Vapor Intrusion Partner Panel

Facilitator: Roshani Dantas, Senior Environmental Scientist, Division of Water Quality, State Water Resources Control Board

Panelists

Renée Funston, Project Manager, Linc Housing

Steve Luis, Principal, Ramboll

Ignacio Dayrit, Program Lead, Center for Creative Land Recycling

Marisela Fuller, Director of Real Estate Development, Innovative Housing Opportunities, Inc.

Lenny Siegel, Executive Director, Center for Public Oversight

Dr. Kelly Pennell, University of Kentucky, Civil Engineering

Marisela Fuller and Renée Funston

- ***What are the challenges associated with developing affordable housing? How does vapor intrusion impact those challenges?***

INNOVATIVE HOUSING OPPORTUNITIES

Developing Housing on a Brownfield Site

A Case Study

Innovative Housing Opportunities,

a CA-based nonprofit affordable developer

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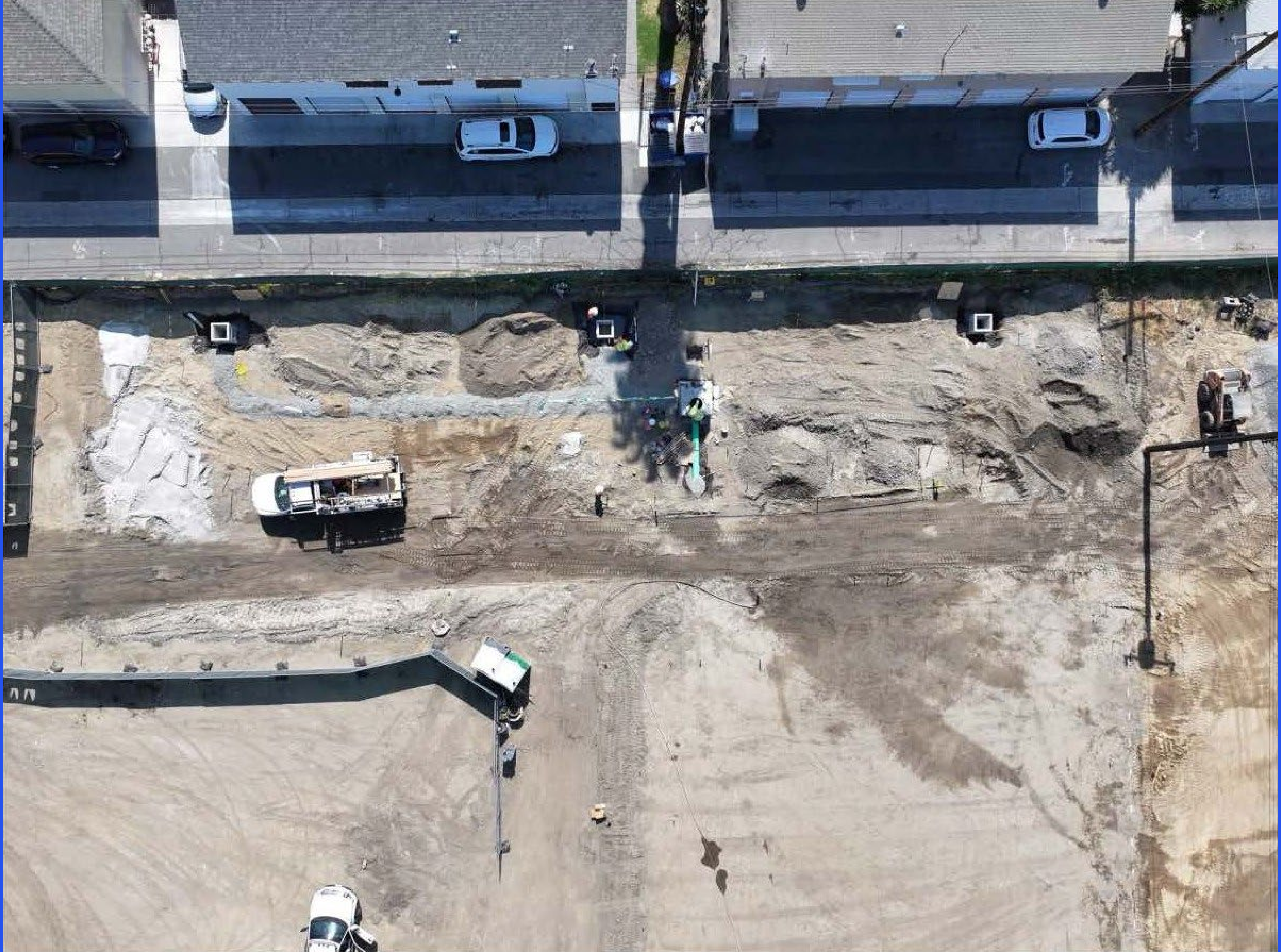
Los Angeles Times

