

**Chemical Trespassers
in Your Indoor Air**

Characterizing Vapor Intrusion Exposure Risks

The Collaborative on Health and the Environment
- Partnership Call -
February 25, 2014

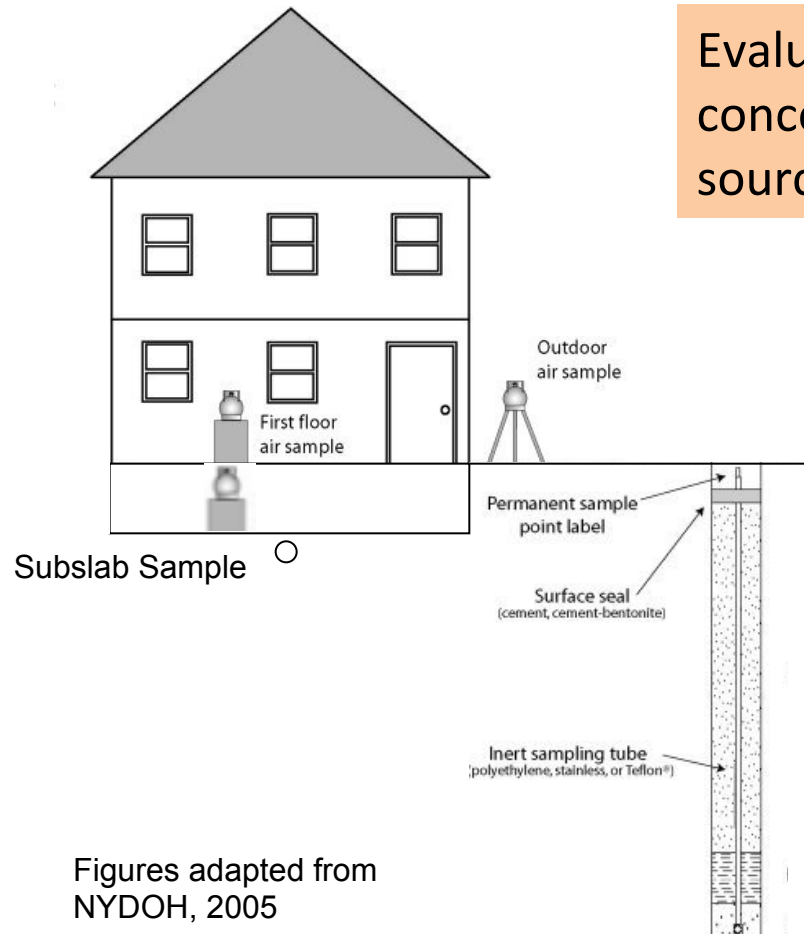


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Sampling

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

Figures adapted from
NYDOH, 2005

If Vapor Intrusion is Confirmed...

