

*Cal-EPA Soil Gas Advisory Forum
Los Angeles, California
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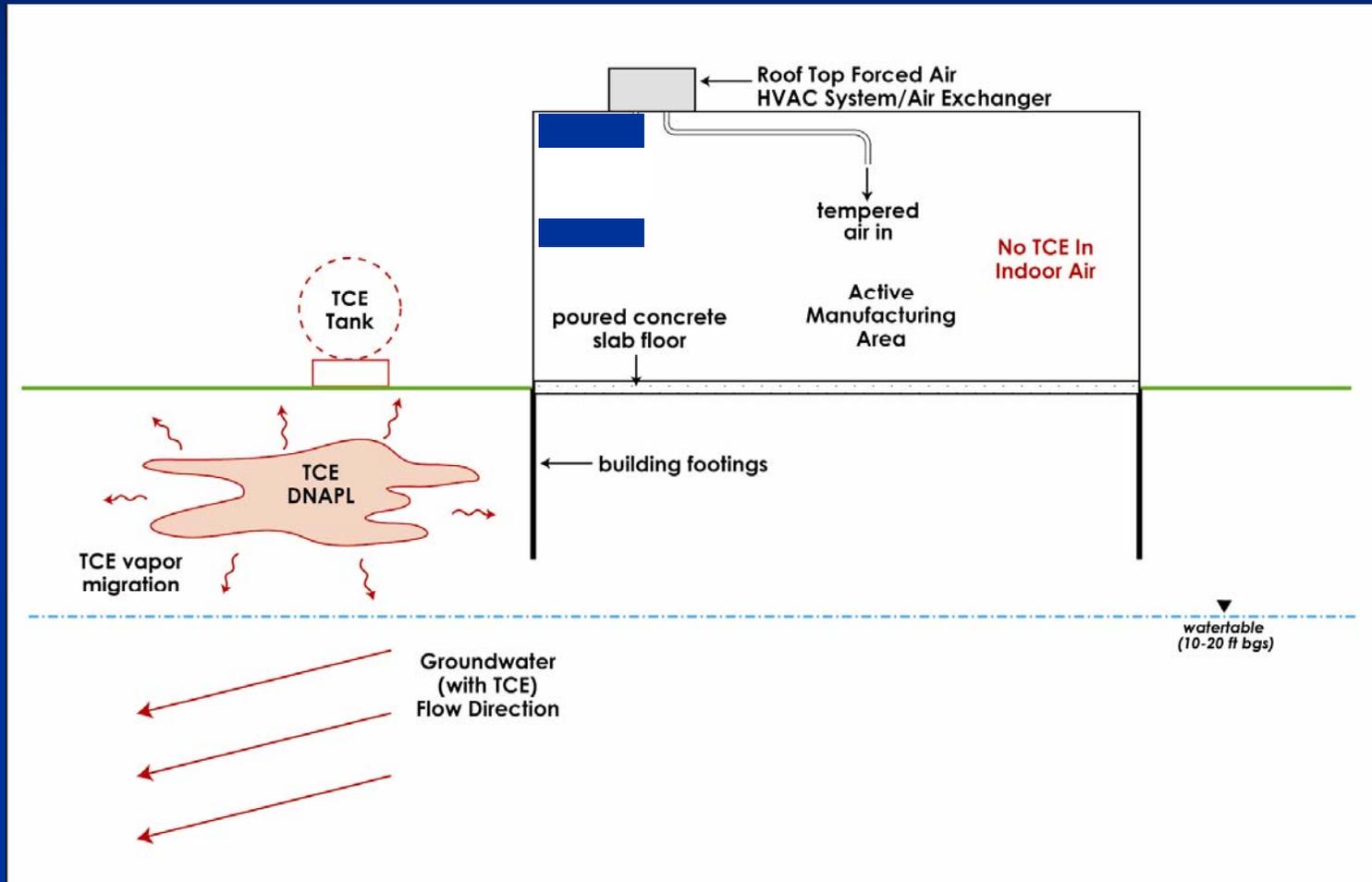
**Comments on the
DTSC / LARWQCB
Soil Gas Sampling Advisory**