The effort to revamp Beach Boulevard has faced numerous challenges through the years, including the self-described "environmental nightmare" of trying to build on a former landfill site at the intersection.

Anaheim officials gave a progress update on efforts to redevelop the city's 1.5-mile stretch of Beach Boulevard. (Allen J. Schaben/Los Angeles Times)



June 2025

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INNOVATIVE HOUSING OPPORTUNITIES

key State agency deadlines

TCAC = CA Tax Credit Allocation Committee

INNOVATIVE HOUSING OPPORTUNITIES

challenges created by brownfield cleanup

Open-ended Added Costs

+

Unclear Requirements and Timelines

+

Uncertainty

Estimated OMM Costs
Affordable Housing Project
208 S. Beach Blvd., Anaheim, CA

Year	Sample Frequency	Number of Buildings	SAMPLE QUANTITIES				TEST METHOD		SAMPLING COST				
			Sentinel Probes[A]	Below Membrane Probes[B]	Above Membrane Probes[C]	Vent Risers[D]	VOCs by 8260B (10% Duplicates)	VOCs by PID	Sampling Labor, Equipment, Expenses	Laboratory Analysis	Reporting	Subtotal[E]	Subtotal with 15% Contingency[E]
1	Semi-Annual	1	6	8	4	6	20	24	$4,200	$3,300	$14,000	$21,500	$24,725
2	Semi-Annual	1	6	8	--	6	16	20	$4,080	$2,640	$14,000	$20,720	$23,828
3	Annual	1	3	4	--	3	8	10	$1,920	$1,320	$8,750	$11,990	$13,789
4	Annual	1	3	4	--	3	8	10	$1,920	$1,320	$8,750	$11,990	$13,789
5	Annual	1	3	4	--	3	8	10	$1,920	$1,320	$8,750	$11,990	$13,789
6	--	--	--	--	--	--	--	--	--	--	--	--	--
7	--	--	--	--	--	--	--	--	--	--	--	--	--
8	--	--	--	--	--	--	--	--	--	--	--	--	--
9	--	--	--	--	--	--	--	--	--	--	--	--	--
10	Every 5-Years	1	3	4	--	3	8	10	$1,920	$1,320	17,500	$20,740	$23,851
11	--	--	--	--	--	--	--	--	--	--	--	--	--
12	--	--	--	--	--	--	--	--	--	--	--	--	--
13	--	--	--	--	--	--	--	--	--	--	--	--	--
14	--	--	--	--	--	--	--	--	--	--	--	--	--
15	Every 5-Years	1	3	4	--	3	8	10	$1,920	$1,320	17,500	$20,740	$23,851
16	--	--	--	--	--	--	--	--	--	--	--	--	--
17	--	--	--	--	--	--	--	--	--	--	--	--	--
18	--	--	--	--	--	--	--	--	--	--	--	--	--
19	--	--	--	--	--	--	--	--	--	--	--	--	--
20	Every 5-Years	1	3	4	--	3	8	10	$1,920	$1,320	17,500	$20,740	$23,851
21	--	--	--	--	--	--	--	--	--	--	--	--	--
22	--	--	--	--	--	--	--	--	--	--	--	--	--
23	--	--	--	--	--	--	--	--	--	--	--	--	--
24	--	--	--	--	--	--	--	--	--	--	--	--	--
25	Every 5-Years	1	3	4	--	3	8	10	$1,920	$1,320	17,500	$20,740	$23,851
26	--	--	--	--	--	--	--	--	--	--	--	--	--
27	--	--	--	--	--	--	--	--	--	--	--	--	--
28	--	--	--	--	--	--	--	--	--	--	--	--	--
29	--	--	--	--	--	--	--	--	--	--	--	--	--
30	Every 5-Years	1	3	4	--	3	8	10	$1,920	$1,320	17,500	$20,740	$23,851
											30 Year Total	**$181,890**	**$209,174**

