

Vapor Intrusion: Involved-Stakeholder Awareness of the Uncertainty (and Multiple Benefits of Controls)

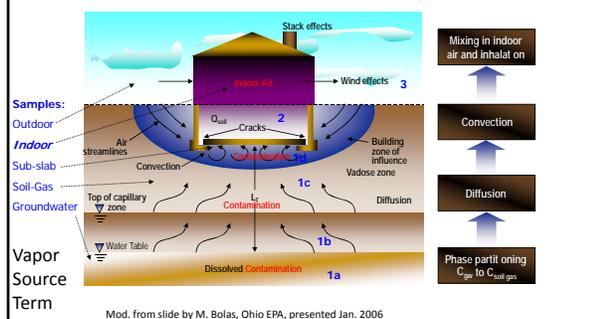
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Open Time Session
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Crystal City, VA
July, 20, 2011

In this Session we will discuss:

- How the intrusion of Volatile Organic Compounds (**VOCs +**) (and naturally-occurring **Radon**) into homes gives impacted residents an:
- **Unusual opportunity** to launch their **own** environmental **investigation** and **response**
- An approach that trained Community Engagement specialists could assist them with

+ = and other hazardous-vapor forming chemicals, e.g., mercury, etc.

Simple conceptual model of the vapor intrusion exposure pathway



Extent of Impacts



Vapor Intrusion (VI)

- VI involves unavoidable contamination in personal spaces (e.g., residential) indoor air
- Raises significant concern in communities overlying volatile contamination

Involved-Stakeholders have ...

- An Opportunity to see the:
 - Uncertainties in typical-chemical-based Assessments
 - Multiple Benefits of intrusion Controls
- To be a **key** to the solution to this problem

Numerous Challenges in Traditional Chemical-based VI Assessment

- VI is characterized by **Variability**
 - Across:
 - Space
 - Time
- Assessing VI (indoor) chemical **Exposures** is Difficult, Disruptive, & Costly
 - Thus, typically involves a limited number of short-term samples from some locations/buildings

Other constituents in soil-gas

- Moisture/mold, Radon, Methane, CO₂, ...
 - Typically these do not improve indoor air quality
- Radon is:
 - Naturally-occurring in all soil-gas
 - Measureable concentrations in most soil-gas
 - In indoor air it is a **general tracer of soil-gas entry**
 - If radon is getting in, so could VI (spilled) chemicals in soil-gas

RADON

FIGURE 1
Generalized Geologic Radon Potential of the United States by the US Geological Survey

EPA's Perspective on Risks from Residential Radon Exposure
 "Indoor radon ... the most serious environmental carcinogen which the EPA must address for the general public" Puskin 1989

Human Health-based studies (2005) required: **1 yr-long** samples to enter

Risk* ~ 2.3000% (4pCi/L)
20,000 Lung* Cancers/yr
 But: Complacency & Costs
 Jalbert, 2004
 * adult cancer

Geologic Radon Potential (Predicted Average Screening Measurement)
 Low (<2 pCi/L)
 Moderate/Volatile (2-4 pCi/L)
 High (>4 pCi/L)

Zones Based on indoor air & geology

The same VI pathway
 Real 'background' for chemical VI
 With chemical VI you get BOTH

From Frumkin, H. et al. CA Cancer J Clin 2001;51:337-344.
 Copyright ©2001 American Cancer Society

Cost & Practicality of Monitoring

Differences between VOCs & radon

- Significantly less cost for radon collection & analyses
 - Than for chemical-contaminants
- Simple passive sorbent (e.g., charcoal canisters)
 - ~\$10/sample for 2 to 14 days (used for real-estate transfers)
- **Continuous digital monitors (like Smoke & CO detectors)**
 - Models **designed for homeowner use** (dual channel)
 - ~\$130, 2-day running avg., and continuous avg. since plugged in
 - (e.g., Safety Siren Pro Series 3 model)
- Long-term (>90 d) practical & affordable
 - Several existing technologies for accurate 90+ day samples
 - (Alpha-track, Electret, Glass, ...)