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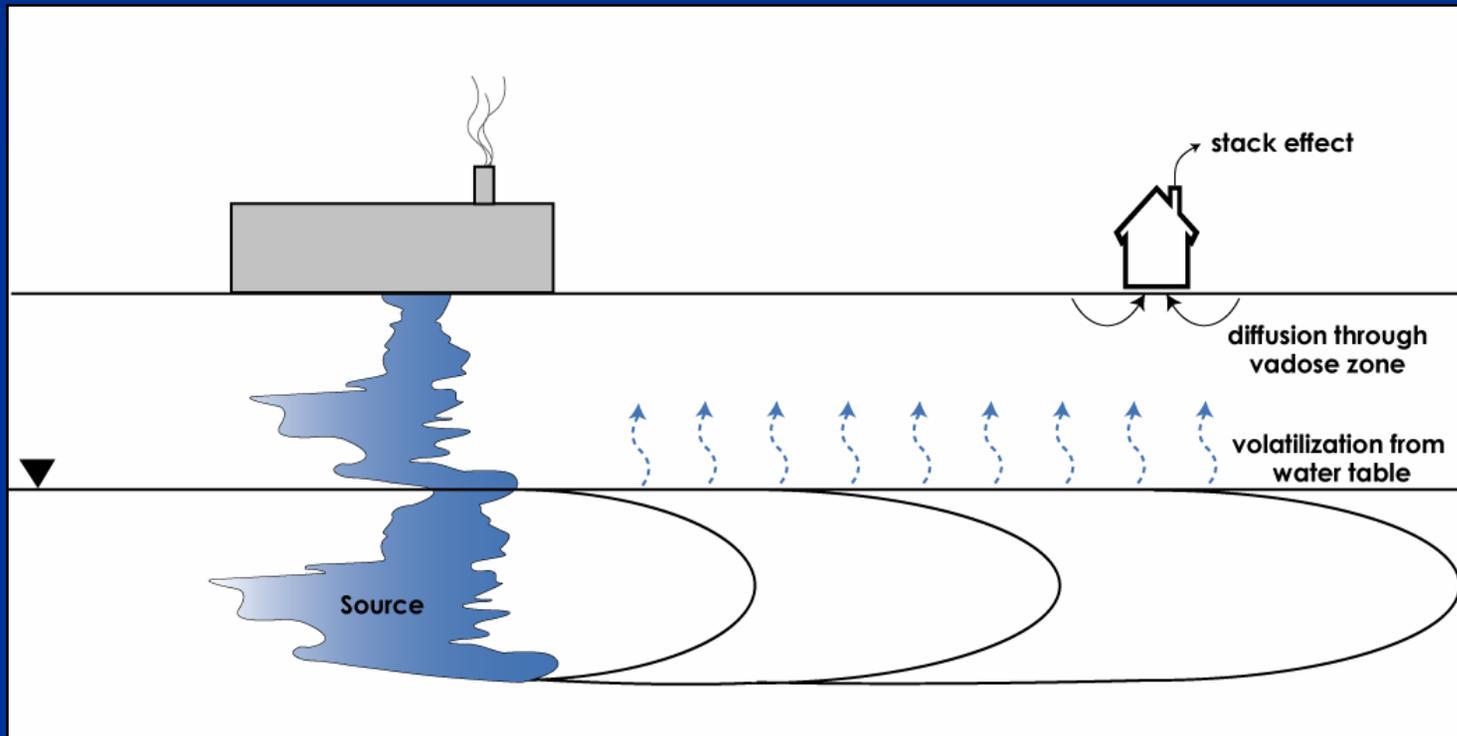
Site Conceptual Model

- All sites are not the same
 - Shallow vadose zone source
 - Groundwater source
 - Geologic barriers
 - Freshwater lens
 - Biodegradable compounds
- A single sampling strategy is not appropriate for all sites