NOTES:

[A] 3 sentinel probes sampled semi-annually years 1 & 2, annually years 3, 4, & 5, and every five years thereafter.

[B] 4 below membrane probes sampled semi-annually years 1 & 2, annually years 3, 4, & 5, and every five years thereafter.

[C] 4 above membrane probes sampled 1st monitoring event only.

[D] 3 vent risers sampled with PID only (no lab analysis) semi-annually years 1 & 2, annually years 3, 4, & 5, and every five years thereafter.

[E] Estimated costs are based on current estimates with no consideration for inflation or NPV.

collaboration achieved the goal

ANAHEIM

DTSC
Department of Toxic Substances Control

INNOVATIVE HOUSING OPPORTUNITIES
IHO

Pacific Edge Engineering, Inc.

GeoKinetics
A FULLTERRA COMPANY

COX CASTLE

INNOVATIVE HOUSING OPPORTUNITIES

opportunities for smarter solutions

- Mitigation templates and cost guidance
- Conditional approvals to advance financing during mitigation
- Cost-benefit analysis conducted by regulatory agencies

INNOVATIVE HOUSING OPPORTUNITIES

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Steve Luis

- ***What are the challenges encountered in the process of characterizing, remediating, and obtaining closure for vapor intrusion sites? How do steps in the process (submitting reports, obtaining comments on those reports, implementing interim remedies, etc.) impact the process?***

Lenny Siegel

- *How do we improve the capacity of local government to coordinate with regulators to evaluate vapor intrusion and environmental issues? How can we increase more permanent remedies so that remediation serves as mitigation? For existing buildings, how do we ensure that occupants are protected?*

Potential Advantages of Remediation Providing Mitigation

- More permanent solution (removes the source)
- Can be quicker (than mitigation only) & less expe
- Area-wide protection, not building by building
- Access to indoors is less of an issue
- Less liability for property owners and developers
- Shortens long-term management required
- Pulls contamination away from living/work spaces

Ignacio Dayrit

- ***How does access to data impact the ability to address/evaluate vapor intrusion for cities? What are the other larger non-vapor intrusion issues impacting development of low-income housing?***

Ignacio Dayrit, Center for Creative Land Recycling

ignacio.dayrit@cclr.org

What data should be used to assess impact of cities' ability to address/evaluate vapor intrusion in the development of housing?

What are the other larger non-vapor intrusion issues impacting development of (affordable) housing?

Infill Housing: A Climate & Equity Solution

"Housing is issue No. 1 for America's mayors." James Anderson, Bloomberg Philanthropies (2025).

[housing shortage is] like the cancer was limited to certain parts of our economic body. And now it's spreading". Sam Khater, Freddie Mac (2021)

- Reuses land with existing infrastructure & transit
- Reduces vehicle miles traveled (VMT) and pollution
- Limits sprawl and protects forests, farmland, and ecosystems
- Supports California's climate, housing, equity and public health goals

VI Regulation Standards Slowing Infill Housing?

- 2020: State adopted a 0.03 attenuation factor (AF) without clear health data
- Adds cost, uncertainty, and delays for housing on infill/brownfield sites
- Limits reuse of “orphan” sites with no responsible party
- Pushes development to undeveloped, higher-risk greenfields

Most infill residential development on VI sites before 2020 used prior AF with no documented health impacts.

Is help on the way?

- Land use and CEQA help - check
- Popular, productive CA grant program was unfunded
- Federal funding is drying up.
- Cities have other priorities and limited funds since RDAs were eliminated
- Sprawl is forced on all of us to the detriment of the environment.

