Multiple Commercial Buildings: Continuous Monitoring Data Patterns for Resolving Key VI Questions







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Key Questions

- Is there an indoor VOC concentration exceedance?
- If an exceedance exists, is this due to indoor sources or vapor intrusion?
- If present, what/where is the indoor source?
- If VI is occurring, where are the vapor entry points?
- If VI is occurring, when is it occurring and for how long?
- What can be done to immediately reduce risk?

Dynamic Data Pattern = Answers!

Vapor Safe Continuous Monitoring System



Wireless Press Diff



Field Images







Data Pattern = Opportunity Freon 11 – Agency Office Bldg – 1 Day

DCP Port-01 (Port1) Freon-11 (ug/m3)



Freon 11 – Agency Office Bldg – 2 Days



Freon in Soil Vapor Transported Indoors via HVAC

Drycleaner Site 1

- Bank in strip mall; former drycleaner
- ~6K sq ft., 4 partitioned businesses
- Shallow depth to source
- Slab-on-grade
- Interbedded sands, silty sands, and silty gravel
- 3C climate zone; Southern CA
- Wind/pressure varied
- Advective flux

Drycleaner Site 1

Type & Depth to VOC source	Building type & size (ft2)	Foundation	Sub- foundation horizontal permeable	Preferential pipe pathway	Bldg- Climate zone (Temp)	Press./ Wind speed & direction	Intrusion primarily Advect. vs Diffusive
Shallow Soil	Modern sub-urban SFR Mod. 2k	Slab-on- Grade	Continuous horizontal/ permeable	High	1- 3	Low	Advective
Deep Soil	Legacy Urban Multi- Family	Split level – SoG & basmt	Discontinuous - impermeable	Mod.	4	Mod.	Diffusive
Shallow GW	Non-Res. <10k ft ²	Full basement		Low	5	High steady direct	50-50
Deep GW	Non-Res. >100k ft ²	Crawlspace -dirt floor		None	6-8	High varying direction	

Former Drycleaner 1

IA-2-[7043226261-2-[PCE (ug/m3) vs. San Diego-[NOAA-KSAN-[Barometric Pressure (mBar) vs. SSV-4-[62658527885-9-[Diff Pressure (Pa)

2018-03-10 09:52:20 AM to 2018-03-17 09:52:20 AM



VAPOR INTRUSION ASSESSMENT, MONITORING & RESPONSE SERVICES

Large Industrial Building

- Federal agency building
- Shallow depth to source
- 172K sq ft
- Slab-on-grade
- Sandy/estuarine sub-foundation, fill
- 3C climate zone, Coastal Southern CA
- Wind/pressure varied
- Advective flux

Large Industrial Building

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Natural Fluctuations





Daily BP Change - Slight Pressure Diff - VI

Hosangadi *et al.*, 2017, *High Frequency Continuous Monitoring To Track Vapor Intrusion Resulting From Naturally Occurring Pressure Dynamics*, Journal of Remediation, Spring, v.27, no.2, p.9-25.



Natural Fluctuations



Exhibit 4. Indoor TCE concentration versus pressure differential



Exhibit 5. Indoor TCE concentration versus pressure differential values greater than zero

Hosangadi et al., 2017, High Frequency Continuous Monitoring To Track Vapor Intrusion Resulting From Naturally Occurring Pressure Dynamics, Journal of Remediation, Spring, v.27, no.2, p.9-25.



Natural Fluctuations



Exhibit 6. Barometric pressure versus pressure differential

Hosangadi *et al.*, 2017, *High Frequency Continuous Monitoring To Track Vapor Intrusion Resulting From Naturally Occurring Pressure Dynamics*, Journal of Remediation, Spring, v.27, no.2, p.9-25.



Furniture Facility Rapid Resolution

- Building for Sale
- Owner "Low-Balled" by \$2M Assumed VI (SS TCE/PCE and Canisters)
- Indoor TCE Only During Work Hours; Pattern Ubiquitous



Furniture Facility Rapid Resolution



TCE Not Listed!!!

Furniture Facility Silicone Spray Chromatogram



Chromatogram Proves TCE in Material!

Lessons

- Concluded No VI (via MLE)
- Traditional Methods = Mystery, Costs, Exposures
- Continuous Monitoring = Accurate Sourcing
- Uncertainties Quickly Resolved, Remedy Obvious
- Protected Occupants
- Saved Owner \$2M w/3 Field Days!



Selected Observations

- Spatial/Temporal Data:
 - Answer Key VI Questions
 - ID Controlling Factors
 - Locate Indoor Sources and VI Pathways
 - HVAC VOC Redistribution
- Controlling Factors:
 - BP <u>*Trend*</u>, Wind, Temp, Ventilation, etc.
 - Reflected in Diff Pressure, But Not Always!
 - Need to Confirm Correlations