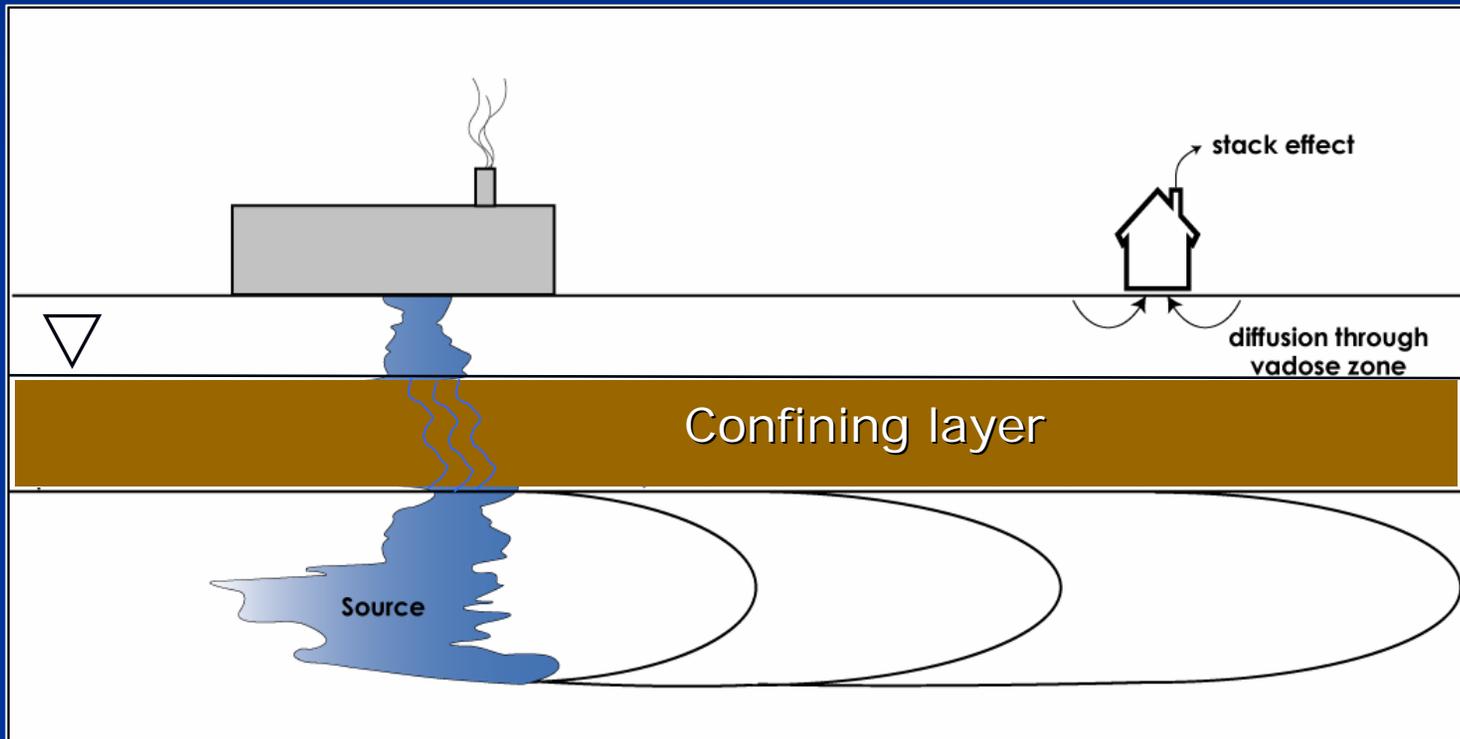
Vadose Zone Source



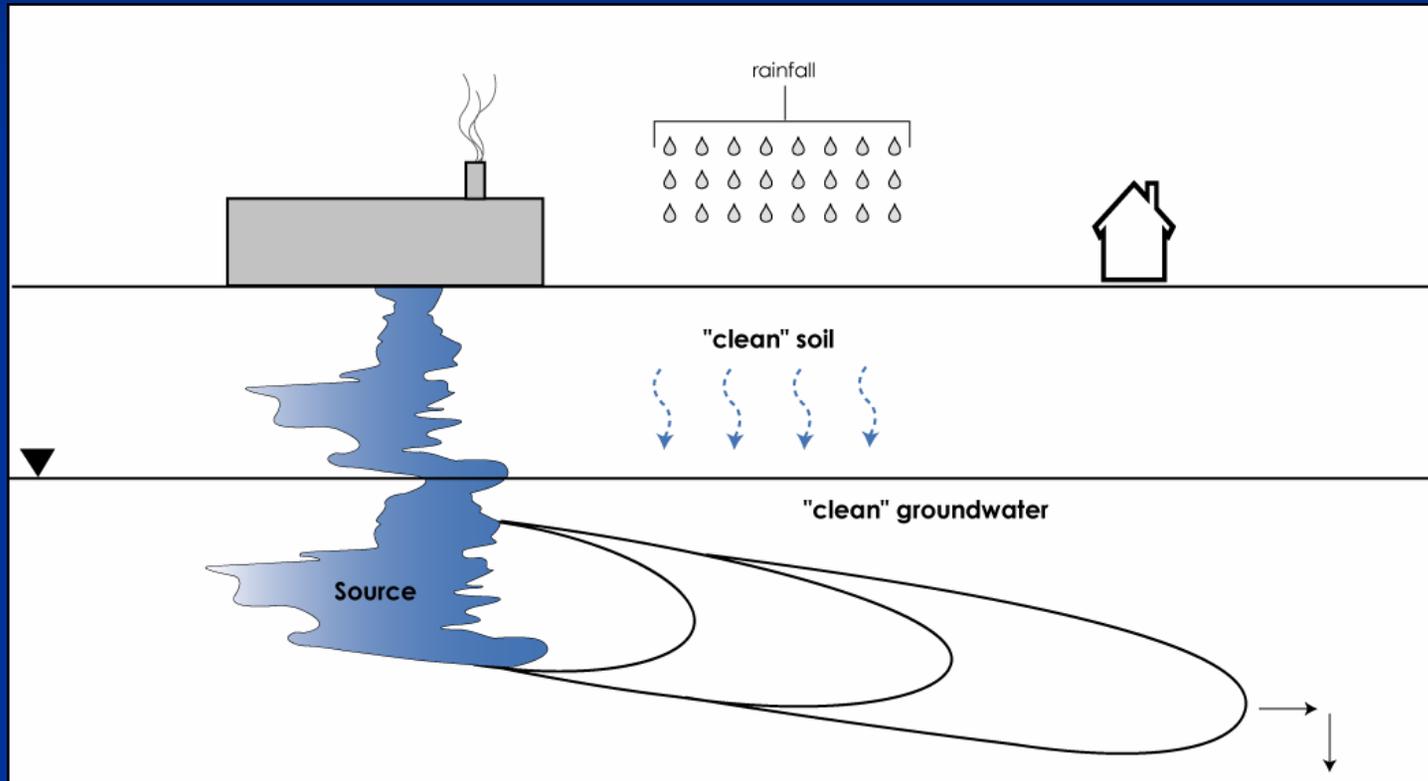
Volatilization From Groundwater



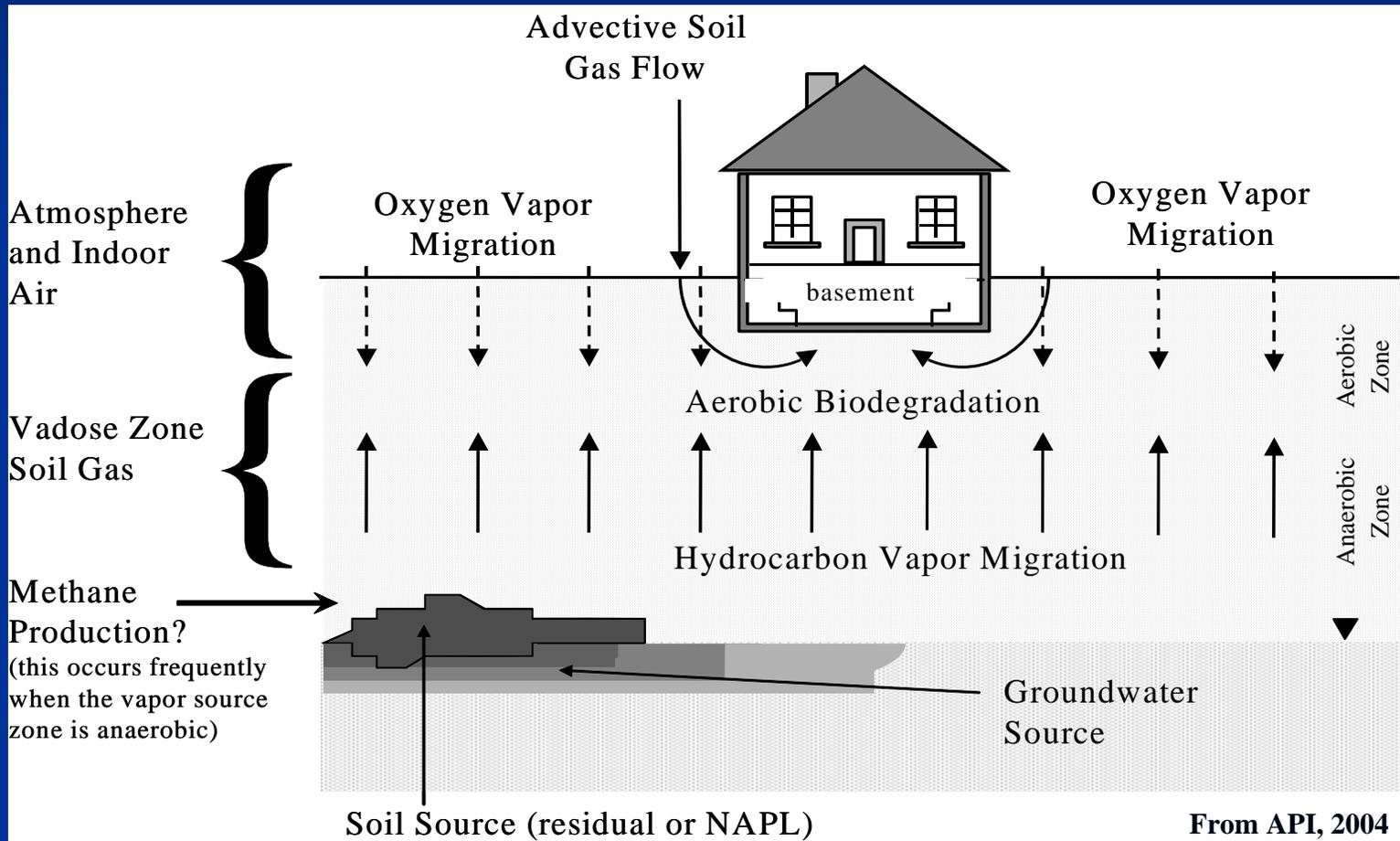
Geologic Barriers



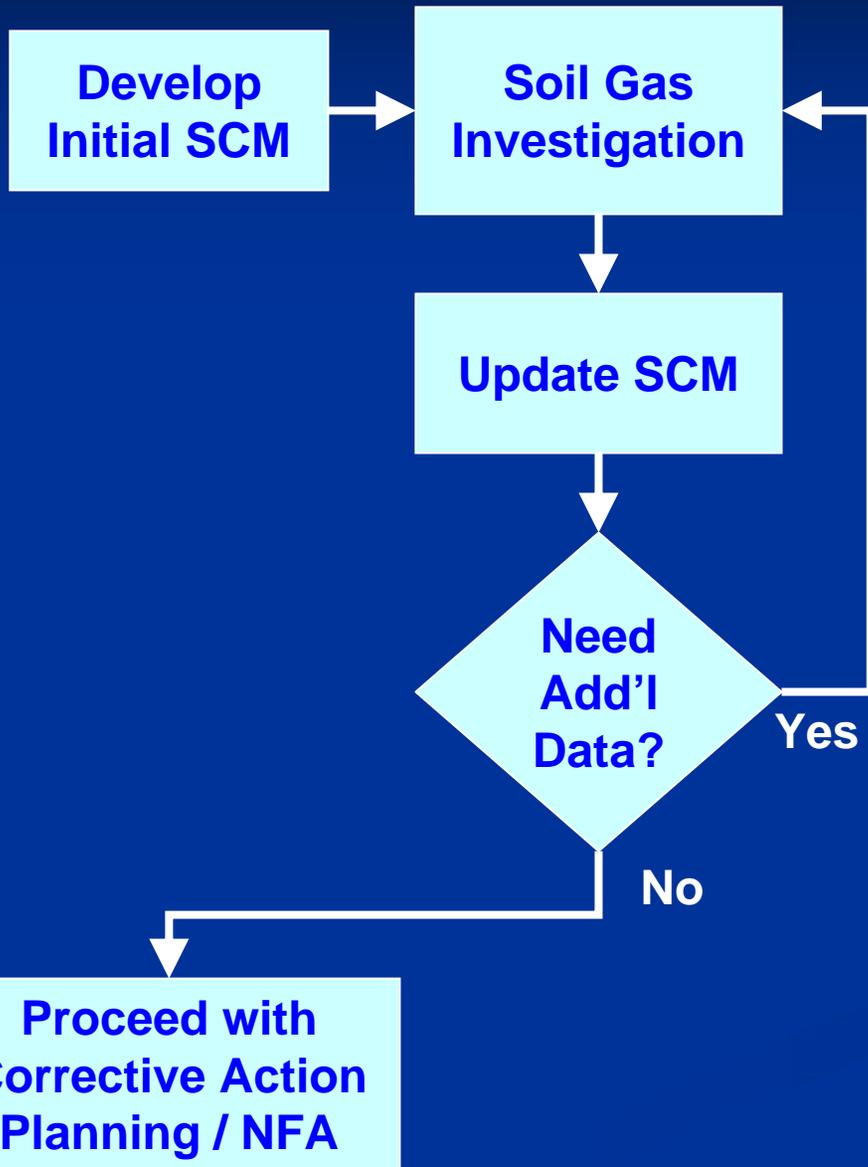
Fresh-Water Lens



Biodegradable Compounds



Importance of a Site Conceptual Model



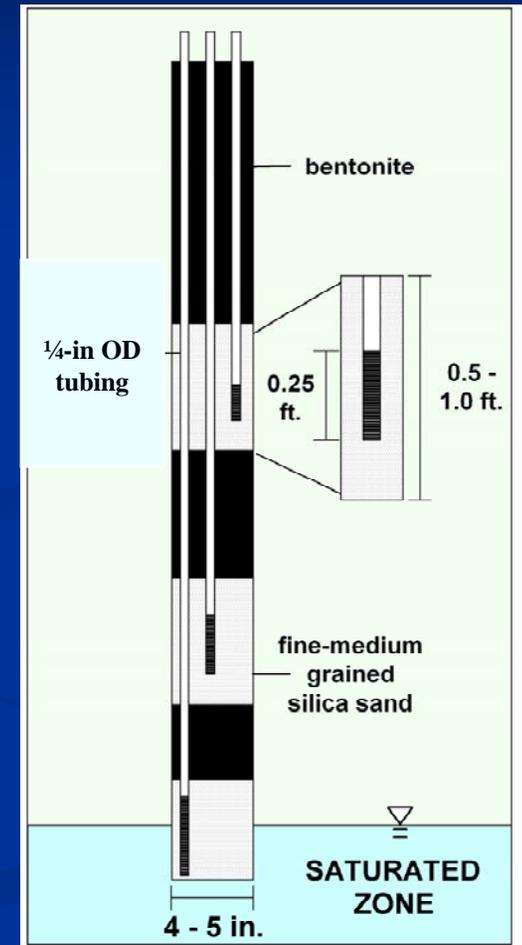
- Site-specific conditions should be used to plan soil gas investigation
 - No. of sample locations
 - Sample depths
 - Chemicals of concern