> - ***Revenues Are Unlikely to Grow Fast Enough to Catch Up to Atypically High Spending Growth.***
> - ***No Capacity for New Commitments.***
>
> ***Excerpt from 2025-26 Budget Executive Summary, CA LAO, 2025***

Sprawl is Expensive, Risky, and Inequitable

- 45% of new homes built in wildfire/flood zones since 1990
- Increases air pollution, asthma rates, and traffic fatalities
- $140 billion/year in lost economic output due to housing shortage
- Public investment favors sprawl (roads, freeways) over urban neighborhoods

Sprawl is cheap to the developer –
not to just about everybody else.

Solutions for Smarter Cleanup and Housing Policy

- Break down silos - align cleanup policy with housing, land use, infrastructure, equity goals
- Involve agencies beyond CalEPA — HCD, OPR, SGC, Caltrans, COGs/MPOs etc.
- Fund infill cleanups using sprawl mitigation fees or redirected revenue?
- Support local use of regulatory tools to improve access for off-site assessment

"Infill redevelopment should not just a policy preference — it is a necessity."

Kelly Pennell

- ***How can we determine when we have enough vapor intrusion data? How do we make decisions with the data we have even though there may be uncertainty?***

CALEPA VAPOR INTRUSION PUBLIC WORKSHOP SERIES

July 24, 2025

Superfund Research Center

Kelly G. Pennell, PhD, PE
Director of the University of Kentucky Superfund Research Center (UKSRC)

Earl Parker Robinson Chair Professor of Environment and Sustainability

Stanley and Karen Pigman College of Engineering, Department of Civil Engineering

Two Questions

- How do we determine if we have enough vapor intrusion data?
- How do we make decisions with the data we have, even though there may be uncertainty?

Conceptual Modeling and Data Collection

Kenneth Craik, a philosopher and psychologist, wrote - *The Nature of Explanation*, which helped found the idea of mental models.

"If the organism carries a "small-scale model" of external reality and of its own possible actions within its head, it is able to try out various alternatives, conclude which is the best of them, react to future situations before they arise, utilise the knowledge of past events in dealing with the present and future, and in every way to react in a much fuller, safer, and more competent manner to the emergencies which face it." *…" 1943, Craik*

We establish and reestablish "mental models" to define problems, develop solutions and interpret data associated with complex contaminated sites to make decisions about vapor intrusion.

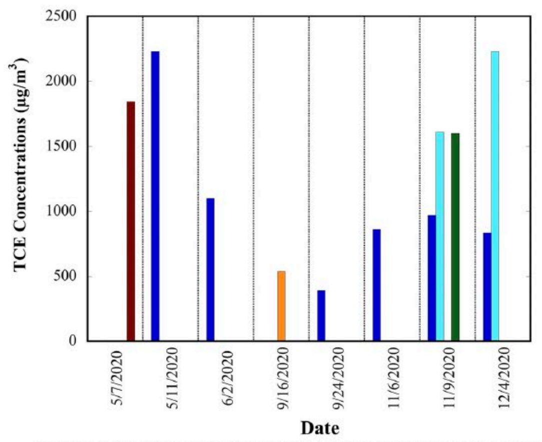
My research journey has reinforced the benefit of seeking to UNDERSTAND when developing and redeveloping conceptual models for decision making.

Two Questions

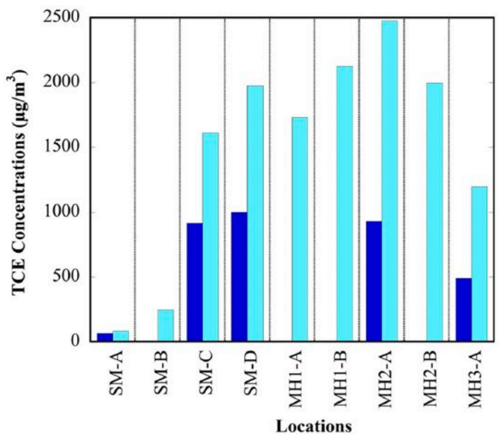
- How do we determine if we have enough vapor intrusion data?

