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Procedures for Passive Soil Gas Sample Collection and Sorbent Tubes to Measure a Broad Range of VOCs

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ROAD MAP

- Passive Soil Gas (PSG) Testing: Background and Applications
- Active Soil Gas Testing: EPA Methods TO-15 and TO-17
- PSG Testing: Mass to Concentration-Risk Evaluation
- Vapor Intrusion Testing:

  A. Indoor Air Study-Cans/Tubes/Passive Diffusion Samplers

  Concentration Range 10-30 ug/m3

  B. Subslab Study-Cans/Tubes

  Concentration Range 100-50,0000 ug/m3

Spatial Variability of VOCs

Passive Soil Gas (PSG) sampling and analysis to cost effectively characterize sites with Quantitative Data for VOC & SVOC contamination in soil, groundwater, soil vapor or indoor air.

Benefits:

- Maximize the number of locations that can be sampled
- Reduce uncertainty, surprises, and unforeseen costs
- Make well-informed and appropriate corrective action decisions
- Rapidly collect accurate data

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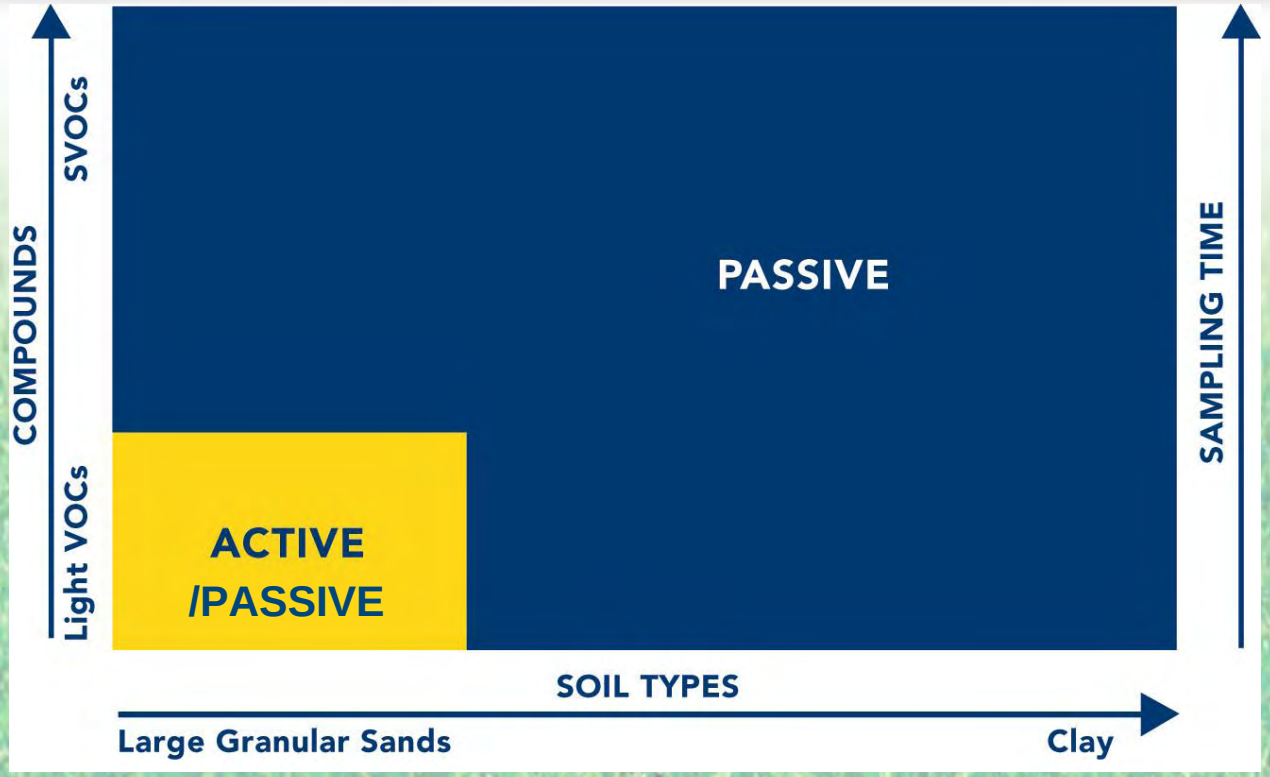
PASSIVE VS ACTIVE