There are many examples of long-term continuous measurements for radon

Temporal variation at the Example house

July 2003 to July 2005

Approx. Ranges

Days	Approx. Ranges (pCi/L)
0-16	0-16
1-13	1-13
1.5-11	1.5-11
3-8	3-8
4.3-5.0	4.3-5.0

Legend: Hourly Fin, Two day, Weekly, 90 day, annual average

EPA min. 2-day sample duration for Radon
 Slide by Dr. Dan Steck, from AEHS March 2011

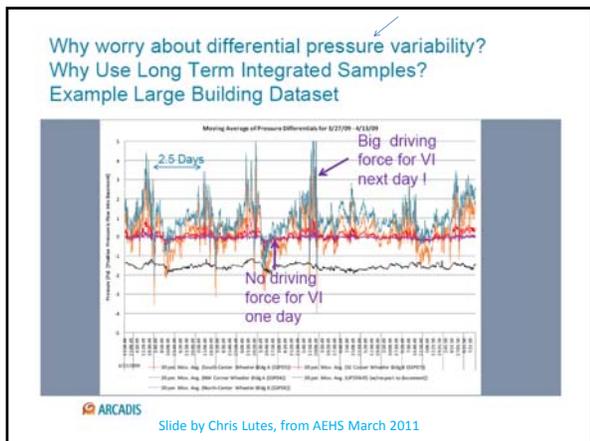
TCE Indoor Air Concentrations

Non-random but irregular (complex, episodic), temporal variability observed in chemicals from VI in ASU's Sun Devil Manor.

There are very few examples of long-term continuous measurements for VI chemicals, but here is the one I know, for 5 and 30 days

See iavi.rti.org for Dr. P. Johnson's comments for regulators; including comments on need for real-time continuous chemical indoor air monitoring.

Similar to observations of radon.

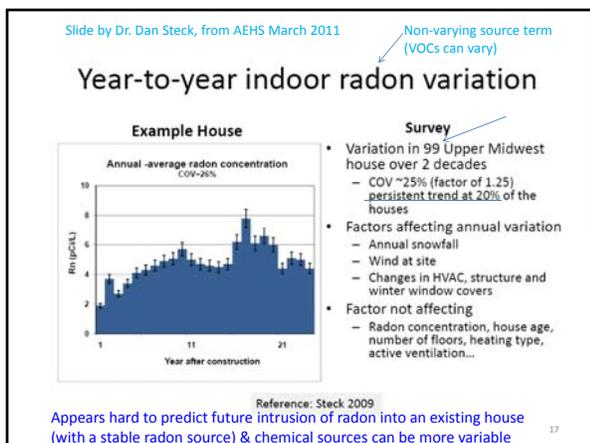
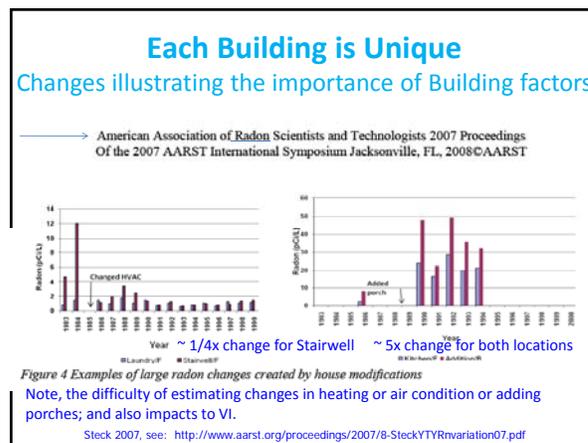
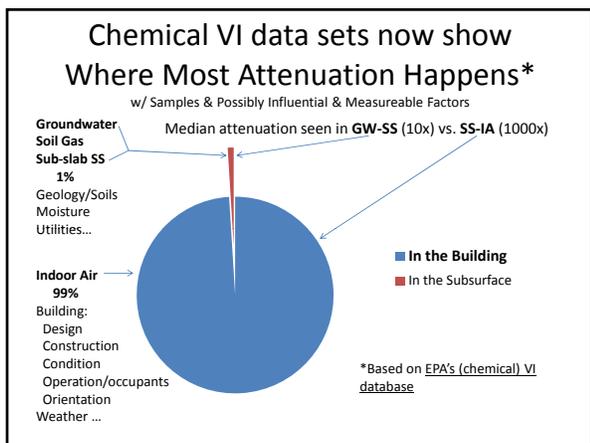


