve or response factor, or unique equation or coefficient used to reduce instrument responses to concentration.

16.6.3 The initial calibration verification must be successfully completed prior to analyzing any samples; unless otherwise stated by the test method.

The use of a standard from a second lot is acceptable when only one manufacturer of the standard exists (Note: manufacturer refers to the producer of the standard, not the vendor).

The concentration of the second source standard is at or near the midpoint of the calibration range. Acceptance criteria for the initial calibration verification must be at least as stringent as those for the continuing calibration verification.

16.6.4 Criteria for the acceptance of an initial instrument calibration is established at an RD equal to or less than 20% if only 5 calibration points are used, if more than five are used alternative calibration curve fit models may be used.

The lowest calibration standard is the lowest concentration for which quantitative data are to be reported. Any data reported below the lower Limit of Quantitation should be considered to have an increased quantitative uncertainty and will be reported using defined qualifiers or flags or explained in the case narrative.

The highest calibration standard is the highest concentration for which quantitative data are to be reported. Any data reported above this highest standard should be considered to have an increased quantitative uncertainty and typically are reported using defined qualifiers or flags or explained in the case narrative.

NOTE: However, passive soil gas analyses generate detections above the upper limit of the initial calibration (200 ng). 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.

16.6.5 The LOQ and the highest calibration standard of a multi-level calibration curve establish the quantitation range. When sample results exceed the quantitation range, the laboratory does not reanalyze the sample to bring results within the quantitation range. Data reported for passive soil gas samples are in units of mass and values tend to range several orders of magnitude in a single data set. While measurements above the upper calibration standard are estimated, these measurements are reported without qualifiers because all reported measurements are relative to each other and are of value to the data user and project objectives of locating possible sources and defining the lateral extent of contamination. These

measurements are noted in the case narrative as being estimated values above the calibration range.

If it is found that the initial instrument calibration results are outside established acceptance criteria, prescribed corrective actions must be performed and all associated samples reanalyzed. If reanalysis of the samples is not possible, data associated with an unacceptable initial instrument calibration will be reported with appropriate data qualifiers.

Corrective actions are performed when the initial calibration results are outside acceptance criteria. Calibration points are not dropped from the middle of the curve unless the cause is determined and documented. If the cause cannot be determined, the calibration curve is prepared again. If the low or high calibration point is dropped from the curve, the working curve is adjusted and sample results outside the curve are qualified.

16.6.6 Electronic audit trail functions are available, via the ChemStation software, for the GC/MSD, and must be in use at all times, and the associated data must be retained. The Markes software includes method versioning and sequence history.

17 PROCEDURE

17.1 Sample Handling and Preparation

17.1.1 Receive samples according to the latest revisions of SOPs 14 and 65..

17.1.2 Create new sequence on ChemStation consisting of:

- Bromofluorobenzene (BFB) Tune
- Calibration Check (using mid-point 50 ng calibration curve)
- Method Blank
- Laboratory Control Sample or calibration verification (second source)
- Samples in analytical order matching Sample Receipt log
- Note: **All** DoD work requires method blanks, CCV and LCS samples every 20 or fewer field samples (maximum batch size is 20 field samples). See job folder for client specific information on the frequency of quality control sample analysis

17.1.3 save new sequence

17.1.4 Verify GC parameters

Initial Temperature: 45°C hold for five minutes
Temperature Program: 11°C/min to 60°C
35°C/min to 260°C hold 1.4 or 4 minutes
Mass range: m/z 35 to 270
Sampling rate: at least 5 full spectra across the peak, 3 to 5 scans/sec *(innovations in chromatography and mass spectrometry has made it possible to scan at much faster rates and still meet all tuning and calibration criteria)*
Source temp: manufacturer's recommendation

Tuning: 50 ng or less Bromofluorobenzene

17.1.5 Passive soil gas samples are purged with ultra-high purity (UHP) Hydrogen to help eliminate matrix interference.

17.1.5.1 Dry purge for 60 minutes

A sheet containing the sample, job number, and date and time purged is printed out to document the condition (damaged, wet or discolored) of the sample prior to dry purge. This document is found in folder: C:\BEACON\Sample Receipt Log\Sample Purging Log.xls

17.1.6 Using a 0.5µL micro syringe, spike sample with 0.5µL internal standard/surrogate dilution standard at a 200 ng/µL concentration. (remake this solution every week.)

17.1.7 Load spiked samples into Markes sample tube loading tray, in analytical order, and create sequence in the Markes Unity Software. In the Unity sequence, select the appropriate method for analysis.

17.1.8 Start sequence on the ChemStation Software

17.1.9 Verify in the Markes software under View/Options/Reporting that all boxes are selected. Start sequence on the Markes Software

17.1.10 Upon completion of the sequences, check the Markes software for any discrepancies in the sequence, such as missed injections or leaks, and note the tube number and corresponding sample if a re-analysis or O-ring replacement must be performed.