- Soil gas investigation data can help with
 - Quality assurance
 - Corrective action planning

Sample Depths

- Shallow samples
 - Should not be shallower than foundation depth
 - Characterize near surface soil gas conditions
 - Demonstrate attenuation from source depth to surface
- Deep samples
 - Characterize deep source
- Soil gas profile data (2 or more depths)
 - Valuable for assessing more complex geologies or sites with degradable compounds
 - Not necessary at all sample locations

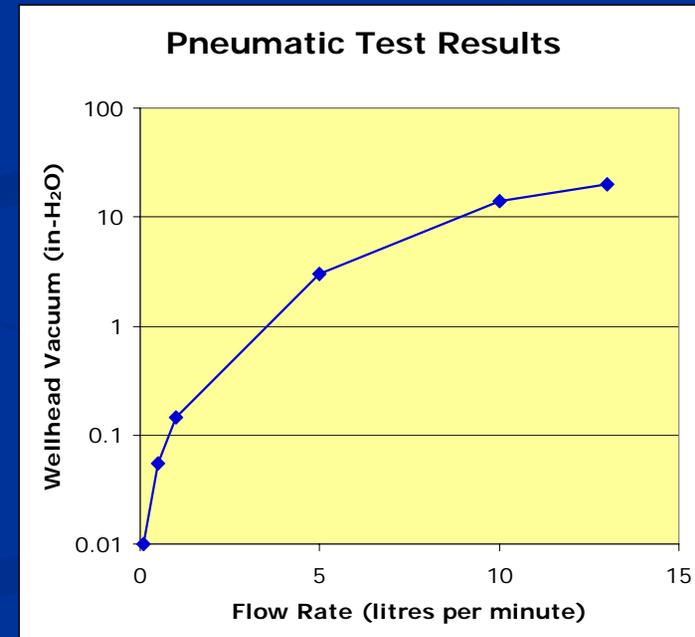
Soil Gas Probe Design

- Typically follow “permanent/semi-permanent” soil gas probe methods in current Soil Gas Sampling Advisory
 - Sand pack
 - Bentonite seals (slurry or lifts of granular)
 - Surface completion (compression fittings, valves to seal probes)
- Probe designs allows for greater flexibility for low permeability soils



Pneumatic Testing

- Simple field test to estimate soil permeability
 - Extract soil gas at varying rates and measure vacuum response in well
 - Similar to single well step-drawdown test for groundwater well
- Review pneumatic test results
 - Are results consistent with the SCM?
 - Is there indication of plugged probe?
 - Revise SCM and/or investigation plan, as appropriate
 - Identify purge rate for sampling



Field Screening During Purging

- Field screening measurements may be used for additional QA/QC during purging
 - Similar to field screening during groundwater sampling
- Potential screening measurements:
 - Vacuum
 - Flow rate
 - Total VOCs
 - Fixed gases (O_2 , CO_2 , CH_4)
 - Tracer gases



