Vapor Intrusion Sampling and Analysis

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DQOs - Analytes of Concern

- Bryant Grinder Facility, Springfield
- Machine Manufacturing from 1909 to 2002

DQOs - Sampling Design: Planning for Variability with High Resolution Site Characterization

Soil gas probe

Machine Base
Soil Gas Variability

High Density, 80 points
Low Density, 16 points

DQOs – Select Detection Limits suitable for your Action Limits

<table>
<thead>
<tr>
<th>Analyte</th>
<th>Target IA</th>
<th>Shallow Soil Gas</th>
<th>GC EPA 8021</th>
<th>GC/MS EPA 8260 – Tedlar/SPME</th>
<th>GC/MS EPA 8260 Tedlar/TD</th>
<th>HapSite GC/MS</th>
<th>GC/MS TO-15</th>
<th>GC/MS TO-15 Low Level</th>
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<tbody>
<tr>
<td>Vinyl Chloride</td>
<td>0.11</td>
<td>1.1</td>
<td>1-20</td>
<td>80</td>
<td>5-10</td>
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<td>0.51</td>
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<td>TCE</td>
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<td>5.0</td>
<td>1-20</td>
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<td>Benzene</td>
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<td>1180</td>
<td>1-20</td>
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<td>Naphthalene</td>
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<td>3.0</td>
<td>??</td>
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<td>2.6</td>
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DQOs – Precision and Accuracy

- **Field Quality Control Samples**
  - Field Duplicates (precision)
  - Matrix Spikes / Matrix Spike Duplicate (Precision and Accuracy)
  - Trip Blanks / Equipment Blanks (detect unwanted contamination)

- **Laboratory Quality Control Samples**
  - Laboratory Duplicates
  - Secondary Source Standards
  - Laboratory Blanks

*These DQOs are meant to establish the defensibility of your data. Without these, your data may be held in question.*

Sample Collection

- AMS Soil Gas Probe
- AMS Retract-a-tip
- Geoprobe Post-Run Tubing (PRT)
- Geoprobe PRT Implant
Sample Collection – Sub Slab

Standard Soil Gas Sample Port

Cox-Colvin Vapor Pin

Leak Testing

Cox-Colvin Vapor Pin with Water Dam

Restek shroud and leak detector

Shut-in Test Set-up
Up-Hole Collection

Field Sampling – Summary

- Keep in mind DQOs for study design
  - Biased/unbiased sampling
  - Sampling and analytical methods based on action levels
  - Sampling method also needs to contemplate site conditions
- High Resolution Site Characterization to Manage Variability
- Leak testing of the full sampling train is imperative
Onsite VI Analytical Techniques

Why do onsite analytics?

- Support Dynamic Work Strategies
  - Sampling guidance – locations added/subtracted
- Recognize/resolve issues early
- Reduce project costs due to day rate structure
- Data Can Be Used for Risk Evaluations

Onsite soil gas techniques can be defensible

- Not necessarily limited to screening level data
- Capable of complying with EPA 8000 QA/QC protocol
- If DQOs are met consistently throughout the project, data are defensible for the purposes of the study.
Tedlar/GC vs TO-15

Comparison of On-Site Analysis of TCE by 8021 out of a Tedlar Bag vs. Off-site Analysis by TO-15 Out of a 6 Liter Summa Canister Collected by EPA-ORD at a Test Site (DiGiulio et al. 2006b)

VI Analytical Techniques

Defensible Techniques – Field Guidance and Risk

- GC (PID/EICD/ECD), EPA Method 8021
- GC/MS EPA 8260
- HAPSITE GC/MS
- TO-15 GC/MS (24-hr TATs)

Last three have sufficient sensitivity to meet most DQO’s for VI assessments.
VI Analytical Techniques

GC (PID/ELCD/ECD), EPA Method 8021

Pros
- Very portable
- Least expensive – about $75/sample at 20/day
- Limited range of target compounds
- Can be sensitive – TCE at 1 ug/m3 with GC/ECD

Cons
- Generally less sensitive than GC/MS technique
- Prone to interferences
- Requires significant experience to operate

Suitcase Models

Bench Top Models

VI Analytical Techniques

GC/MS, EPA Method 8260
Tedlar/SPME or Tedlar/Thermal Desorption

Pros
- Very sensitive, can reach most soil gas screening levels
- Not as prone to interferences

Cons
- Less portable
- Requires 24/7 power
- More expensive – about $125/sample at 20 per day
- Requires significant experience

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VI Analytical Techniques

Hapsite GC/MS

- **Pros**
  - Very portable
  - Very sensitive, can reach most soil gas screening levels
  - Not as prone to interferences
  - Training is easier than GC/MS, 8260 method – but still challenging

- **Cons**
  - Has reliability issues
  - Not very available
  - More expensive – about $125/sample

VI Analytical Techniques

TO-15 GC/MS – SIM and Scan Modes

- **Pros**
  - Considered the gold standard
  - Most sensitive
  - Not as prone to interferences

- **Cons**
  - Sampling instrumentation (Summas) are prone to errors and contamination
  - Most expensive – approx. $480/sample for 24-hr TAT
VI Analytical Techniques

Summary of Analytical Program and Techniques

- Make sure DQO’s are solidified
- Appropriate selection of instrument/methodology
- Run more QC than usual
- Adequate experience needed