17.1.11 Analyze GC/MS data

17.2 Creating Analytical Sequence in ChemStation

17.2.1 Open Instrument 1# -- ChemStation window software window

17.2.2 Select <Sequence Menu>

17.2.3 Select <Load Sequence>

17.2.4 Choose file named DEFAULT (never save over this file)

17.2.5 Choose Use Quick Sequence Generator to include:

- BFB Tune (next sequential position)
- LCS (next sequential position)
- LB (next sequential position)
- LCSD (next sequential position)
- Count additional samples that will be run in the sequence and place in field labeled "Number of Samples"
  NOTE: The number of samples in a sequence between the Method Blank and the next BFB Tune shall not exceed 20 samples and the time between BFB Tunes shall not exceed 12-hours) unless otherwise specified.

17.2.6 The first data file name will ALWAYS be the last two numbers of the year, followed by two-digit description of month, followed by two-digit description of the day and then two digits 01 (proceed this with an A or C depending on whether it is run on the 5973A or 5975C mass spectrometer).

For example,

- (A, C, S, or K)09011501
  09 – Year
  01 – January
  15 – Fifteenth day of January
  01 – First run of the sequence

17.2.7 All other fields will be left at their default values.

17.2.8 If more than one sequence per day is assigned, a letter will be added to BOTH the data file name as well as the sequence, at the end of the digits, starting with the letter "a."

17.2.9 Save the sequence using the same name as the folder where the data files will reside. This folder should be named in the following format: (A or C)YYMMDD.

17.2.10 Once the sequence is created, delete the first three lines of the sequence.

17.2.11 Save the sequence with a new name (same as the file folder previously created for analytical data to be stored).

17.2.12 Load new sequence

17.2.13 Run new sequence

17.2.14 In RUN MENU, choose to run full method, include analyst's initials

17.3 Using DIFF-LOK® Caps

17.3.1 End of the stainless steel tube with a groove is the sampling end

17.3.2 De-activated silica-lined Diff-Lok® cap (blue colored) will be placed on sample end

17.3.3 Opposite end place stainless steel cap

17.3.4 Always check if O-ring replacement is necessary.

17.4 Using Calibration Solution Rig to spike BFB, LCS, LB, LCSD samples

17.4.1 Attach tube to the "loading rig"

17.4.2 Finger tighten the tube until the fitting is "finger tight"

17.4.3 Draw 0.5µL aliquot from appropriate standard

17.4.4 Inject into tube

17.4.5 Purge sample for 0.5 minutes, using stop-watch with alarm

17.4.6 Attach Diff-Lok® caps, with de-activated silica-lined Diff-Lok® cap (blue colored) on sample end

17.4.7 Place in Auto Sampler tray in appropriate position to match sequence for analysis

17.5 AutoSampler Sequence

17.5.1 Delete all lines under "Controlling Sequence"

17.5.2 Right click in window and select "Add Ultra Set"

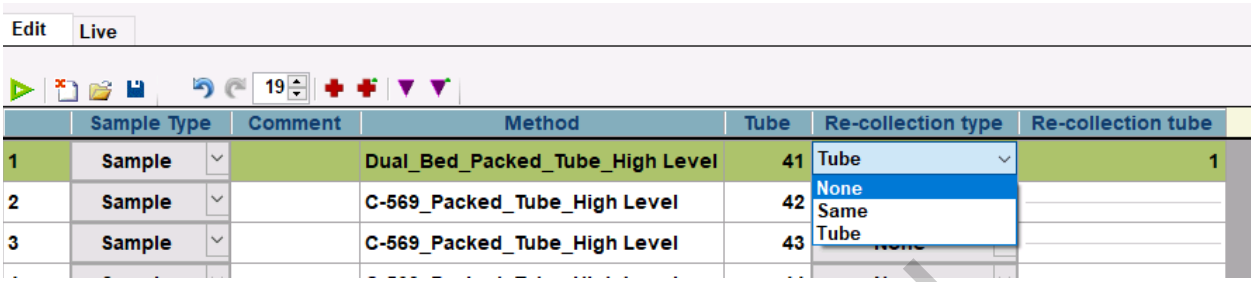
17.5.3 Select Method

17.5.4 Assign tubes run by method as defined in the previous sequence

17.5.5 Select whether or not to recollect the sample starting with the next tube in the recollection

17.5.6 All field samples for concentration analysis are recollected for dilution analysis:

17.5.6.1 Tubes are recollected back onto the original tube. Beacon Samplers are recollected onto dual bed tubes.

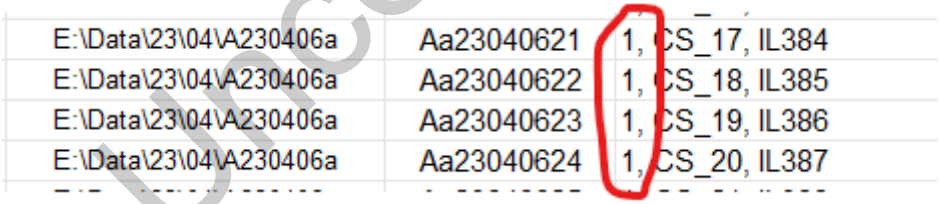


17.5.6.2 The dilution Excel worksheet located in the Z:\msdchem\instrument network folder contains the dilution factor calculation based on instrument flows.

17.5.6.3 If a dilution is needed, copy the appropriate dilution Excel worksheet into the lab data\support section of the job folder.

