

# **GeoEnviroLogic Professional Development** *Beyond Data: Better Investigations – Better Results*

February 18, 2011

## *Soil Vapour* *Analytical Method Update*



## **Objective:** Update on soil vapour analysis.

1. Methods & Instrumentation
2. Data Quantitation
3. Data Application – Regulatory vs.Risk?
  - Aromatic/Aliphatic Fractionation
4. Other Issues
5. Questions



1. **Thermal Desorption (TD)** - Volatile Organic Compounds in Air-Vapour by Thermal Desorption Tube / GCMS – PBM, Based on EPA TO-17
2. **Canister** - Volatile Organic Compounds in Air-Vapour by Canister Sampling / GCMS – PBM, Based on EPA TO-15
3. **Volatile Hydrocarbons (VH)** - Volatile Hydrocarbons in Air-Vapour by GC-FID / GC-MS
4. **Other Methods** - Volatile Organic Compounds & Other Volatile Substances in Air-Vapour by Charcoal Tubes and Miscellaneous Collection Media – PBM

**Performance Based Methods (PBM)** - Must meet prescribed method validation and method QC requirements. Allows for “equivalency” using alternative approaches and technologies. Allows for interpretation ..... and shortcuts .....



- Targeted VOCs
  - GC/MS – SIM Mode, Scan Mode, or both
- Volatile Hydrocarbons (nC6-nC13)
  - Two approaches:
    1. GC/MS Scan Mode;
    2. GC/FID
  - VH Response vs. toluene and dodecane
  - Example: high “perc” sample has low VH via GC/FID
- $VPH = VH - \Sigma(\text{BTEX} + \text{n-hexane} + \text{n-decane})$ 
  - Siloxane correction? Other groups?
  - These are not routine test parameters?

## 1. Regulatory Comparison

- BCMOE Schedule 11

## 2. Risk Management (CCME, Health Canada, other)

### – VH/TPH Carbon Markers


- BCMOE: nC6, nC10, and nC13
- Risk Based: nC6, nC7, nC8 .... nC16
  - - “*After the fact*” request
  - - Extended Range >nC13 – TD Tube only
- Carbon number vs. elution
  - » - e.g. n-methyl pentane (6 carbons) elutes before nC6

- Definitions
  - VH – Aromatics ≠ Aliphatics
  - VH – Aromatics = “non-aromatics”
  
- Which aromatics? And How?
  - 1) Direct - Quantitative Analysis
    - Specify aromatic compounds, calibrate, and quantify via GC/MS SIM
  
    - List grows with carbon numbers
  
  - 2) Indirect - Semi-Quantitative Analysis
    - Isolate spectral masses, estimate aromatics based on literature and empirical response factors
  
  - 3) Hybrid - e.g. Atlantic PIRI , MAPH

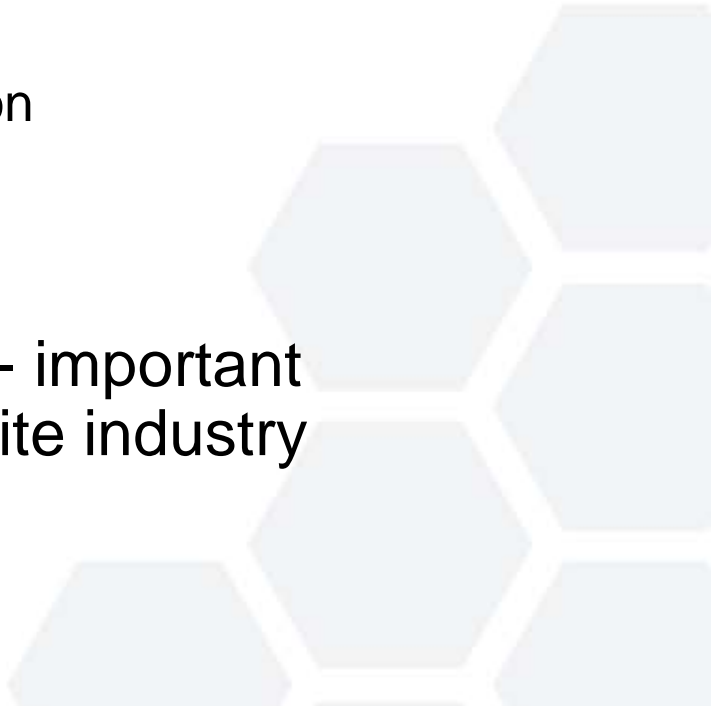
**BCELTAC – BCMOE Method Under Development**