Mitigation

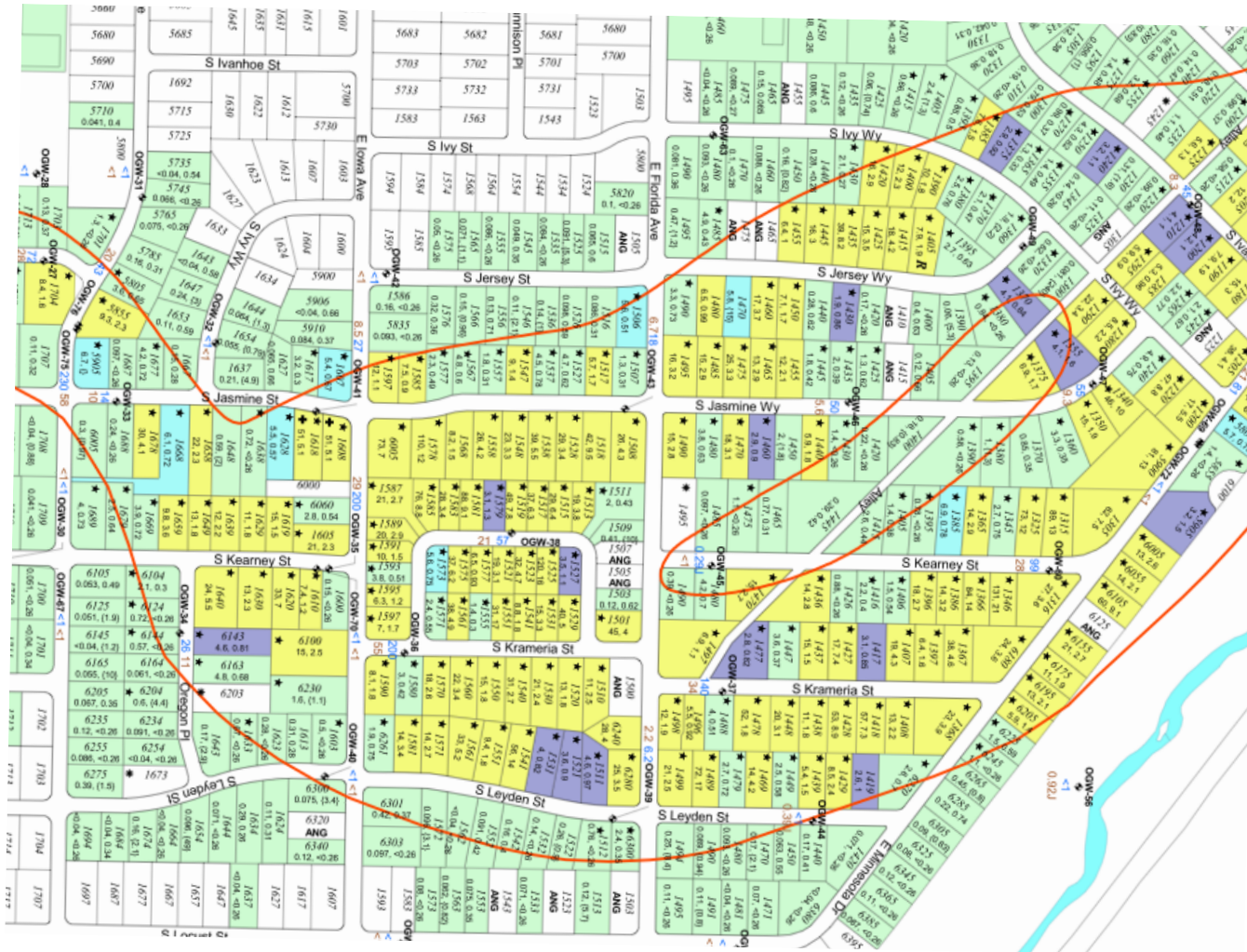
Mitigation

- 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.”

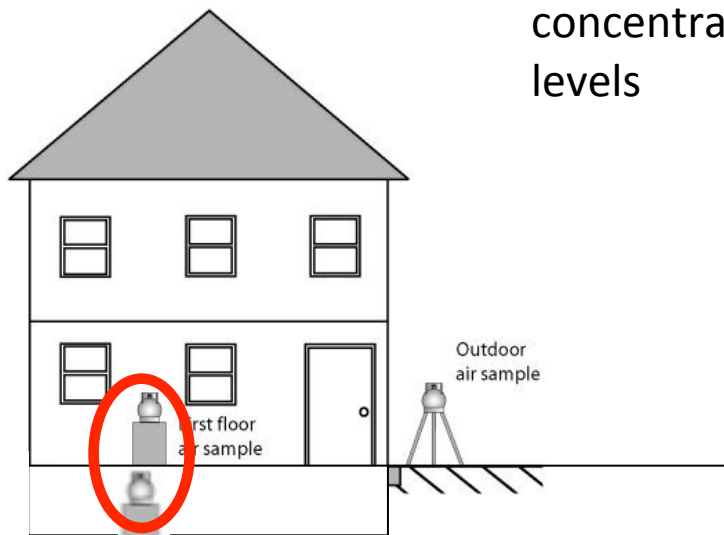
Stars indicate mitigation

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



Figures adapted from NYDOH, 2005

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)