17.5.6.4 If the flows have not been checked in the past quarter, verify before assigning a dilution factor.

17.5.6.5 Make sure the dilution factor is the first thing listed in the miscellaneous info column in the data acquisition software.



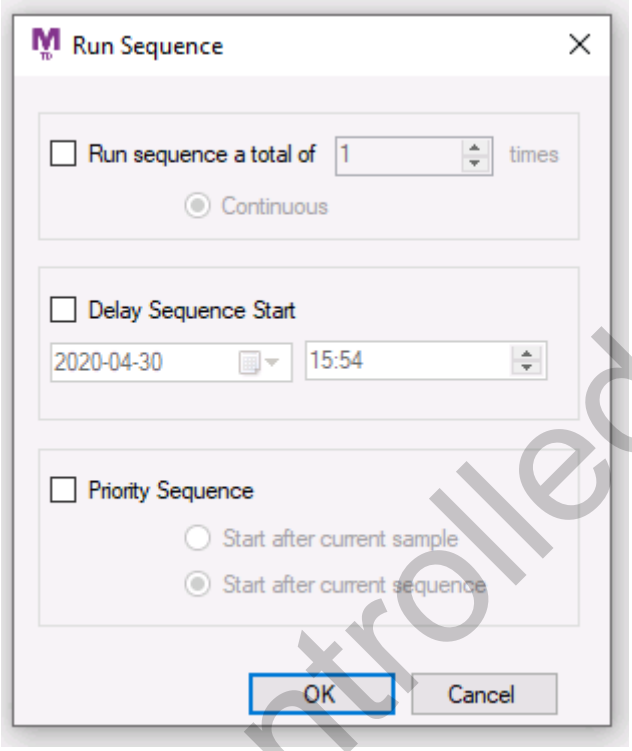
17.5.6.6 Do not put the dilution factor in the instrument dilution column.

17.5.6.7 When analyzing dilutions spike the recollection tube with the internal standard/surrogate amount listed in the dilution worksheet.

17.5.6.8 Make sure correct dilution is carried over during data entry.

17.5.7 When sequence is correct and trays are loaded press the play button.

17.5.8 The software will validate the sequence and if acceptable a window will open to start run.



17.5.9 Click 'OK' to start.

17.6 SEQUENCE LOG

17.6.1 Once sequence is complete, save sequence log from ChemStation software

18 DATA ANALYSIS AND CALCULATIONS

18.1 Analysis of GC/MS DATA

18.1.1 Copy data folder from ChemStation computer to the Beacon\GCMS\data*.directory

18.1.2 Analysis of passive soil gas samples is performed with the most recent calibration's analysis method

18.1.3 Using custom reports create a new database for the samples and QA/QC files

18.1.4 Copy the data to the latest lab data template located \\BEACON\BEACON Administration\LabData

18.2 Quantification Review

18.2.1 Team effort performed by Laboratory Director, Quality Manager, and additional laboratory staff.

18.2.2 Include QA-QC check report where internal standard areas of the CCV are compared to all of the method blanks and samples of the analytical batch

18.2.3 Surrogates are monitored for internal use and reported when requested. Surrogates that fail to meet QA criteria will be documented in the corrective action log, and appropriate corrective action taken. If Beacon is required to report the surrogates, surrogates failing to meet QA criteria are flagged with a Q, or other client specific code.

18.2.4 Enter data according to the latest revision of SOP 62.

18.3 Concentraion Calculations

18.3.1 When reporting concentration data the LIMS calculates the final concnetraion in ug/m3 from the instrument ng result based on the data logged in for each sample.

18.3.2 Passive Analysis Calculation:

$$C = \frac{1000 \times M \times d}{U \times t}$$

where:

C	=	concentration (µg/m³)
M	=	mass (ng)
d	=	dilution factor
U	=	Uptake rate (ml/min),
t	=	sampling time (minutes)

19 METHOD PERFORMANCE

The measurement uncertainty for this method is reported using the in-house, statistically-derived LCS control limits based on historical LCS recovery data as an estimate of the minimum laboratory contribution to measurement uncertainty at a 99% confidence level

20 POLLUTION PREVENTION

Thermal desorption of air samples produces very little pollution, as sample preparation is kept to a minimum, vapor traps are used on the outlet of the gas chromatograph, and much of the sample introduced to the gas chromatograph is recollected. Unused samples are thermally destroyed. Small quantities of solvent are used to prepare the calibration standards and quality control standards, and all solvents used are disposed of in accordance with local, state and federal regulations.

21 DATA ASSESSMENT and ACCEPTANCE CRITERIA for QUALITY CONTROL MEASURES

Quality control samples must be processed in the same manner as the actual samples. They must be analyzed and reported with their associated field samples. If QC results are outside method-specified or project-specified criteria, corrective action will be taken to correct the problem and to prevent incorrect results from being reported. Reportable quality control samples (as required by a specific customer or contract) are appropriately date quality coded and discussed in the report narrative (examples of common data quality codes, or flags are shown in the table below).

Data Quality Code	Use
B	Contamination in blank
J	Estimated value below the contract reporting limit, normally the 'LOQ', and above the detection limit 'DL')
N	Non target analyte
Q	QA sample failure (LCS, CCV, IS, Surrogate)
U	Undetected
D	Dilution
NR	Not reported

If manual integrations are performed, identify the samples and analytes for which manual integration occurred in the case narrative or analytical report, including the cause and justification for the integration. Both the original and manually integrated chromatograms are also documented with the analyst's signature, the date and the reason for the manual integration.