- How do we make decisions with the data we have, even though there may be uncertainty?

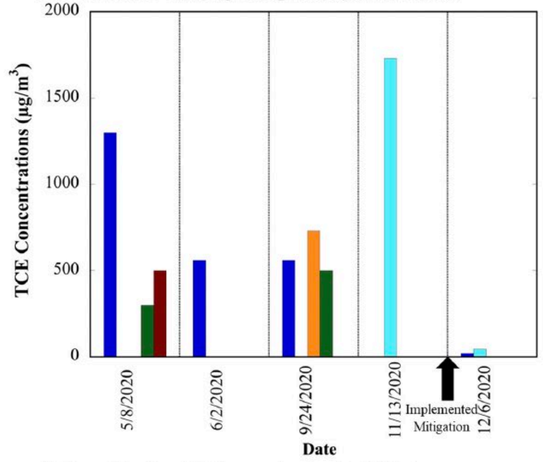
High-level of sophistication for environmental sampling and data analysis to inform decision making.



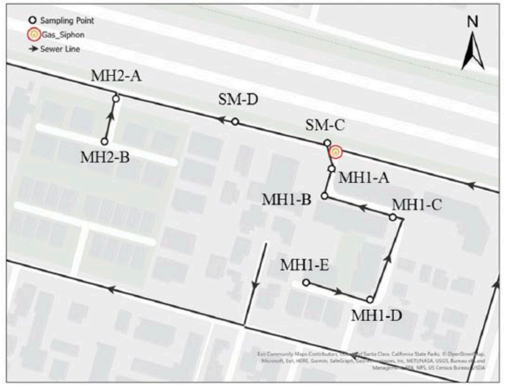
(a) Pre-mitigation TCE Concentration in a manhole in the main sewer line (SM-C), using multiple analytical methods.



(b) Pre-mitigation TCE concentration in manholes near a residential area (11/13/2020).



(c) Pos-mitigation TCE concentration in MH1-A.



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Social ecological system framework as a decision-making tool for risk mitigation: A superfund site case study

Hong Cheng Tay [a,b], Nader Rezaei [a,b,c], Anna G. Hoover [b,d], Kelly G. Pennell [a,b,*]

