Toward Quantifying the Risk of VOC Exposure via Vapor Intrusion in Post-Industrial Cities

WAYNE STATE UNIVERSITY

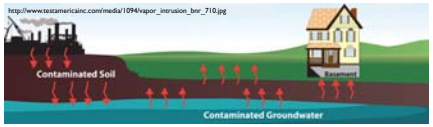
Orlando Rios[1,2] (orlando.rios@wayne.edu), Shirley Papuga[1], Carol Miller[2], Gianluca Sperone[1]

[1]Dept of Geology, WSU, [2]Environmental Sciences, UPR, [3]Dept of Civil & Environmental Engineering, WSU

1. Background/Rationale

In Michigan, recent emphasis has been placed on the issue of vapor intrusion of volatile organic compounds (VOCs) into buildings. At the basic level, VOCs have the ability to volatilize from shallow groundwater and contaminated soil into the soil gas from where they can move into buildings. Importantly, most people in the U.S. spend at least 90% of their time indoors.

Despite the importance of VOC vapor intrusion, little is known in part because of the difficulty in measuring and analyzing the type of data necessary to assess this exposure pathway.

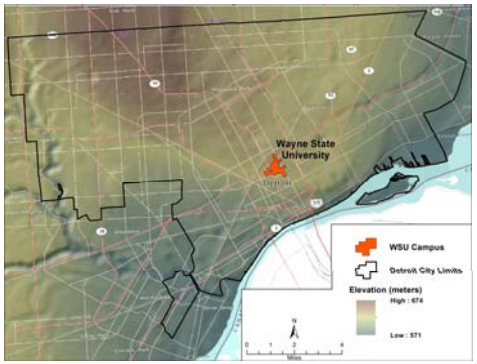


2. Aim 1: Collect, Organize, and Synthesize Existing Spatial Data

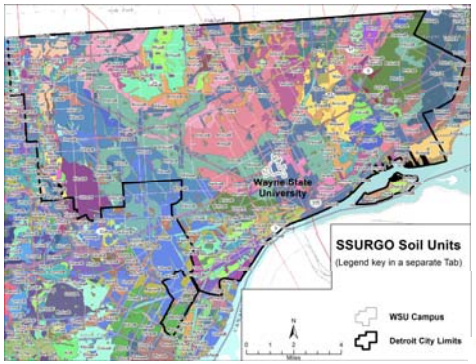
Several factors make particular buildings more susceptible to vapor intrusion and therefore increase the risk for exposures capable of causing public health issues. These include features of the buildings themselves and the environmental conditions in which they are surrounded (e.g. Soil type, age of home) depth to GW.

- ❑ Lots of existing Detroit data
- ❑ Variety of sources
- ❑ Not necessarily readily available or conducive to scientific research

Examples of Spatial Data:



National Elevation Dataset (NED) – The Long Term Archive - USGS



SSURGO Database | NRCS Soils - USDA

Soil Legend (*#$!?)

Wayne State

RvfubB

Riverfront-Urban Land Complex
Sandy Loam

FrtuaB

Fortress Family Riverfront Urban Land Complex
Loamy Sand

3. Aim 2: Explore Simple Low Cost Methods for Monitoring Indoor/Outdoor Sources of Vapor Intrusion

To date, a variety of both active and passive methods have been employed in vapor intrusion studies with different goals, costs, and success rates.

Active methods use a vacuum to collect a finite volume of air or a pump to force a metered volume of air across a filter for subsequent analysis over an 8-hour to 24-hour period.

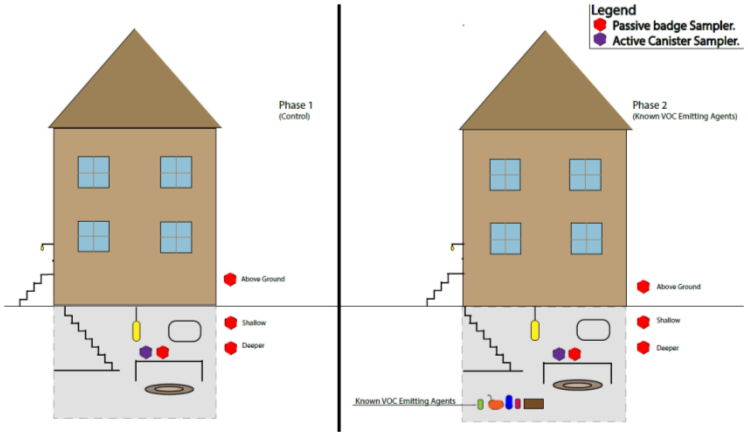
Passive methods, such as badges, rely upon diffusion to measure air pollutants collected in response to concentration gradients between the sampler and the surrounding atmosphere over a finite exposure time.

Passive Monitoring Product	Voc Measured Compunds	Price
ULTRA Passive Sampler for ppb-Level Organic Vapors	Dioxane, Thichloroethane, Tetrachloroethane, Benzene, Ethyl benzene, MTBE, Toluene, o-Xylene & p-Xylene.	$112.00- $309.00.
VOC Chek 575 Series Passive Samplers for PPM-level VOCs	Dioxane, Thichloroethane, Tetrachloroethane, Benzene, Ethyl benzene, MTBE, Toluene, o-Xylene & p-Xylene.	$85.00- $5,689.00.
166 Organic Vapor Monitor	Dioxane, Thichloroethane, Tetrachloroethane, Benzene, Ethyl benzene, MTBE, Toluene, o-Xylene & p-Xylene.	$181.00- $276.00.
166 High Capacity Organic Vapor Badge	Dioxane, Thichloroethane, Tetrachloroethane, Benzene, Ethyl benzene, MTBE, Toluene, o-Xylene & p-Xylene.	$181.00- $276.00
521 TraceAir® Organic Vapor Monitor	Dioxane, Thichloroethane, Tetrachloroethane, Benzene, Ethyl benzene, MTBE, Toluene, o-Xylene & p-Xylene.	$200.00- $430.00

- ❑ Active methods generally preferred in studies requiring quantitative metrics
- ❑ Passive methods have not been fully vetted
- ❑ Active methods typically cost ~ 10X as much as passive methods (~$1000/sample)
- ❑ Using passive methods would considerably increase the capacity to address research questions pertaining to vapor intrusion of VOCs

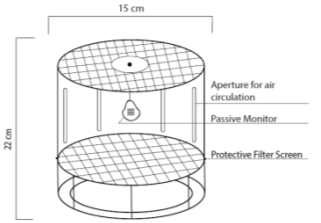
Here, we propose to employ a combination of active (TO-15) and passive (3M badge) sampling methods to compare and evaluate their ability to adequately measure VOC concentrations of indoor and outdoor air for use in future vapor intrusion field studies related to our CLEAR objectives. Because research addressing vapor intrusion is logistically problematic (e.g. access to property; safety) we propose conducting our pilot study on Wayne State property..

- ❑ Phase 1: Measure ambient VOCs in the air for 3 days using both active (TO-15) and passive methods (Badge) both indoor and outdoor at all sites
- ❑ Phase 2: Add known VOC-emitting indoor source (e.g. adhesive; cleaning agent) to the sites and re-measure VOCs in the air for 3 days using both active and passive methods both indoor and outdoor at all sites
- ❑ Repeat experiment during different season (time and budget permitting)



Can passive samplers be used to measure VOCs in soil vapor?

- ❑ Design passive badge sampling system that would work with the physics of air transfer in the unsaturated soil zone
- ❑ Test the sampling system in our experimental set up buried at shallow and deeper soil depths



4. Key References

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5. Acknowledgments

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