Table 3 summarizes the quality control samples used in this SOP, and their acceptance criteria.

Table 3. Quality control samples and acceptance criteria

QC Check	Minimum Frequency	Acceptance Criteria
5-pt initial calibration	Before analysis	RSD<20 or >0.99r^2 for linear and quadratic regression
2nd source calibration verification (ICV/LCSD)	Before analysis	±30%
Calibration Verification (LCS)	Prior to analysis	±20%
Internal Standards (IS)	all analysis requires internal standards	50% to 200% of the area count of the respective IS from the initial calibration.
Method Blank	before analysis, daily	no compounds detected above the limit of quantitation or Contract required reporting limit
LCSD for all analytes	before analysis, daily	±30% (±20% for DoD samples)
MS/MSD	as required by contract, generally not applicable	70-130 % recovery, for the MSD when comparing quantitative results,

QC Check	Minimum Frequency	Acceptance Criteria
Surrogate Spike	all analysis requires surrogates	70-130 % recovery
MDL study	annually	
BFB tuning	before analysis	Refer to section 14 tables 2 & 3 for acceptance criteria
Limit of quantitation (LOQ) and Limit of detection (LOD) demonstrations	quarterly	LOQ is the lowest point on the curve, LOD is the lowest standard made where detectable amounts can be resolved above the baseline
Field Sample Duplicates	as required by contract	Calculate the relative percent difference (RPD) between sample and field duplicate; use CRQL for all non-detects. Take the average for all analyte RPD values. Discuss RPD values greater than or equal to 100% with client. Divide number of failed RPD values by the total RPD values to describe the agreement between sample and duplicate to the client.

22 CORRECTIVE AND PREVENTIVE ACTION

Corrective action will be initiated when quality control criteria is not met. Refer to SOP 41 for the corrective action process. Various sources of information, such as control charts, equipment maintenance, and monitoring of QA/QC samples, provide opportunities for preventive actions.

23 CONTINGENCIES for UNACCEPTABLE DATA

Table 4 below summarizes the common actions to perform for unacceptable data.

Table 4. Quality control samples, criteria, and corrective actions for common causes of unacceptable data.

QC Check/frequency	Acceptance Criteria	Corrective Action
5-pt initial calibration, quarterly	RSD<20	Remake standard, rerun, or clean system then recalibrate
2nd source calibration verification, quarterly (ICV)	±30% (±20% for DoD)	Remake standard, rerun, or clean system then recalibrate
Calibration Verification (LCS/BS), prior to analysis	±20%	Remake standard, rerun, or clean system then recalibrate
Internal Standards (IS), every sample batch	50% to 200% of the area count of the respective IS for the initial calibration	Review for co-elution or masking, re-run if possible, otherwise flag data and discuss in report
Method Blank, prior to analysis, daily	no compounds detected above the limit of quantization, or Contract required reporting limit	Clean system with bake out, rerun method blank until system clean
LCSD for all analytes, prior to analysis, daily	±30% (±20% for DoD)	Remake standard, rerun, or clean system then recalibrate

QC Check/frequency	Acceptance Criteria	Corrective Action
MS/MSD, as required by contract; generally not applicable	70-130 % recovery	Re-analyze if possible, otherwise flag data and discuss in report
Surrogate Spike, all sample batches	70-130 % recovery	Flag data and discuss in report if contracted to report surrogates
BFB tuning, prior to analysis	REQUIRED BFB KEY IONS AND ION ABUNDANCE CRITERIA REQUIRED BFB KEY IONS AND ION ABUNDANCE CRITERIA Mass Ion Abundance Criteria 50 8.0 to 40.0 Percent of m/e 95 75 30.0 to 66.0 Percent of m/e 95 95 Base Peak, 100 Percent Relative Abundance 96 5.0 to 9.0 Percent of m/e 95 (See note) 173 Less than 2.0 Percent of m/e 174 174 50.0 to 120.0 Percent of m/e 95 175 4.0 to 9.0 Percent of m/e 174 176 93.0 to 101.0 Percent of m/e 174 177 5.0 to 9.0 Percent of m/e 176	Clean the mass spectrometer, re-tune, recalibrate.
Limit of quantitation (LOQ/LLOQ) and Limit of detection (LOD) and detection limit (DL) demonstrations, Quarterly	LOQ or LODis the lowest included point on the curve, DL is the lowest standard made where detectable amounts can be resolved above the baseline +50% Recovery	
Field Sample Duplicates, as required by contract	Calculate the relative percent difference (RPD) between the sample and field duplicate. Average RPD values for the sample.. Use the CRQL for non-detects. Use an evaluation criteria limit of 50% RPD for positive duplicate results	Discuss RPD values greater than or equal to 50% with client. Divide number of failed RPD values by the total RPD values to describe the agreement between sample and duplicate to the client.

24 WASTE MANAGEMENT

Waste is minimized whenever possible, and recycling is used for glassware, paper, and other recyclable items.