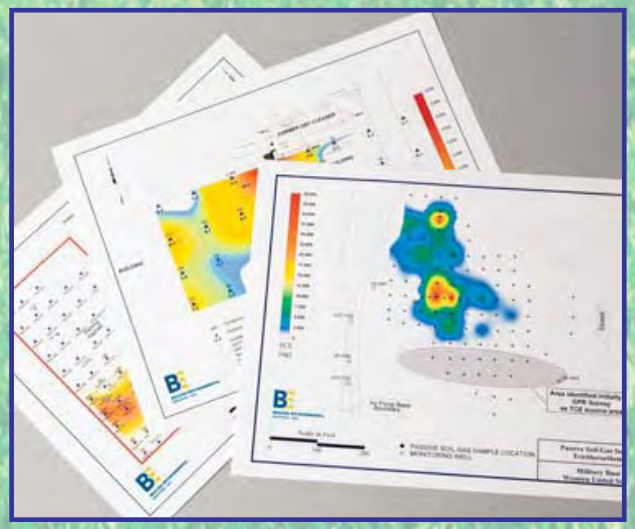
Time Integrated Samples **Effective in Most Soil Conditions**

Target a Broad Range of Compounds

PSG SURVEYS

PSG surveys are routinely performed to:

- Identify source areas and release locations
- Focus soil and groundwater sampling locations
- Identify vapor intrusion pathways
- Select whole air sample locations
- Track groundwater plumes
- Focus remediation plans and
- Evaluate Remediation Progress



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VALUE OF DATA?

A standard PSG survey provides mass from one location to another on a Compound-By-Compound Basis. * *New Feature: MtoC Tie-In*. [Measure Not Model]

- Not just yes/no answers
- Delineates lateral extent across site
- Shows source areas and migration patterns
- Targets broad range of VOCs & SVOCs
- Focuses soil and gw sample locations
- Use for Risk Screening and Evaluation
- Reduces costs, while increasing information

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EASE OF USE IN FIELD

Installation of PSG samplers is easy!

A single BESURE Collection Kit is custom prepared and comes with all materials needed to perform up to a 60-point survey!

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SAMPLER DESIGN

A PSG sampler is designed for rapid installation and ease of use in the field!

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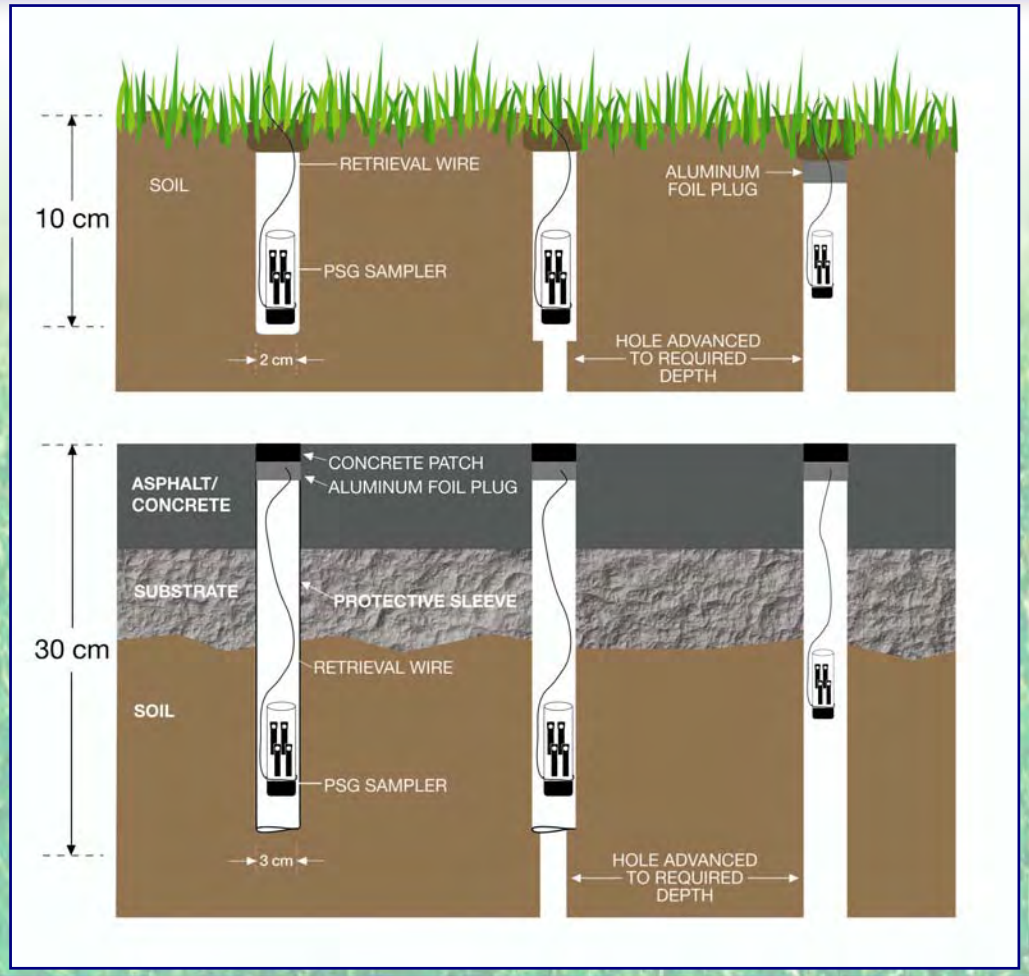
VERSATILE TECHNOLOGY



