CHALLENGES IN ASSESSING VAPOR INTRUSION

Clean, Green, and Healthy Schools Partnership

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DTSC Guidance Documents

Site Characterization
Advisory – Active Soil Gas Investigations (2003, 2012)

Evaluation of Vapor Intrusion Risk
Guidance for the Evaluation and Mitigation of Subsurface Vapor Intrusion to Indoor Air (2005, 2011)

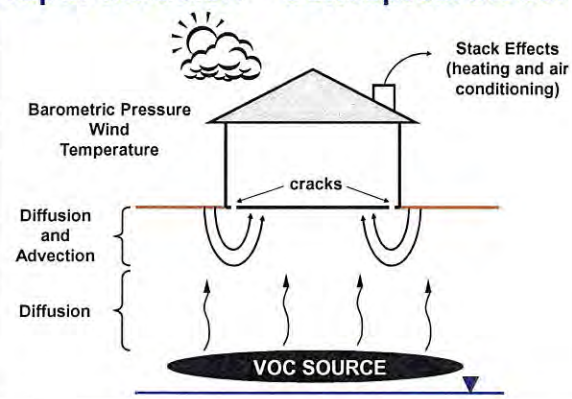
Mitigate Indoor Air Exposure
Vapor Intrusion Mitigation Advisory (2009, 2011)

Remediation of Vapor Source
Remediation of Chlorinated VOCs in Vadose Zone Soil (2010)

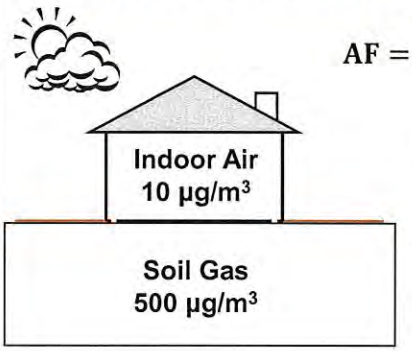
Public Participation
Public Participation Strategy for Vapor Intrusion Sites (2012)

https://dtsc.ca.gov/SiteCleanup/Vapor_Intrusion.cfm

Vapor Intrusion – Conceptual Model



Attenuation Factor Concept



$$AF = \frac{\text{Indoor Air}}{\text{Soil Gas}}$$

$$AF = \frac{10}{500}$$

$$AF = 0.02$$

DTSC Tiered Approach

1. Exposure Pathway Complete?
   - Building and volatile chemicals present?
2. Preliminary Screening
   - CA Human Health Screening Levels (CHHSLs)
   - USEPA Regional Screening Levels (RSLs)
3. Site-Specific Screening
   - Subslab sampling
   - In-situ measurements
   - Fate and transport modeling (J&E Spreadsheet)
4. Indoor Air Testing

Attenuation Factors

			Attenuation Factor		
Building Scenario	Building Type	Sample Location	DTSC 2011	USEPA 2012	USEPA 2013
Existing	Residential	Contaminant Source	0.002	0.1	0.03
		Crawl Space	1.0	1.0	1.0
		Subslab	0.05	0.1	0.03
	Commercial	Contaminant Source	0.001	0.1	0.03
		Subslab	0.05	0.1	0.03
Future	Residential	Contaminant Source	0.001	0.1	0.03
	Commercial	Contaminant Source	0.0005	0.1	0.03

Department of Toxic Substances Control. 2011. Guidance for the Evaluation and Mitigation of Subsurface Vapor Intrusion to Indoor Air (Vapor Intrusion Guidance). Final. October 2011.

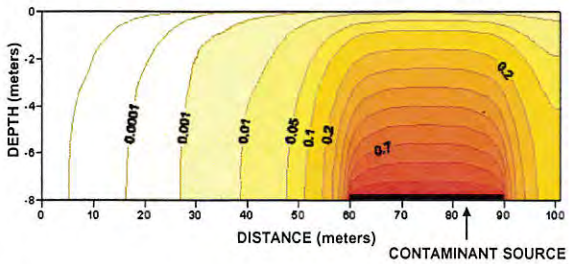
United States Environmental Protection Agency. 2012. Superfund Vapor Intrusion FAQs. Office of Superfund Remediation and Technology Innovation. February 2012.