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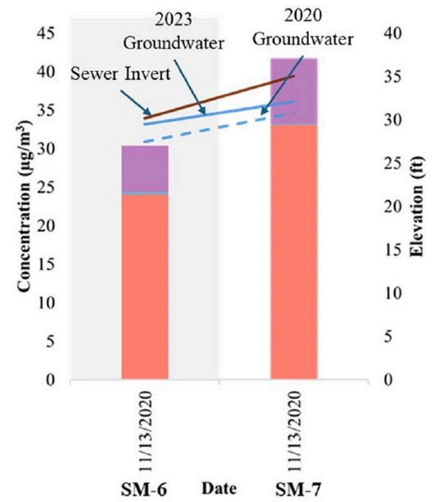
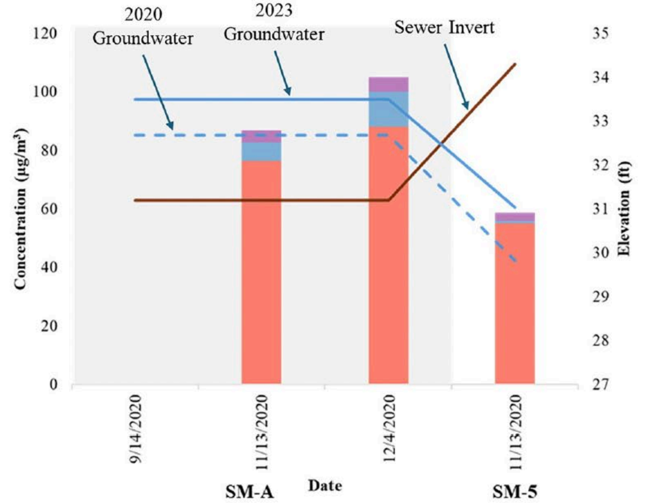
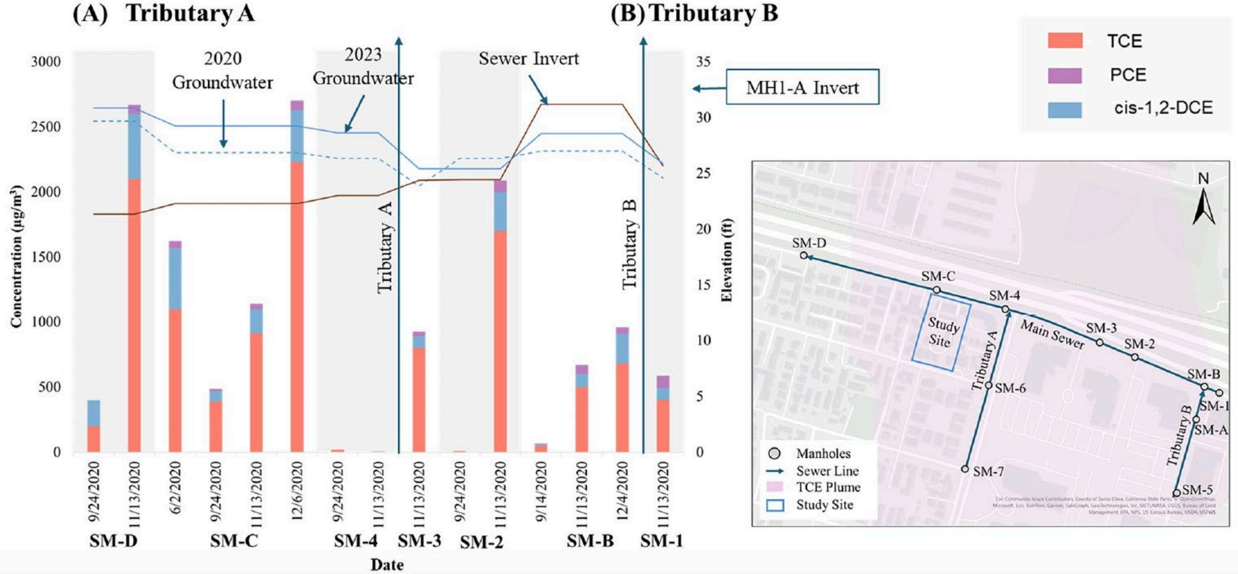


(A) Tributary A



(B) Tributary B



(C) Main Sewer

How do we determine if we have enough vapor intrusion data?

Measuring vapor intrusion: from source science politics to a transdisciplinary approach

Peter C. Little & Kelly G. Pennell

…the tendency to define and practice VI investigations as source science has political consequences that include disregarding the complexity and ambiguity in assessing VI in the field, obscuring the public health effects and legal contours of VI, and increasing costs to homeowners. It also misses no-cost opportunities to promote public health, suffers from the fallacy of techno-scientific reductionism, and overlooks transdisciplinary opportunities to explore the social and environmental complexities of this new toxics debate.

Peter C. Little & Kelly G. Pennell (2016): Measuring vapor intrusion: from source science politics to a transdisciplinary approach, Environmental Sociology, DOI: 10.1080/23251042.2016.1224528

Table 1. Summary of the Source Science Approach.

VI Source Science Approach*

- Decide which areas to include in VI investigation
- Prioritize multiple buildings and neighborhoods
- 'Involve' community
- Determine the nature and extent of vapor source
- Evaluate vapor migration in soil
- Consider the building's susceptibility to VI
- Confirm presence of VOCs in subsurface
- Confirm presence of non-VI sources (see below)