ROUTINE TARGETS

Halogenated hydrocarbons

- PCE
- TCE
- DCEs
- Vinyl chloride
- TCA
- Carbon tetrachloride
- Chloroform
- Freons
- Chlorobenzene
- Dichlorobenzenes
- Trichlorobenzenes

Complex mixtures

- Stoddard solvent
- Paint thinners

Petroleum Blends

- Gasoline
- Fuel oil
- Diesel
- Jet Fuel

BTEX, MTBE and PAHs

- Naphthalene
- 2-Methylnaphthalene

ADDITIONAL TARGETS

Heavier PAHs

- Acenaphthalene, Fluorene, Pyrene

Ketones

Explosives

Chemical Warfare Agent (CWA)

- Mustard, GB, VX

CWA Breakdown Products

- 1,4-Thioxane, 1,4-Dithiane, Thiodiglycol

Mercury (Hg)

BEST METHODS

Standard analytical procedures:

- Analysis by thermal desorption-gas chromatography/mass spectrometry (TD-GC/MS) following EPA Method 8260B
- Analytical results based on 5-point initial calibration
- Internal standards and surrogates included with each analysis
- Daily continuing calibration checks
- Duplicate field samples
- System daily tunes
- Method blanks

IN THE LAB

All samples are analyzed in-house using state-of-the-art analytical instruments

- Markes International Thermal Desorption System
- Agilent GC/MS
- Analysis following the EPA Method 8260B
- Highly sensitive MDL's below 5 nanograms

Agilent GC/MS Markes TD

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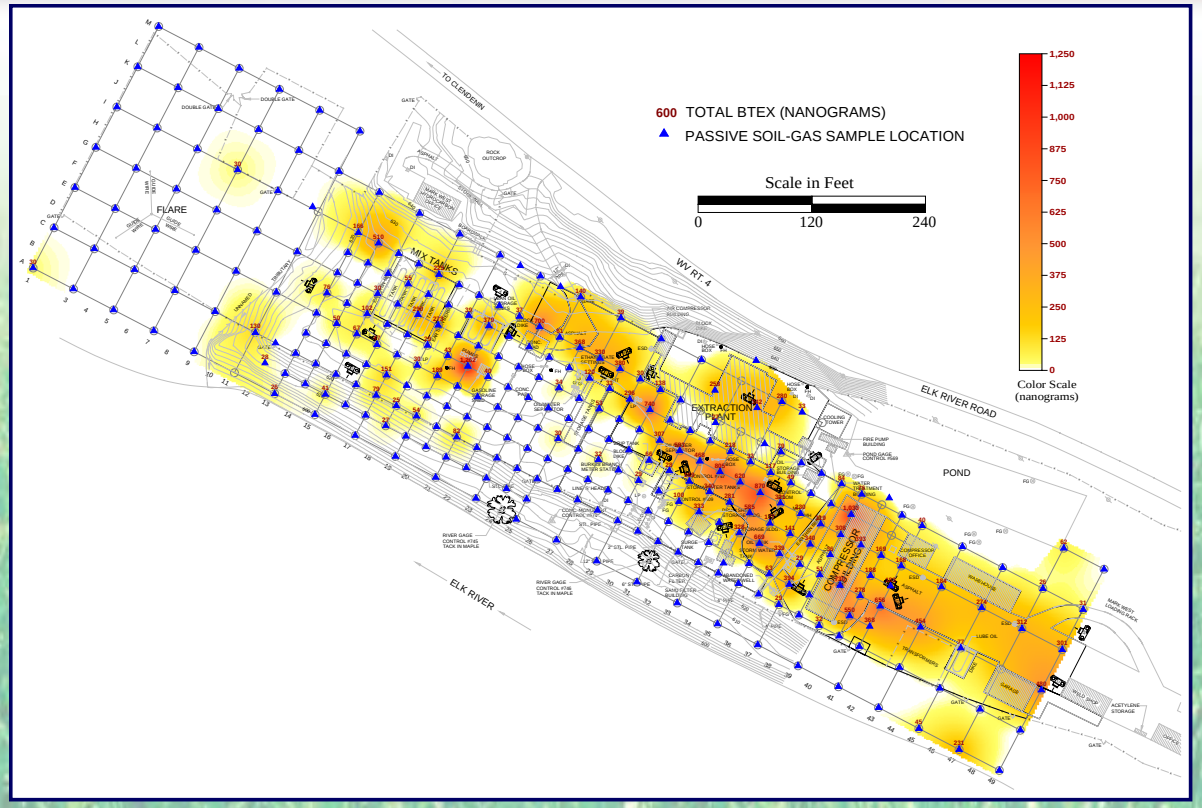
EXPERIENCE



Two people installed 304 PSG Samplers in two days and 1/3 of locations were through asphalt

Objectives: Identify source areas and delineate lateral extent of contamination at Manufactured Gas Plant

1,200 ftx250 ft area (7 acres)

Results: A grid based on 25-foot and 50-foot spacing accurately identified locations where petroleum contaminants had been released and their migration pathways. Client was able to significantly minimize the number of soil and groundwater samples required.