## Aromatics:

<b>Fraction 1 (nC6-nC8)</b>	Characteristic Mass (m/z), +14amu:	78, 92
Benzene	Toluene	
<b>Fraction 2 (nC8-nC10)</b>	Characteristic Mass (m/z), +14amu:	106, 120, 134
Ethylbenzene (8)	Isopropylbenzene (9)	1,3,5-trimethylbenzene (9)
m-Xylene (8)	n-Propylbenzene (9)*	1-Methyl-2-Ethylbenzene (9)*
p-Xylene (8)	1-Methyl-3-Ethylbenzene (9)*	1,2,4-trimethylbenzene (9)
Styrene (8)	1-Methyl-4-Ethylbenzene (9)*	tert-Butylbenzene (10)*
o-Xylene (8)		
<b>Fraction 3 (nC10-nC12)</b>	Characteristic Mass (m/z), +14amu:	128, 134, 148, 162
Isobutylbenzene (10)*	n-Butylbenzene (10)*	1,2,4,5-Tetramethylbenzene (10)*
sec-Butylbenzene (10)*	1,3,-Dimethyl-5-Ethylbenzene (10)*	2-Methylbutylbenzene (11)*
1-Methyl-3-Isopropylbenzene (10)*	1,2-Diethylbenzene (10)*	tert-1-Butyl-2-Methylbenzene (11)*
1,2,3-Trimethylbenzene (10)*	1-Methyl-2-n-Propylbenzene (10)*	n-Pentylbenzene (11)*
1-Methyl-4-Isopropylbenzene (10)*	1,4-Dimethyl-2-Ethylbenzene (10)*	t-1-Butyl-3,5-Dimethylbenzene (11)*
1-Methyl-2-Isopropylbenzene (10)*	1,2-Dimethyl-4-Ethylbenzene (10)*	t-1-Butyl-4-Ethylbenzene (11)*
1-Methyl-3-n-Propylbenzene (10)*	1,3-Dimethyl-2-Ethylbenzene (10)*	Naphthalene (12)
1-Methyl-4-n-Propylbenzene (10)*	1,2-Dimethyl-3-Ethylbenzene (10)*	
<b>Fraction 4 (nC12-nC16)</b>	Characteristic Mass (m/z), +14amu:	142, 156, 162, 176, 190
1,3,5-Triethylbenzene (12)*	n-Hexylbenzene (12)*	2-Methylnaphthalene (12)*
1,2,4-Triethylbenzene (12)*	1-Methylnaphthalene (12)*	

1. Extreme Concentrations, e.g.  $>1 \times 10^6 \mu\text{g}/\text{m}^3$
  2. Duplicate Precision
  3. Safe Sampling Volumes (SSVs)
  4. Cross contamination
  5. PCOCs
- 

## My Observations:

1. Labs are vital to the regulatory process
  2. Commoditization trend
  3. Soil vapour is unique:
    - New
    - Sophisticated
    - High-level lab/consultant interaction
- Shift back to “science”
  - Professional Chemists (PChems) - important contributors to the contaminated site industry
- 

# Questions?

CARO Analytical Services  
Richmond, Kelowna, Edmonton  
Brent Mussato, B.Sc., PChem.,  
([bmussato@caro.ca](mailto:bmussato@caro.ca))  
[www.caro.ca](http://www.caro.ca)