Events between the blue dots

Radon workers have long focused on **building specific factors** interacting with environ. variables

RADON

A Guide for Canadian Homeowners



- ### Involved-Stakeholders could see the uncertainties ...
- In Chemical-based Assessments involving:
 - A **limited number** of:
 - short-term samples
 - collected from
 - some locations/buildings
 - To estimate:
 - Current
 - Future
 - Vapor Intrusion

Possible Alternative Approach

(If Building Occupant/Owners & PRP can decide together)

- Involved-Stakeholder's Intrusion Assessment
 - PRP offers stakeholder-community volunteers continuous soil-gas tracer monitors (e.g., radon)
 - Stakeholder-community volunteers are empowered
 - by having assessment-monitoring tool as good as or better than traditional low-number of short-term sample assessments
 - Can see their own building's variability/signature response to environmental changes through time
 - Continuous monitoring (of soil-gas tracers) provides fuller understanding of intrusion into their buildings through time, &
 - Can also show the variability between surrounding buildings

Involved-Stakeholders May See

- Risks due to tracers (e.g., Radon) alone is:
 - > Health-based recommendations to prevent/control intrusion
 - or
 - > 100x the generic-screening high-end estimated (remote potential VI (95%)) chemical risk:
 - i.e., Chemical VI risks are estimated <1% of that from radon

Involved-Stakeholders' may also See the Multiple Benefits of Controls

- Buildings overlying a source have a potential for VI
- Radon entry can show how soil-gas is entering
 - & VOCs could be entering as well (similarly, i.e., variably)
 - That is not easily assessed with limited number of short-term chemical samples
- Observed Radon levels may exceed health recommendation for controls – (e.g., for Rn alone)
 - Radon is the #1 carcinogen the EPA addresses for the public
 - If we also add (+/x) VI potential = recommend controls?
- **Only** mitigation (w/ on-going monitoring) **protects** for environmental and building changes with time

Possible Alternate Decision Framework

(If Building Occupant/Owners & PRP can decide together)

- PRP offers 'Preemptive' (Radon) Mitigation where:
 - Radon levels (alone) exceed health-based recommendations to control VI, or
 - Radon (lung cancer) risks are > 100x the generic-screening high-end estimated (remote potential VI (95%)) chemical risk
 - Radon levels are such that EPA recommends controls should be considered (for Radon alone) and when combined with concerns for possible VI, controls may be desired, and/or
 - Costs to conduct a definitive chemical-based assessment are higher, and community prefers controlling intrusion
 - That reduces intrusion of both natural and any possible chemical gases/vapors in soil gas

USEPA's developing 'Pre-emptive'* mitigation guidance provides:

- An opportunity for stakeholders to become actively involved in their VI assessment to:
- **Improve** their understanding of:
 - Uncertainty in typical VI assessment/predictions,
 - and the
 - Multiple benefits of engineered intrusion controls to:
 - Confidently remove the uncertainty of potential chemical Vapor Intrusion,
 - as well as
 - Reduce other undesirable soil-gas constituents such as **Radon, moisture/mold, methane, CO₂**, etc.
 - with **significant public health benefits** (due to radon alone)

* Without conclusive proof of unacceptable current VI exposures

Lenny's (Siegel) perspective:

Five kinds of people at VI/radon sites

- People who figure out how to investigate on their own
 - and are willing to pay for mitigation
- People who would mitigate, on their own dime
 - if someone figured it out for them
- People who would mitigate
 - if another pays.
- People who **do not** cooperate,
 - even if someone else is paying
- People who **not only do not** cooperate
 - but also try to discourage publicity

Thank You

We look forward to your help in developing the guidance for this approach.

- Questions / Discussion