United States Environmental Protection Agency. 2013. DRAFT OSWER Final Guidance for Assessing and Mitigating the Vapor Intrusion Pathway from Subsurface Sources to Indoor Air. Office of Solid Waste and Emergency Response. April 2013.

Soil Gas Modeling

Theoretical Distribution of Soil Gas Above a Subsurface Contaminant Source

Modified from Johnson and Abreu (AEHS Conference 2005)

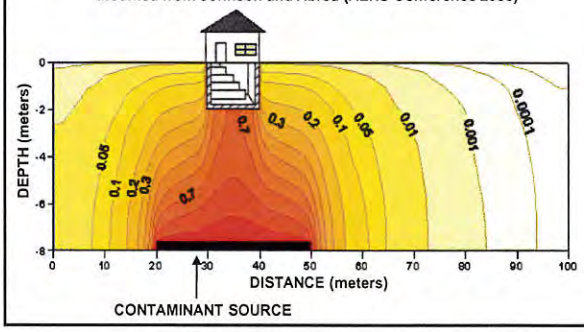


USEPA. 2012. Conceptual Model Scenarios for the Vapor Intrusion Pathway. Document No. EPA 530/R-10-003

Soil Gas Modeling

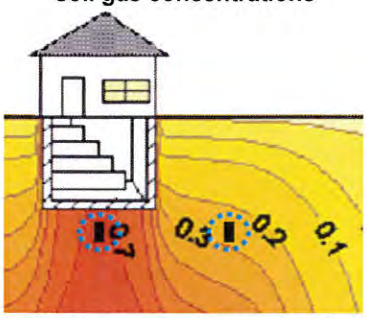
Theoretical Distribution of Soil Gas Above a Subsurface Contaminant Source With a Building

Modified from Johnson and Abreu (AEHS Conference 2005)



Soil Gas Sampling Depths

Differences in "open-field" and "under-building" soil gas concentrations



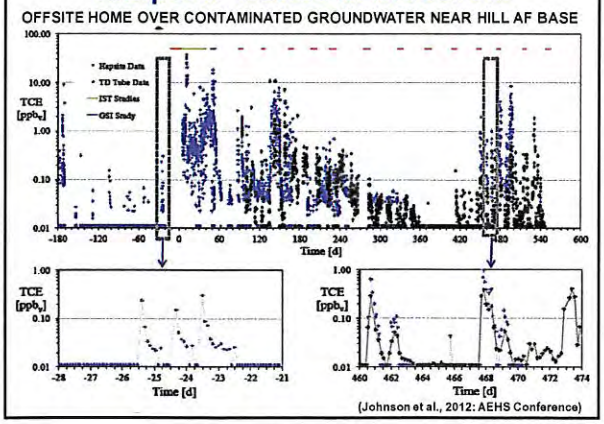
Higher concentrations are observed under buildings

Indoor Air Testing

Six Liter Summa Canister

Temporal Trends in Indoor Air

OFFSITE HOME OVER CONTAMINATED GROUNDWATER NEAR HILL AF BASE



(Johnson et al., 2012: AEHS Conference)

New Sampling Approaches

Automatic Thermal Desorption (ATD) Tube

Waterloo Membrane Sampler

SKC Ultra II

Radiello Sampler

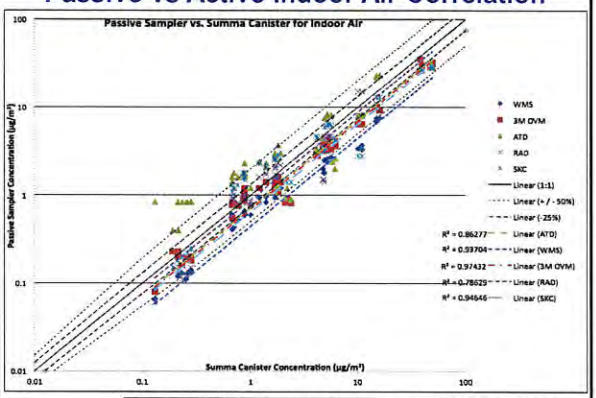
3M OVM 3500

Sorbent Concentration Calculation

$$C = \left(\frac{M}{Q\,t}\right)$$

C = concentration in air
M = mass of analyte on sorbent
t = exposure time
Q = experimentally measured sampling rate