25 REFERENCES

16.1 Agilent 7890-5975 GC/MS with ChemStation Manual

16.2 Markes TD-100xr User Manual, Version 4.0 June 2021

16.3 EPA Method 8260D, February 2017

16.4 EPA Method 8260C, August 2006

26 EQUIPMENT/INSTRUMENT MAINTENANCE

All equipment and instruments are maintained in accordance with the manufacturer's recommendations, modified as necessary and appropriate based on the number of and type of samples analyzed.

27 COMPUTER HARDWARE and SOFTWARE

This method uses Agilent ChemStation software to operate the GC/MSD

28 TROUBLESHOOTING

Section 22 summarizes basic troubleshooting when acceptance criteria are not met for this method. More advanced troubleshooting procedures can be found in the manufacturer's manuals for the Agilent gas chromatograph, Agilent mass selective detector, Markes AutoSecure Thermal Desorption System with Recollection, and Markes TC-20. Table 5, below, summarizes some basic maintenance requirements

Table 5 Equipment Maintenance and Troubleshooting

Maintenance	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Assigned to:
Transfer line	Preventive maintenance	Check for leaks and O-ring wear, check cold trap (front Tenax trap) for adsorbent shrinkage	Upon response dwindling and tune failure	Tune and CCV pass criteria	Tighten ferrules, inspect for leaks, and check alignment. Rebuilt cold trap if necessary.	Analyst
Detector maintenance	Column change, unable to tune	Clean Detector, change pump oil	When responses drop and tunes fail	Tune passes, air and water not present in scan	Disassemble detector and check parts, check filaments, reanalyze tune	Analyst

29 Appendix A

DoD QSM ELAP, Rev 5 Requirements

Table 4: Organic Analysis by Gas Chromatography/Mass Spectrometry

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Tune Check	Prio to ICAL and prior to each 12-period of sample analysis	Specific ion abundance criteria of BFB or DFTPP from method	Retune instrument and verify	Flagging is not appropriate	No samples shall be analyzed without a valid tune.
Initial Calibration (ICAL) for all analytes, including surrogates	At instrument set-up, prior to sample analysis	Each analyte must meet one of the three options below: Option 1: RSD for each analyte ≤ 20% Option 2: linear least square regression for each analyte: $r^2 \geq 0.99$; Option 3: non-linear least squares regression (quadratic) for each analyte: $r^2 \geq 0.99$.	Correct problem then repeat ICAL	Flagging is not appropriate	Minimum 5 levels and 6 levels for quadratic. No samples shall be analyzed until ICAL has passed. If the specific version of a method requires additional evaluation (e.g., RFs or low calibration standard analysis and recovery criteria) these additional requirements must also be met.
Retention Time window position establishment	Once per ICAL and at the beginning of the analytical sequence	Position shall be set using the mid-point of the ICAL when ICAL is performed. On days when ICAL is not performed, the initial CCV is used.	NA	NA	Required for each analyte and surrogate.
Evaluation of Relative Retention Times (RRT)	With each sample	RRT of each reported analyte within ±0.06 RRT units	Correct problem, then rerun ICAL.	NA	RRTs may be updated based on the daily CCV. RRT shall be compared with the most recently updated RRTs
Initial Calibration Verification ((ICV)	Once after each ICAL, analysis of a second source standard prior to sampe analysis.	All reported analytes within ± 30% of true value	Correct problem. Rerun ICV. IF that fails, repeat ICAL.	Flagging is not appropriate.	No samples shall be analyzed until calibration has been verified with a second source.
Continuing Calibration	Daily before sample analysis; after every 12	All reported analytes and surrogates within	Recalibrate, and reanalyze all affected samples	If reanalysis cannot be performed, data	Results may not be reported without a valid CCV.

Table 4: Organic Analysis by Gas Chromatography/Mass Spectrometry					
QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Verification (CCV)	hours of analysis time; and at the end of the analytical batch run.	±20% of true value. All reported analytes and surrogates within ± 50% for the end of analytical batch CCV.	since the last acceptable CCV: Or Immediately analyze two additional consecutive CCVs. If both pass, samples may reported without re-analysis. If either fails, take corrective action)s) and re-calibrate; then reanalyze all affected samples since the last acceptable CCV.	must be qualified and explained in the case narrative. Apply Q-flag to all results for the specific analyte(s) in all samples since last acceptable calibration verification.	Flagging is only appropriate in cases where the samples cannot be reanalyzed. If the specific version of a method requires additional evaluation (e.g., average RFs) these additional requirements must also be met.
Internal Standards (IS)	Every field samples, standard, and QC sample.	Retention time within ± 10 seconds from retention time of the midpoint standard in the ICAL; EICP area within =50% to +100% of ICAL midpoint standard.	Inspect mass spectrometer and GC for malfunctions and correct problem. Reanalysis of samples analyzed whil system was malfunctioning is mandatory.	If corrective action fails, data must be qualified and explained in the case narrative. Apply Q-flag to analytes associated with the non-compliant IS. Flagging is not appropriate for failed standards.	
Method Blank (MB)	One per preparatory batch	No analytes detected > 1.2 LOQ or 1/10 the amount measured in any associated sample, or 1/10 the regulatory limit, whichever is greater. Common contaminants must not be detected > LOQ.	Correct problem. If required, reprep and reanalyzed MB and all samples processed with the contaminated blank.	If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply B-flag to all results for the specific analyte(s) in all samples in the associated preparatory batch.	
Laboratory Control Sample Duplicate (LCSD)	Once per preparatory batch.	A laboratory must use the QSM Appendix C Limits for batch control if project limits are not specified.	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch	If reanalysis cannot be performed, data must be qualified and explained in the case narrative.	Must contain all surrogates and all analytes to be reported. Results may not be reported without a valid LCS.