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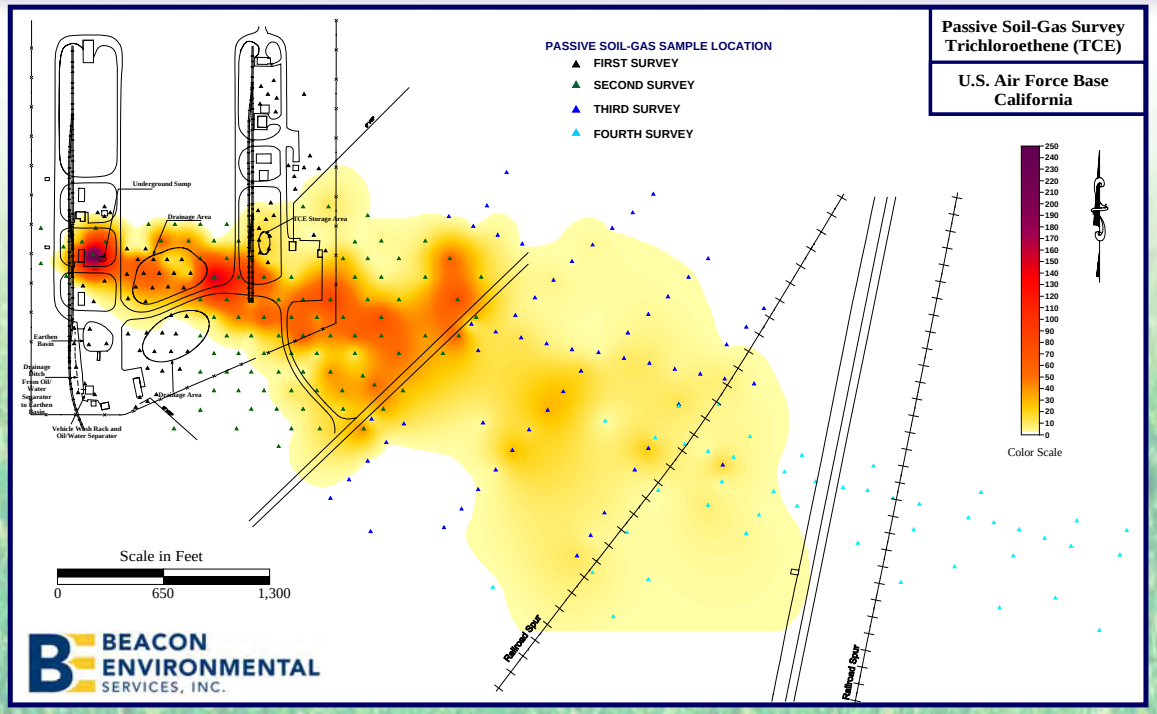
EXPERIENCE



Objectives: Screen for targeted contaminants at multiple areas of concern as part of basewide assessment.

1.3 mi x 0.5 mi (~400 acres)

Results: An initial PSG survey identified a release of TCE. Three subsequent surveys were performed to identify additional release locations and track the extent of the plume prior to any soil or groundwater samples being collected.

A sensitive, but robust technology for identifying a broad concentration range of contamination.