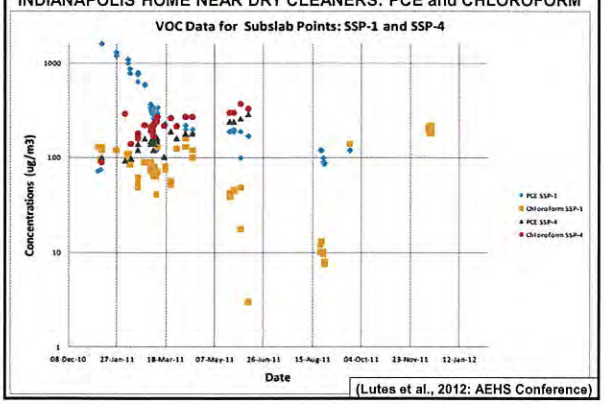
Passive vs Active Indoor Air Correlation



(Environmental Security Technology Certification Program 2011: Report ER-0830)

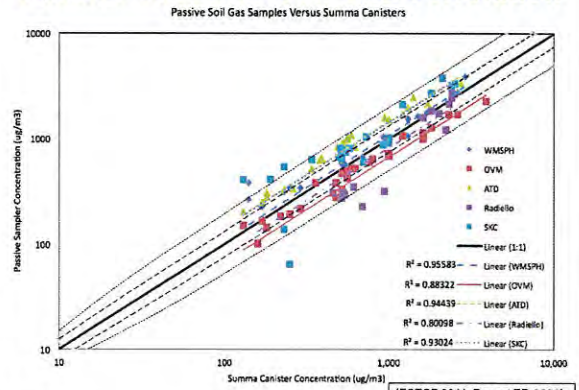
Subslab Soil Gas Trends

INDIANAPOLIS HOME NEAR DRY CLEANERS: PCE and CHLOROFORM



(Lutes et al., 2012: AEHS Conference)

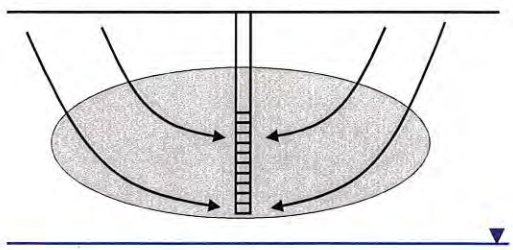
Passive vs Active Soil Gas Correlation



(ESTCP 2011: Report ER-0830)

Post-Remediation Soil Gas Sampling

Soil Vapor Extraction Operation



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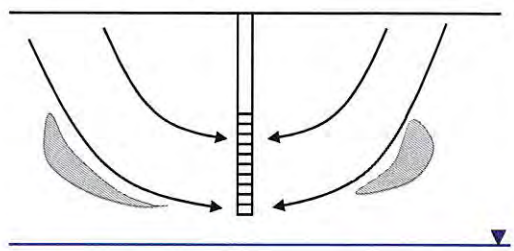
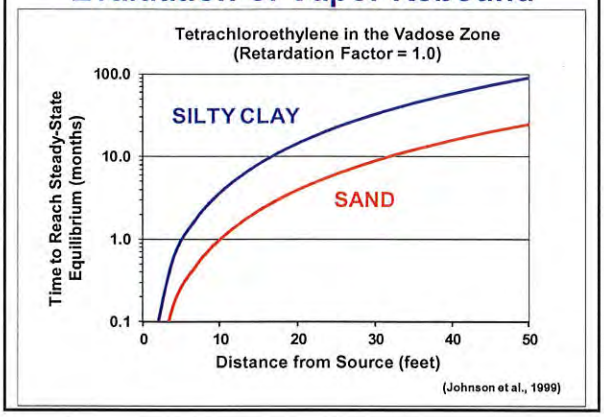
Evaluation of Vapor Rebound