Sampling Challenges

Indoor Air Fluctuations

Day-to-Day Variation of Indoor Air Concentrations



Vapor Intrusion “Lab” (Paul Johnson, ASU)

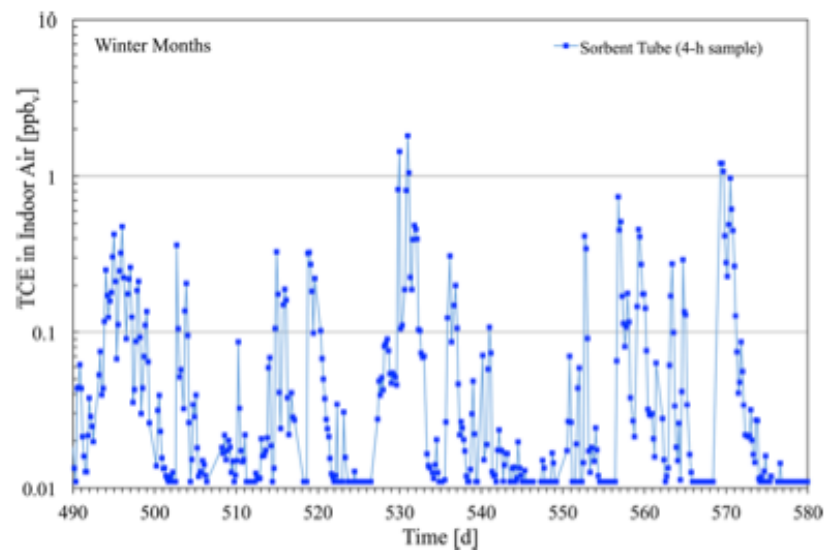


Figure 5. Temporal behavior of TCE in indoor air during a VI-active period (values ≤ 0.011 ppbv, are plotted as 0.011 ppbv). Holdon et al (ES&T 2013)

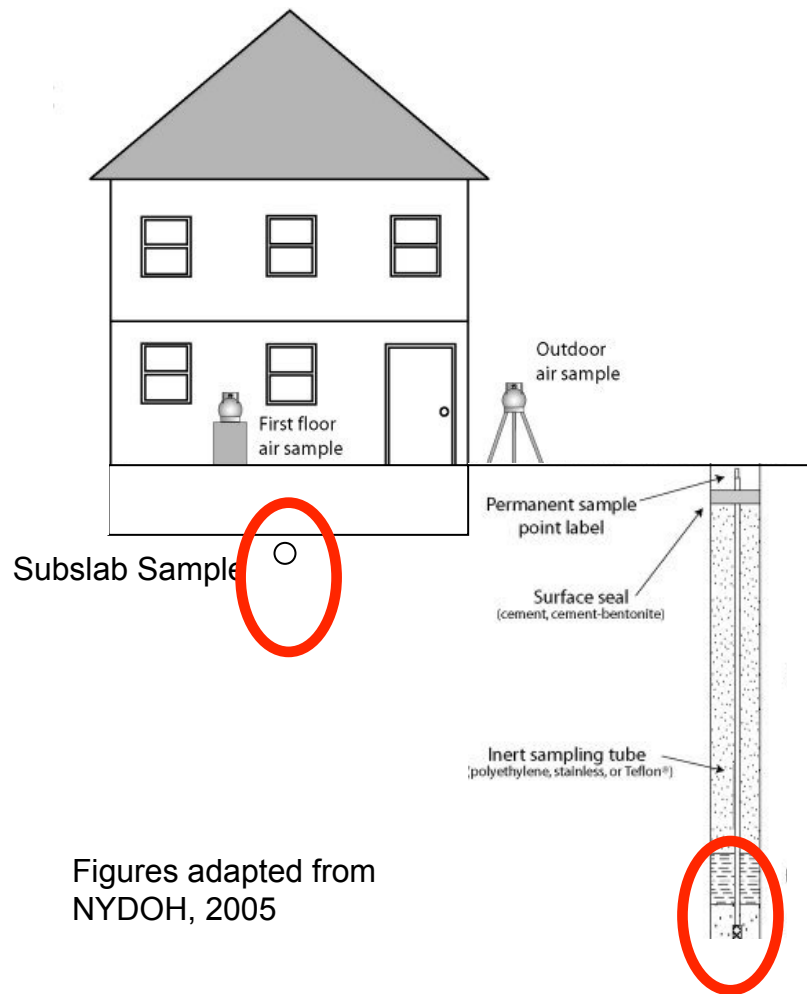
How to accurately measure indoor air concentrations that are relevant for long-term exposures?