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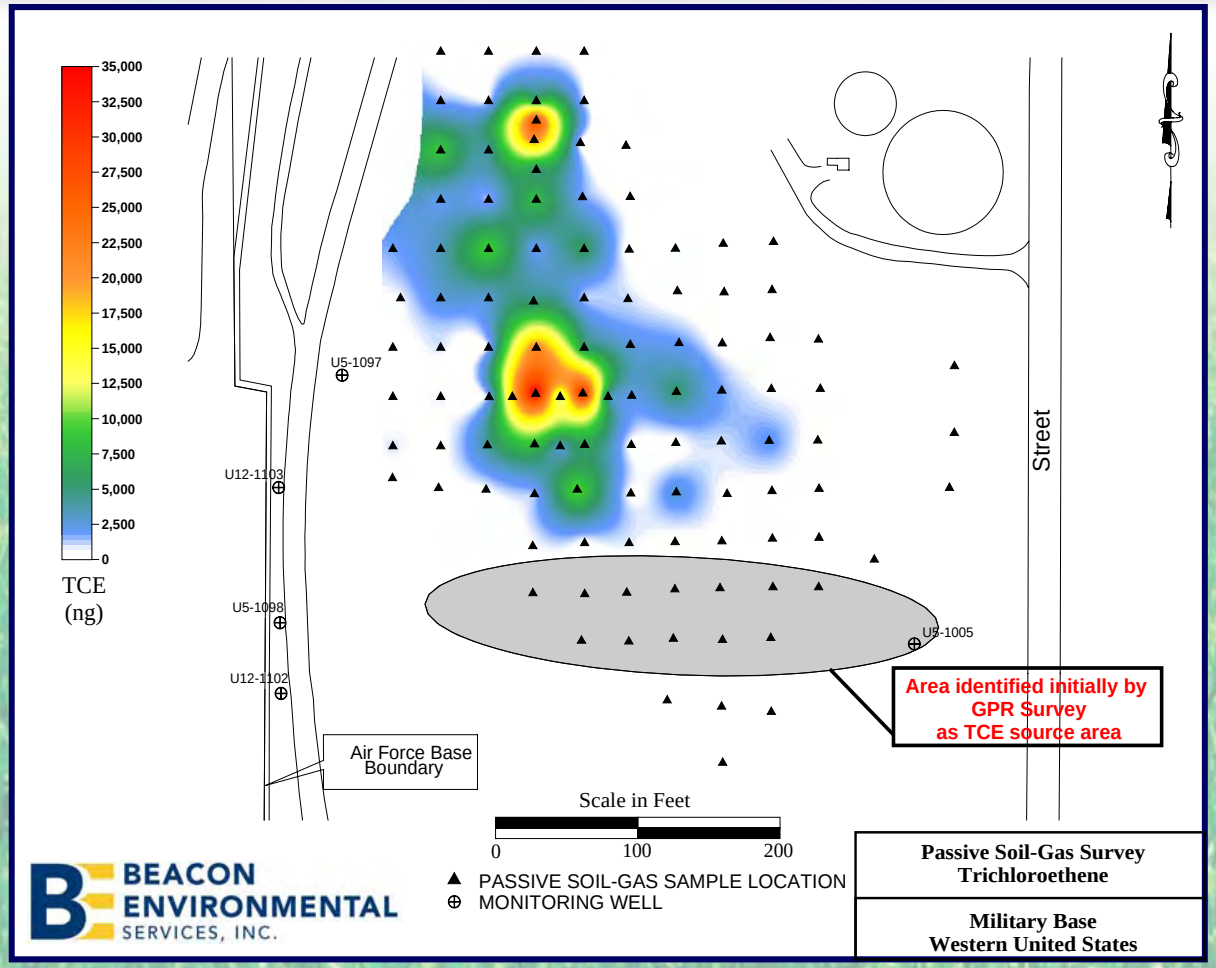
EXPERIENCE



Objectives: TCE was identified in downgradient well adjacent to a military base. An area of concern was identified and a GPR survey was used to guide the PSG survey. (~4 acres)

Results: The PSG survey results which were confirmed with follow-on sampling showed that the GPR results were not effective in identifying TCE releases, while the PSG survey was very effective.

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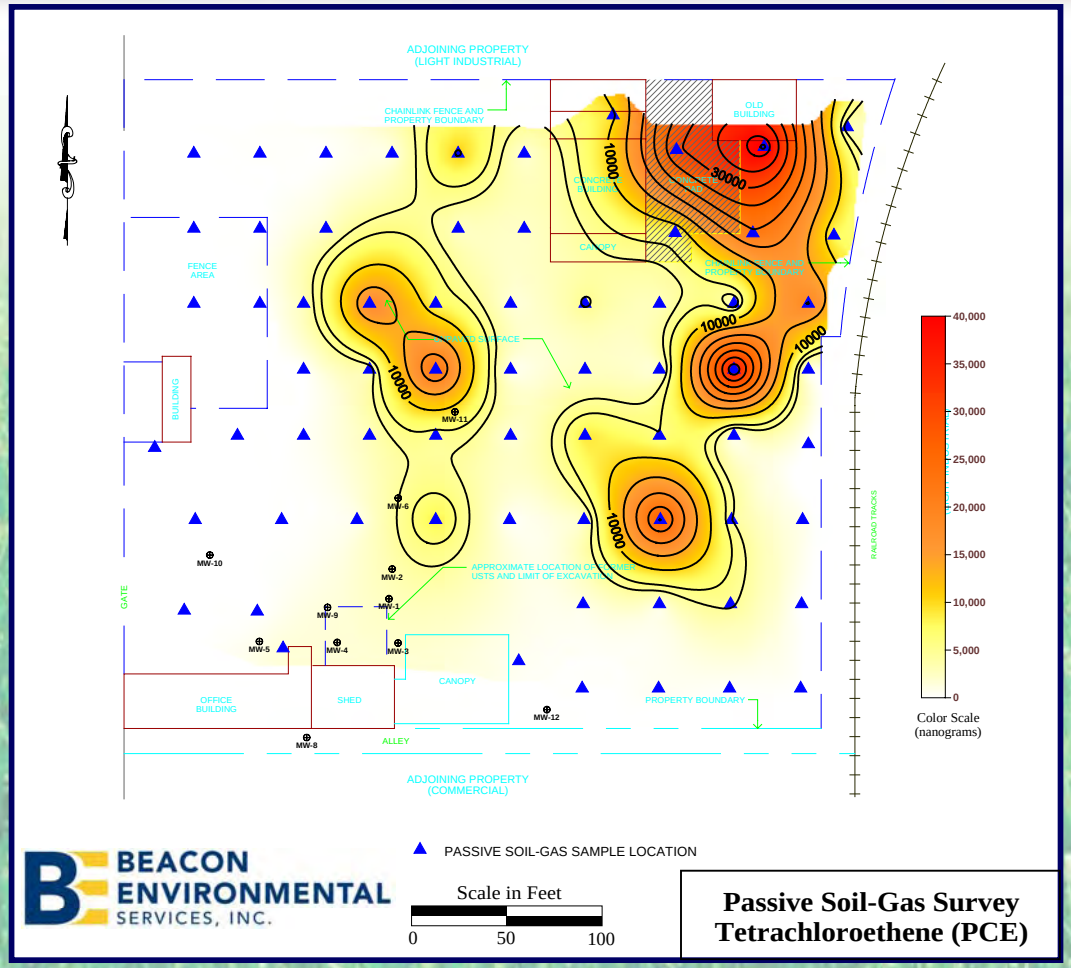
EXPERIENCE