Table 4: Organic Analysis by Gas Chromatography/Mass Spectrometry					
QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
		If the analyte(s) are not listed, use in-house LCS limits is project limits are not specified.	for failed analytes, if sufficient sample material is available.	Apply Q-flag to specific analyte(s) in all samples in the associated preparatory batch.	Flagging is only appropriate when the samples cannot be reanalyzed.
Surrogate Spike	All field and QC samples	QC acceptance criteria specified by the project, if available; otherwise use QSM Appendix C limits or in-house LCS limits if analyte(s) are not listed.	Correct problem, then reprep and reanalyze all failed samples for all surrogates in the associated preparatory batch, if sufficient sample	Apply Q-flag to associated analyte(s) if acceptance criteria are not met and explain in the case narrative.	Alternate surrogates are recommended when there is obvious chromatographic interference.

30 Appendix B (8260) DoD QSM ELAP Rev. 5 LCS Limits

CAS ID	Analyte	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit
630-20-6	1,1,1,2-Tetrachloroethane	101.1	7.8	78	125
71-55-6	1,1,1-Trichloroethane	101.6	9.4	73	130
79-34-5	1,1,2,2-Tetrachloroethane	97	8.9	70	124
79-00-5	1,1,2-Trichloroethane	99.7	7.2	78	121
76-13-1	1,1,2-Trifluoro-1,2,2-trichloroethane [Freon-113]	100.8	11.7	66	136
75-34-3	1,1-Dichloroethane	100.4	8.1	76	125
75-35-4	1,1-Dichloroethene	100.3	10.1	70	131
563-58-6	1,1-Dichloropropene	100.5	8.3	76	125
87-61-6	1,2,3-Trichlorobenzene	97.8	10.6	66	130
96-18-4	1,2,3-Trichloropropane	99.1	8.8	73	125
526-73-8	1,2,3-Trimethylbenzene	99.8	6	82	118
120-82-1	1,2,4-Trichlorobenzene	98	10.4	67	129
95-63-6	1,2,4-Trimethylbenzene	98.7	7.9	75	123
96-12-8	1,2-Dibromo-3-chloropropane	96.6	11.7	61	132
106-93-4	1,2-Dibromoethane	100.1	7.3	78	122
95-50-1	1,2-Dichlorobenzene	99.1	7.2	78	121
107-06-2	1,2-Dichloroethane	100.5	9.2	73	128
17060-07-0	1,2-Dichloroethane-d4	103.1	10.8	71	136

540-59-0	1,2-Dichloroethene	99.9	7.3	78	122
78-87-5	1,2-Dichloropropane	99.5	7.8	76	123
354-23-4	1,2-Dichlorotrifluoroethane [Freon 123a]	97.8	11.3	64	132
108-70-3	1,3,5-Trichlorobenzene	99.4	9.6	71	128
108-67-8	1,3,5-Trimethylbenzene	98.4	8.4	73	124
541-73-1	1,3-Dichlorobenzene	98.9	7.4	77	121
142-28-9	1,3-Dichloropropane	99.1	7.3	77	121
542-75-6	1,3-Dichloropropene	101.6	8.1	77	126
106-46-7	1,4-Dichlorobenzene	97.5	7.6	75	120
105-05-5	1,4-Diethylbenzene	96.6	5.9	79	114
123-91-1	1,4-Dioxane	96.4	13.7	55	138
544-10-5	1-Chlorohexane	100.4	9.8	71	130
594-20-7	2,2-Dichloropropane	99.7	11.1	67	133
78-93-3	2-Butanone [MEK]	99.6	16.3	51	148
126-99-8	2-Chloro-1,3-butadiene	99	11.3	65	133
110-75-8	2-Chloroethyl vinyl ether	96.1	17.6	43	149
95-49-8	2-Chlorotoluene	98.5	7.9	75	122
591-78-6	2-Hexanone	99.1	15.4	53	145
79-46-9	2-Nitropropane	98.3	17.1	47	150
67-63-0	2-Propanol [Isopropyl alcohol]	99.8	13.4	60	140
460-00-4	4-Bromofluorobenzene	98.9	6.8	79	119
106-43-4	4-Chlorotoluene	98.3	8.6	72	124
108-10-1	4-Methyl-2-pentanone [MIBK]	99.6	11.6	65	135
67-64-1	Acetone	99.6	21.4	36	164
75-05-8	Acetonitrile	98.5	14.8	54	143
107-02-8	Acrolein [Propenal]	101.1	18	47	155
107-13-1	Acrylonitrile	99.7	11.4	65	134
107-05-1	Allyl chloride	101.1	11.2	68	135
71-43-2	Benzene	99.2	7.4	77	121
100-44-7	Benzyl chloride	92.1	9.4	64	120
108-86-1	Bromobenzene	99.3	7.3	78	121
74-97-5	Bromochloromethane	101.4	7.8	78	125
75-27-4	Bromodichloromethane	101	8.5	75	127
75-25-2	Bromoform	99.1	10.8	67	132
74-83-9	Bromomethane	98.3	15	53	143

