Chemical Trespassers in Your Indoor Air

Characterizing Vapor Intrusion Exposure Risks

The Collaborative on Health and the Environment
- Partnership Call -
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Kelly G. Pennell, PhD, PE
Assistant Professor
Civil Engineering - University of Kentucky
kellypennell@uky.edu
Figures adapted from NYDOH, 2005

Sampling

How can we confirm vapor intrusion?

Evaluate groundwater and soil concentrations to determine if vapor sources are present.

Then...

1. Indoor Air
2. Subslab Soil Gas
3. Adjacent “Nearby” Soil Gas
If Vapor Intrusion is Confirmed…

Mitigation

- Subslab depressurization (similar to radon)
- Seal foundation cracks
- Modify HVAC to improve ventilation
- Costs:
  - $2000/home to $$$$$
Many Homes May Be Impacted

Example: Redfield, CO Site

Colored squares indicate indoor contamination.

Over 700 homes were “sampled.”

Stars indicate mitigation

Source: David Folkes, Geosyntec
**Sampling**

*Indoor Air*

**Common Rationale:** Most direct measure of health risks

**Difficult Reality:** In many cases, background concentrations exceed EPA $10^{-6}$ (and even $10^{-5}$) risk levels

Method TO-15 using a 6L summa canister is most common

Sampling recommendations (typ.)
- Residential: 24 hours
- Commercial: 8 hours
- Multiple sampling events required (typically 1 to 4 total)

Figures adapted from NYDOH, 2005
Sampling Challenges

Indoor Air Fluctuations

Day-to-Day Variation of Indoor Air Concentrations

How to accurately measure indoor air concentrations that are relevant for long-term exposures?

Figure 5. Temporal behavior of TCE in indoor air during a VI-active period (values ≤0.011 ppb, are plotted as 0.011 ppb.).

Holden et al (ES&T 2013)
Sampling

Soil Gas Sampling

Three Common Approaches

1. Indoor Air
2. Subslab Soil Gas
3. Adjacent Soil Gas

Results do not directly correspond to indoor air concentrations. Existing field data sets show counter intuitive trends for some sites.
Modeling

Informs about counter-intuitive observations

In some cases, an increase in soil gas concentration will not and should not (theoretically) correspond to an increase in indoor air concentrations.

Bozkurt et al (GWMR 2009)
Multiple Lines of Evidence

Field Sampling, Modeling, and “Interpretation”

Vapor Intrusion Field Investigation
Collaboration among multiple Superfund Research Programs (SRPs).

Results emphasize “Multiple-Lines-of-Evidence” approach is best. No single sample will be able to definitely answer the question of vapor intrusion.

EPA and other regulatory agencies support the multiple-lines-of-evidence approach. Methods (and guidance) for data interpretation are needed, but not currently available.