Objectives: PCE was identified in a drinking water well within an urban environment. PSG surveys were performed at those sites identified in a Phase I report to have used PCE. (~3 acres)

Results: The PSG investigation identified this site as being a primary source of PCE that impacted the groundwater. Additional sites were also identified in the PSG investigation, and the results were confirmed through follow-on sampling.

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Active Soil Gas Options

EPA Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air

EPA TO-17 > Determination of VOCs in Ambient Air Using Active Sampling Onto Sorbent Tubes

EPA TO-15 > Determination of VOCs In Air Collected In Specially-Prepared Canisters

******NOTE: Jan. 28, 2003 Active Soil Gas Advisory Makes No Mention of EPA Method TO-17******

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Not a One-Shot Deal

EPA TO-17 > Determination of VOCs in Ambient Air Using Active Sampling Onto Sorbent Tubes

Recollection Device on Thermal Desorption System allows quantitative recollection for repeat analysis. See www.markes.com.

"Very Dangerous Method?"

One of the Speakers in this Forum referred to EPA TO-17 as a "Very Dangerous Method". This speaker is from a laboratory who analyzes and supplies Canisters (TO-15). There is a huge bias with many canister laboratories against tubes that are self-serving in nature.

The truth of the matter is that Method TO-17 is used throughout Europe where cans are not used.

The State of New Jersey Vapor Intrusion Guidance states, "Two methods are commonly employed: collection of samples in an evacuated canister and collection of samples on adsorbent media."

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Prominent Expert Opinion

"I can speak about the original development of TO-17 and the intent regarding the scope of TO-15 and TO-17 was that, to all intents and purposes, they should be identical. The fact that the word 'ambient' is used in the scope of TO-15 clearly shows that it is intended for ambient air concentrations (as opposed to workplace air) which effectively limits the range to 25 ppb anyway. Another thing that your colleague can use to defend this position is that several of the standard TD methods referenced in TO-17 are in fact workplace air monitoring methods which are typically much more concentrated than ambient air - often way above 10 ppm (let alone 25 ppb) - For example see reference to MDHS 72 in section 4.3, also references 7 (also MDHS 72), 20-26 inclusive.

Existing national and international standard methodology for air monitoring using pumped sorbent tubes - most notably: ASTM D6196-3 and ISO 16017-1 shows that sorbent tubes are very versatile with respect to analyte concentration. Both of these leading standards include ambient, indoor and workplace air monitoring in their scope.

In contrast to this, canisters are much more limited. High concentrations of very volatile compounds (more volatile than benzene) probably wouldn't cause too much trouble, but most labs, if they are honest, confess to concerns about analyte recovery for compounds ranging in volatility from toluene and down and this issue gets worse as concentrations increase.

Re canisters - I never stop being amazed that canisters have the hold they have in the US - It is just such a clugey method - impractical, inaccurate (especially for less volatile or polar cpds), expensive, inflexible, etc, etc."