75-15-0	Carbon disulfide	97.9	11.5	63	132
56-23-5	Carbon tetrachloride	102.3	10.7	70	135
108-90-7	Chlorobenzene	99.7	6.9	79	120
124-48-1	Chlorodibromomethane	100.2	8.7	74	126
75-00-3	Chloroethane	98.8	13.3	59	139
67-66-3	Chloroform	100.3	7.6	78	123
74-87-3	Chloromethane	93.3	14.3	50	136
156-59-2	cis-1,2-Dichloroethene	99.9	7.6	77	123
10061-01-5	cis-1,3-Dichloropropene	99.8	8.7	74	126
1476-11-5	cis-1,4-Dichloro-2-butene	106	12.4	69	143
110-82-7	Cyclohexane	98.9	10.6	67	131
108-94-1	Cyclohexanone	93.2	20.9	30	156
1868-53-7	Dibromofluoromethane	98.1	6.8	78	119
74-95-3	Dibromomethane	101.1	7.9	78	125
75-71-8	Dichlorodifluoromethane [Freon-12]	88.9	20.1	29	149
75-43-4	Dichlorofluoromethane	100.8	18	47	155
60-29-7	Diethyl ether	99.6	9.6	71	129
108-20-3	Diisopropyl ether	98.3	9.7	69	127
64-17-5	Ethanol	102.2	18.9	45	159
141-78-6	Ethyl acetate	95.4	14.5	52	139
97-63-2	Ethyl methacrylate	98.9	9.9	69	129
637-92-3	Ethyl tert-butyl ether	98.9	9.1	72	126
100-41-4	Ethylbenzene	99.1	7.7	76	122
462-06-6	Fluorobenzene	97.3	5.4	81	114
142-82-5	Heptane	93.4	14.9	49	138
87-68-3	Hexachlorobutadiene	98.1	12.4	61	135
67-72-1	Hexachloroethane	102.5	10.1	72	133
110-54-3	Hexane	93.6	16.1	45	142
74-88-4	Iodomethane	100.9	10.1	71	131
78-83-1	Isobutyl alcohol	97.5	12.6	60	135
108-21-4	Isopropyl acetate [Acetic acid]	94.2	12.2	58	131
98-82-8	Isopropylbenzene	100.8	11.1	68	134
179601-23-1	m/p-Xylene [3/4-Xylene]	100.4	7.7	77	124
126-98-7	Methacrylonitrile	99.2	11.1	66	132
79-20-9	Methyl acetate	98.7	15.2	53	144

80-62-6	Methyl methacrylate	98.4	11.9	63	134
1634-04-4	Methyl tert-butyl ether [MTBE]	98.9	8.7	73	125
108-87-2	Methylcyclohexane	99.4	11.2	66	133
75-09-2	Methylene chloride	98.9	9.7	70	128
123-86-4	n-Butyl acetate	95.1	11	62	128
71-36-3	n-Butyl alcohol	92.9	12.6	55	131
104-51-8	n-Butylbenzene	98.7	9.7	70	128
103-65-1	n-Propylbenzene	98.9	8.8	73	125
91-20-3	Naphthalene	95.6	11.2	62	129
95-47-6	o-Xylene	100	7.7	77	123
99-87-6	p-Isopropyltoluene [p-Cymene]	100.3	9	73	127
76-01-7	Pentachloroethane	102	11.1	69	135
107-12-0	Propionitrile [Ethyl cyanide]	101	11.1	68	134
135-98-8	sec-Butylbenzene	99	8.8	73	126
100-42-5	Styrene	100.2	8	76	124
994-05-8	tert-Amyl methyl ether [TAME]	99.8	8.9	73	126
75-65-0	tert-Butyl alcohol	100.5	10.7	68	133
98-06-6	tert-Butylbenzene	98.8	8.6	73	125
127-18-4	Tetrachloroethene	100.5	9.2	73	128
109-99-9	Tetrahydrofuran	98	12.4	61	135
108-88-3	Toluene	99.3	7.3	77	121
2037-26-5	Toluene-d8	100.7	5.2	85	116
156-60-5	trans-1,2-Dichloroethene	99.2	8.6	74	125
10061-02-6	trans-1,3-Dichloropropene	100.9	9.8	71	130
110-57-6	trans-1,4-Dichloro-2-butene	98.6	12.3	62	136
79-01-6	Trichloroethene	100.2	7.6	77	123
75-69-4	Trichlorofluoromethane [Freon-11]	101	13.1	62	140
108-05-4	Vinyl acetate	100.3	16.9	50	151
75-01-4	Vinyl chloride	95.6	13.2	56	135
1330-20-7	Xylenes [total]	100.7	7.7	78	124