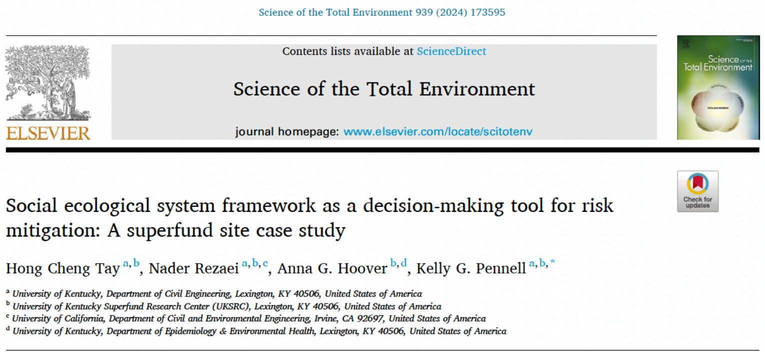
NON-VI Chemical Sources often included in VI Assessments

Other Sources of VOCs: Consumer products and preferential pathways (such as sewers) have also been shown in be sources of VOCs during VI investigations.	• Distinguish between VI sources and other chemicals that may be entering the building. • Remove non-VI sources from the building so that the VI investigation is not affected by the presence of these chemicals. • Use advanced analytical techniques and assessment approaches to evaluate the source of chemicals detected in indoor air. • Limited education provided to homeowners about health effects or alternative consumer products.

*Adapted from USEPA 2015.

Social Ecological System Framework

Levels	Definition
Individual	This level focuses on the individual actor. Data acquisition at this level depends on individual's attitudes, beliefs, and practices, resulting in personal, risk-reducing action.
Interpersonal	This level focuses on a small group of people (e.g., peers and family members). Data acquisition at this level depends on attitudes, beliefs, and practices through the evolution of social norms and resource sharing among a group of people who are already connected.
Organizational	This level focuses on a formal and structured group of people, such as schools, homeowners associations (HOA), community organizations, etc. Data acquisition at this level depends on attitudes, beliefs, and practices by sharing of resources, taking specific actions, and making decisions for larger group needs.
Community	The fourth level focuses on social relationships among individuals, organizations, and communities. Data acquisition at this level depends on attitudes linked to community vulnerability to environmental exposures.
Policy	The fifth focuses on sociocultural and political elements that contribute VI risks. Data acquisition at this level depends on initiatives that support norms associated with sampling across all communities.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Two Questions

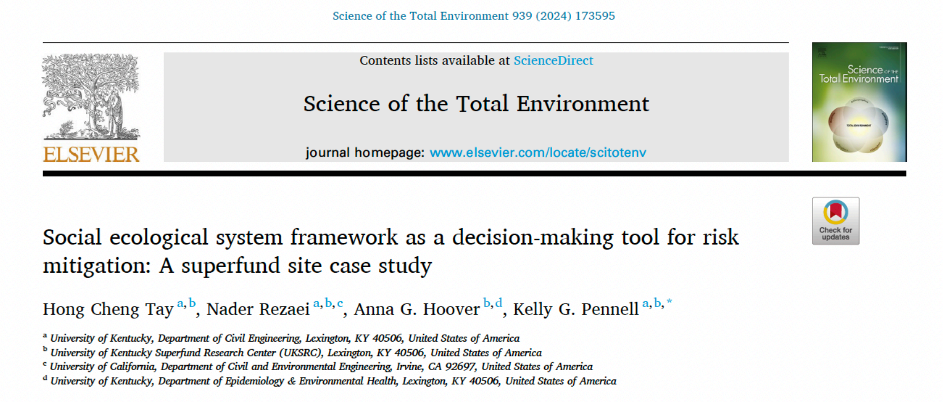
- How do we determine if we have enough vapor intrusion data?

- How do we make decisions with the data we have, even though there may be uncertainty?

Cost Feasible, Health Protective, and Scientifically Valid

Criteria	Sewer ventilation with off-gas treatment	Gas-traps (siphons)	Carbon treatment of wastewater discharges	In-home plumbing connections
Robustness	High	High	High	Low
Feasibility of Installation	Moderate	High	Moderate	Low
Ease of Operation & Maintenance	Low	High	Low	Low
Overall Costs	Low	High / Moderate	Low	Moderate
SES Complexity	Somewhat Complex	Not Particularly Complex	Very to Somewhat Complex	Very Complex

Ranking for Selection: High (green), Moderate (yellow), Low (red)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Thank you!