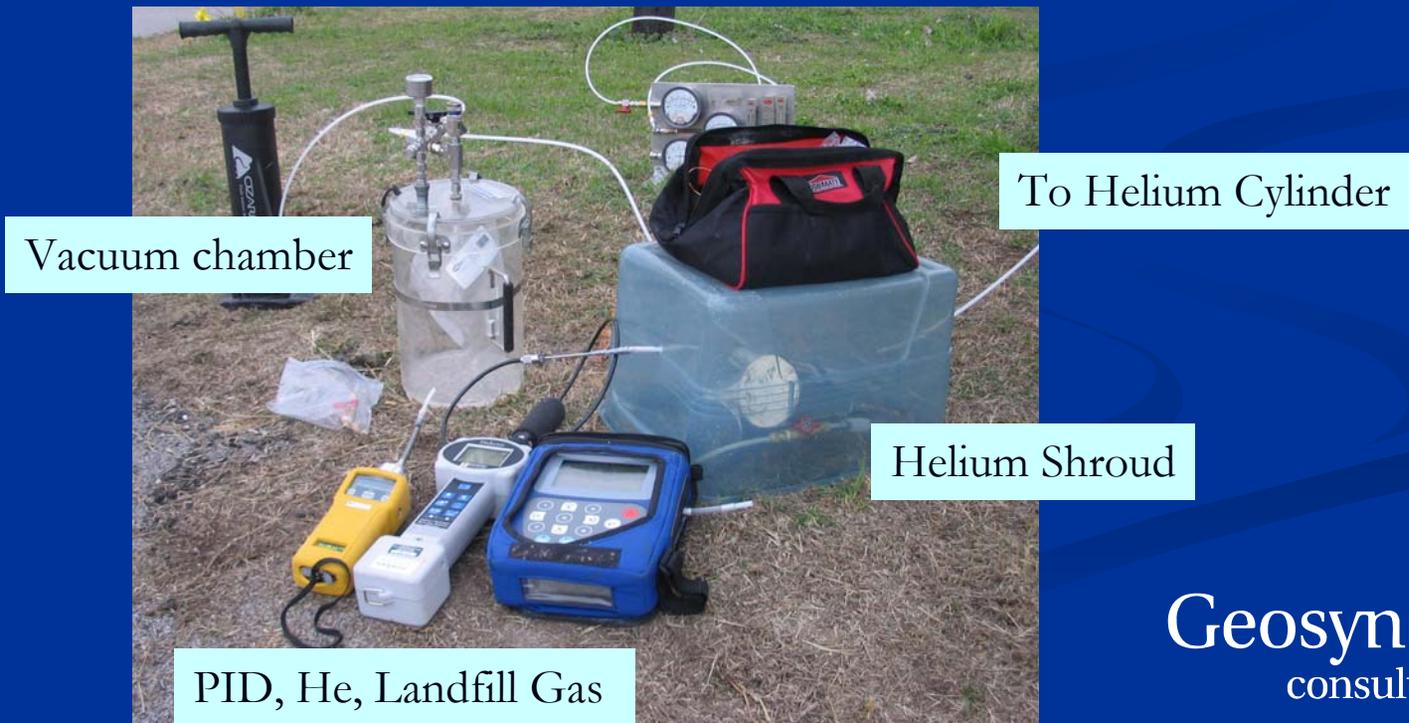
Leak Test Methods

- Shut-in test
 - Create vacuum on above grade equipment and check for dissipation of vacuum
- Tracer test
 - Common tracers – isobutane, propyl alcohol, difluoroethane
 - Helium tracer tests
 - Fixed gases (O_2 , CO_2)
- Tracer leak tests may not be necessary for repeatedly sampled probes
 - Field screening results may be used to assess if flow conditions have changed