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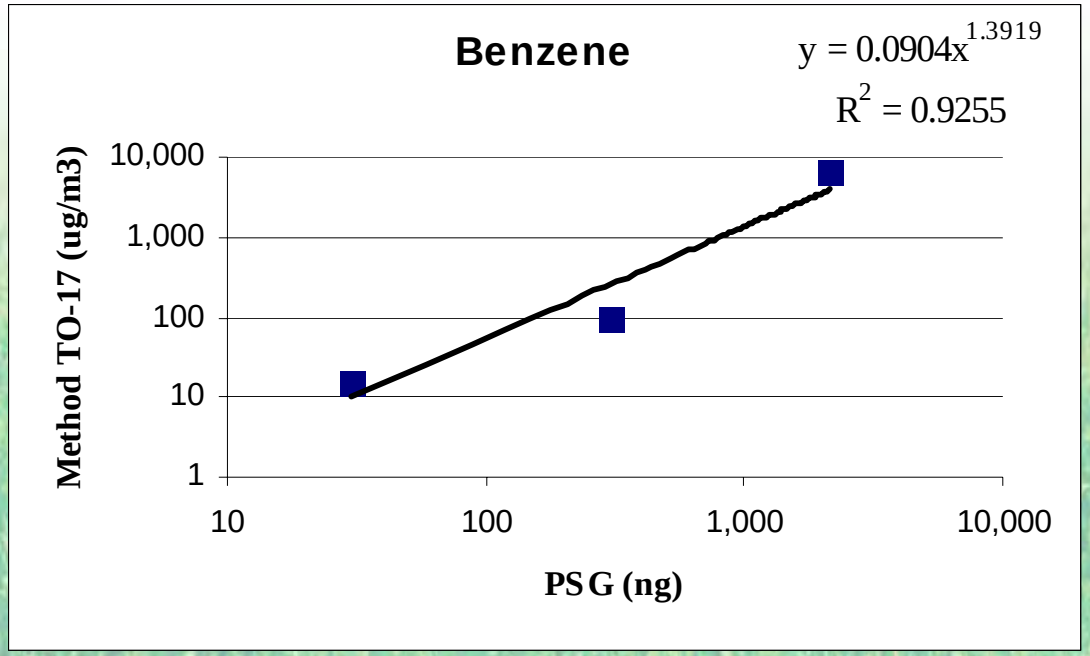
NEW FEATURE: MtoC Tie-In



Objectives: Use Active Soil Gas Method at Three to Five Locales to Related PSG Mass to Concentration for Risk Evaluation Purposes

Results: A Power Function is used to estimate the concentration of compounds across the entire PSG grid. .

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Benzene and TPH MtoC Tie-In

Tabulated Results: In this example, the correlations were applied across the site and the bolded values exceed air-phase screening levels.

	Units	SV-14	SV-15	SV-16	SV-17
Benzene	ng	259	28	2,160	2,425
	ug/m3	207	9	**3,957**	**4,649**
TPH C5-C10	ng	58,033	37,313	325,988	460,879
	ug/m3	11,488	5,970	**148,291**	**247,743**

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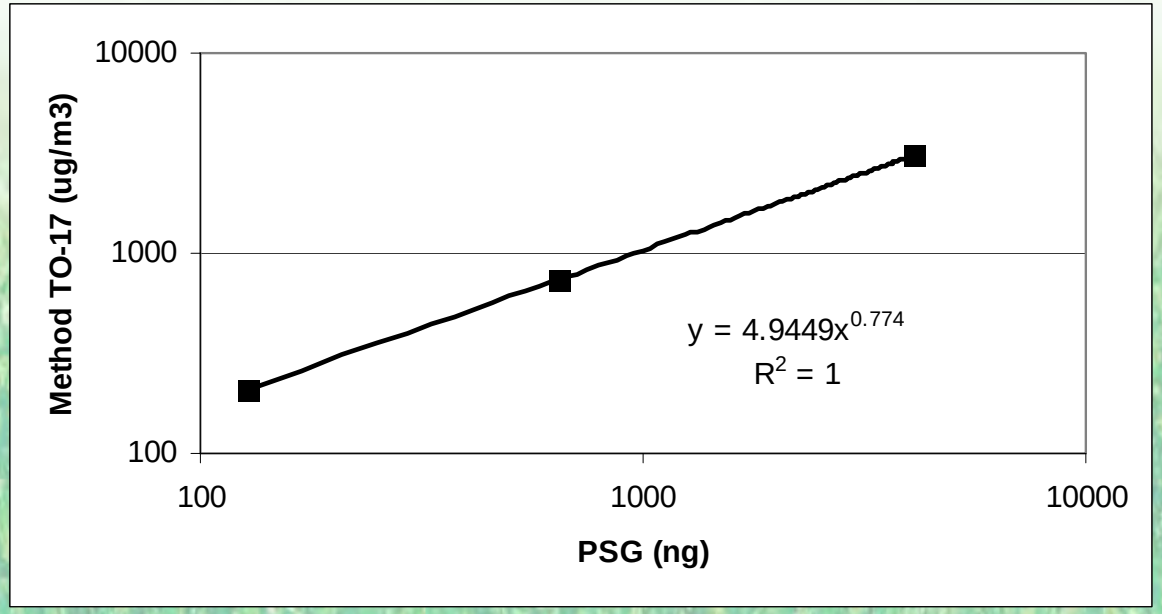
PCE MtoC Tie-In



Objectives: A Different Example Site.