DoD QSM ELAP Rev. 5 LCS Limits

CAS	Analyte 8260, solid, edited to Beacon's accreditation list	Mean	SD	LCL	UCL
630-20-6	1,1,1,2-Tetrachlorothane	101.1	7.8	78	125
71-55-6	1,1,1-trichloroethane	101.6	9.4	73	130

CAS	Analyte 8260, solid, edited to Beacon's accreditation list	Mean	SD	LCL	UCL
79-34-5	1,1,2,2-tetrachloroethane	97	8.9	70	124
79-00-5	1,1,2-trichloroethane	99.7	7.2	78	121
75-34-3	1,1-Dichloroethane	100.4	8.1	76	125
75-35-4	1,1-Dichloroethene	100.3	10.1	70	131
563-58-6	1,1-Dichloropropene	100.5	8.3	76	125
87-61-6	1,2,3-Trichlorobenzene	97.8	10.6	66	130
96-18-4	1,2,3-Trichloropropane	99.1	8.8	73	125
120-82-1	1,2,4-Trichlorobenzene	98	10.4	67	129
95-63-6	1,2,4-Trimethylbenzene	98.7	7.9	75	123
106-93-4	1,2-Dibromoethane	100.1	7.3	78	122
95-50-1	1,2-Dichlorobenzene	99.1	7.2	78	121
107-06-2	1,2-Dichloroethane	100.5	9.2	73	128
17060-07-0	1,2Dichloroethane-d4	103.1	10.8	71	136
78-87-5	1,2-Dichloropropane	99.5	7.8	76	123
108-67-8	1,3,5-Trimethylbenzene	98.4	8.4	73	124
541-73-1	1,3-Dichlorobenzene	98.9	7.4	77	121
142-28-9	1,3-Dichloropropane	99.1	7.3	77	121
106-46-7	1,4-Dichlorobenzene	97.5	7.6	75	120
123-91-1	1,4-Dioxane	96.4	13.7	55	138
594-20-7	2,2-Dichloropropane	99.7	11.1	67	133
95-49-8	2-Chlorotoluene	98.5	7.9	75	122
106-43-4	4-Chlorotoluene	98.3	8.6	72	124
108-10-1	4-Methyl-2-pentanone [MIBK]	99.6	11.6	65	135
71-43-2	Benzene	99.2	7.4	77	121
108-86-1	Bromobenzene	99.3	7.3	78	121
74-97-5	Bromochloromethane	101.4	7.8	78	125
75-27-4	Bromodichloromethane	101	8.5	75	127

CAS	Analyte 8260, solid, edited to Beacon's accreditation list	Mean	SD	LCL	UCL
75-25-2	Bromoform	99.1	10.8	67	132
75-15-0	Carbon Disulfide	97.9	11.5	63	132
56-23-5	Carbon Tetrachloride	102.3	10.7	70	135
108-90-7	Chlorobenzene	99.7	6.9	79	120
67-66-3	Chloroform	100.3	7.6	78	123
156-59-2	Cis-1,2-Dichloroethene	99.9	7.6	77	123
10061-01-5	Cis-1,3-Dichloroproprene	99.8	8.7	74	126
74-95-3	Dibromomethane	101.1	7.9	78	125
75-71-8	Dichlorodifluoromethane [Freon 12]	88.9	20.1	29	149
100-41-4	Ethylbenzene	99.1	7.7	76	122
462-06-6	Fluorobenzene	97.3	5.4	81	114
87-68-3	Hexachlorobutadiene	98.1	12.4	61	135
67-72-1	Hexachloroethane	102.5	10.1	72	133
98-82-8	Isopropylbenzene	100.8	11.1	68	134
179601-23-1	m/p Xylene	100.4	7.7	77	124
1634-04-4	Methyl tert butyl ether [MTBE]	98.9	8.7	73	125
75-09-2	Methylene Chloride	98.9	9.7	70	128
104-51-8	n-butylbenzene	98.7	9.7	70	128
103-65-1	n-propylbenzene	98.9	8.8	73	125
91-20-3	Naphthalene	95.6	11.2	62	129
95-47-6	o-Xylene	100	7.7	77	123
99-87-6	p-Isopropyltoluene [p-cymene]	100.3	9	73	127
135-98-8	Sec butylbenzene	99	8.8	73	126
100-42-5	Styrene	100.2	8	76	124
98-06-6	Tert-butylbenzene	98.8	8.6	73	125
127-18-4	Tetrachloroethene	100.5	9.2	73	128
108-88-3	Toluene	99.3	7.3	77	121

CAS	Analyte 8260, solid, edited to Beacon's accreditation list	Mean	SD	LCL	UCL
2037-26-5	Toluene d8	100.7	5.2	85	116
156-60-5	Trans-1,2-Dichloroethene	99.2	8.6	74	125
10061-02-6	Trans-1,3-Dichloropropene	100.9	9.8	71	130
79-01-6	Trichloroethene	100.2	7.6	77	123
75-69-4	Trichlorofluoromethane [Freon 11)	101	13.1	62	140
75-01-4	Vinyl chloride	95.6	13.2	56	135

Accredited compounds not listed in appendix B default method control limits will be applied.

Appendix C: SOP Annual Review

The following document(s) has been reviewed as part of the annual review process:

Document	Rev. #	Reviewed by	Reviewed Date	Change needed?