Helium Tracer Leak Test

■ Advantages

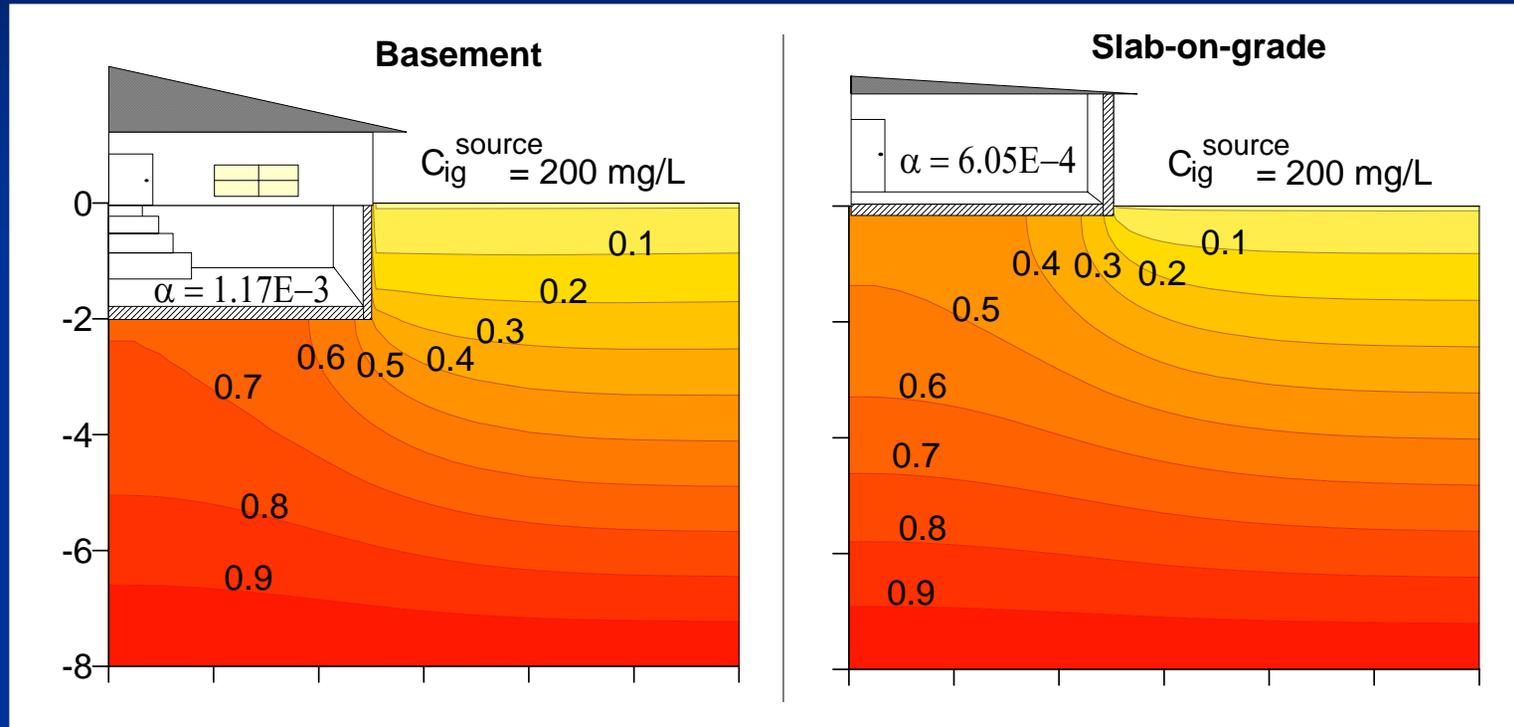
- ❑ Readily available
- ❑ Monitor with field screening instruments
- ❑ Leak quantified based on % of source concentration
- ❑ Can calculate mass-balance correction for minor leaks



Summary

- Site Conceptual Model should be used to guide investigation and corrective action strategy
 - Soil gas investigation strategy will vary from site to site
- Probes constructed following permanent/semi-permanent protocols can typically provide good soil gas samples
- Field screening helps verify sample integrity and provides data to assess permeability, biodegradation
- Consider shut-in and helium tracer tests for leak testing during soil gas sampling

Soil Gas Sample Depth Considerations - Effect of Foundation



- In many cases, foundations are not expected to significantly impact soil gas concentrations
 - Shallow, near slab soil gas data are often appropriate for site characterization

Purge Rate and Volume

	Purge Rate (L/min)	Cumulative Volume Purged (L)	TO-3 GRH (C ₅ to C ₁₀) (mg/L)	PID (ppmv)	Approximate Radius of influence (m)
HPV-2	<0.15	1	110	420	0.1
	1	11	120	440	0.3
	10	90	100	414	1.0
	10	394	110	413	2.0

There's usually no need to limit the flow rate

Better to constrain the applied vacuum so as not to affect partitioning

Measure both flow and vacuum – it is fast and easy

(McAlary and Creamer , 2006)

Matrix for Guidance on Selection of Methods with Compatible DQO Results

(GeoProbe Systems, Technical Bulletin No. MK3098, May 2006)

Downhole Sampling System		Sample Collection Method			
		Syringe	Tedlar Bag	Glass Bulbs	Summa Canister
	Increase Quality				
Direct Sampling		Low/Low			Low/High
PRT System					
Implants					
Gas Wells		High/Lo w			High/High