Results: In this instance of PCE there is a perfect correlation. .

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VAPOR INTRUSION / INDOOR AIR

Beacon Environmental also provides vapor intrusion and indoor air monitoring to:

- Locate/map source areas and vapor intrusion pathways
- Determine presence of compounds in ambient air
- Measure concentrations in soil gas, indoor air, or ambient air
- Quantify actual emission flux rates
- Characterize migration pathways

Off-Site Comparison Test: Tubes v. Cans v. PDS

- Indoor Air Sampling Comparison
- Three Sorbent Tubes, Three Canisters and Three Passive Diffusion Samplers (PDS)
- Extensive Monitoring Program to be Switched from Cans to Tubes After Data Review

Tubes: TO-17 and PDS Types

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VAPOR INTRUSION

Larger View

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Research Results 15/17/PDS

Compound	TCE		
Units	ug/m3		
Lab	Beacon	CAS	Beacon
Method	TO-17	TO-15	MDHS 80
Exposure	24 hr	24 hr	2 weeks
Location			
8158	**20.4**	**28**	**12.1**
8158	**18.1**	**27**	**11.7**
8158	**10.9**	**19**	**10.8**

Vapor Intrusion Side-by-Side

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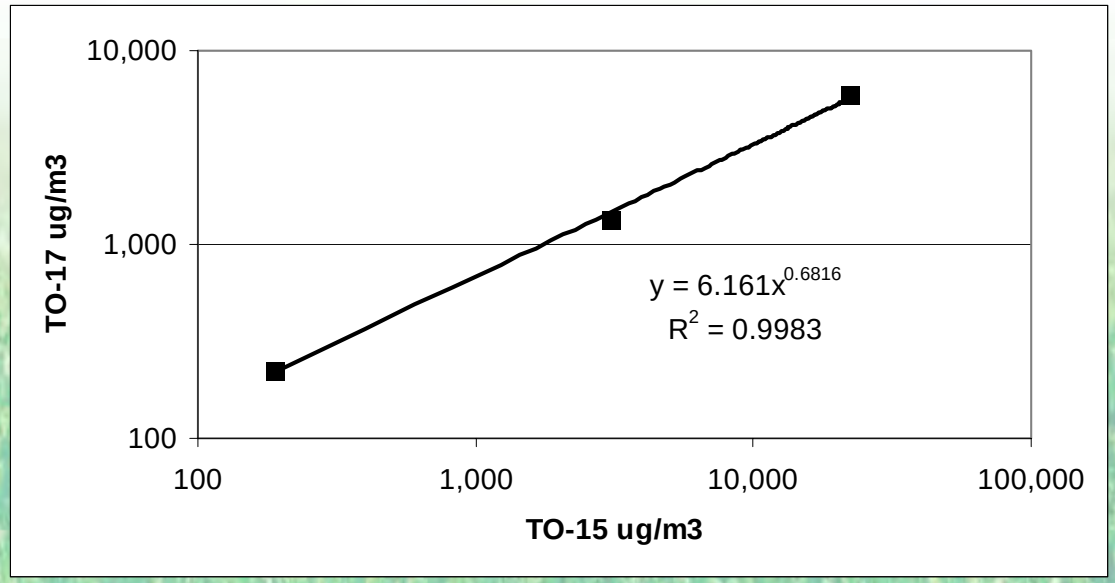
TO-15 & TO-17 Side-by-Side



Objectives: To Compare Summa Canisters to Sorbent Tubes

Results: There is an excellent correlation of relative concentrations, however, the TO-15 values were consistently higher (PCE).

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NON-INTRUSIVE APPROACH

We offer a completely non-intrusive sampling approach.

Characterize sites with UXO or CWA concerns
Provides emission flux rate data (ng/m^2/min)

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Publications-Spring 2008

BATTELLE> Monterrey, CA; May 18-22

1. Canisters v. Sorbent Tubes: Vapor Intrusion Test Method Comparison

2. Preliminary Investigation of A Perchloroethylene (PCE) Groundwater Plume Using A Passive Soil Gas Survey

3. Groundwater Plume, Source and Risk Identification Using Passive Soil Gas

4. Assessment And Remediation of Vapor Intrusion To Indoor Air, South Mesa State Superfund Site, Gilbert, Arizona

A&WMA> Portland, OR; June 23-27

5. Residential Vapor Intrusion to Indoor Air Comparative Study: Canisters vs. Sorbent Tubes vs. Passive Diffusion Samplers

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THANK YOU

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