Sampling

Soil Gas Sampling

Three Common Approaches

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



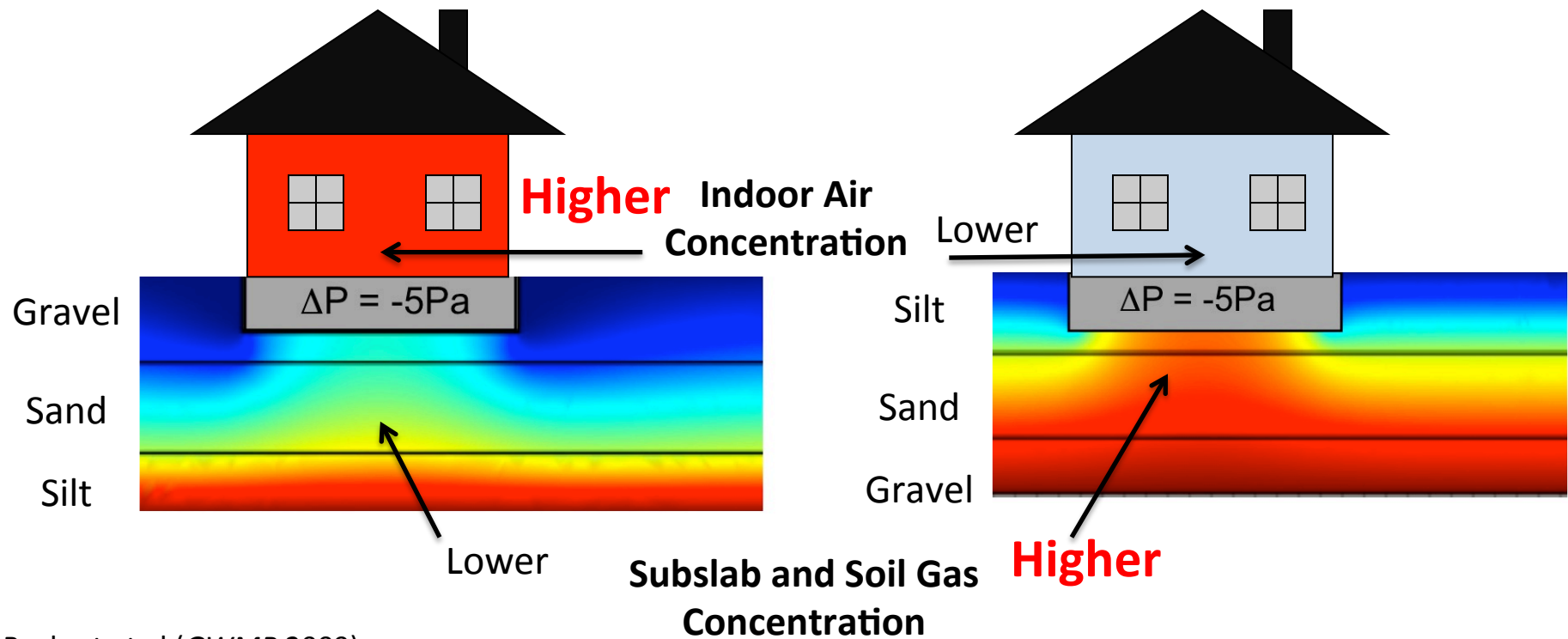
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NYDOH, 2005

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.



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.