Vapor Intrusion Assessments for Concrete Subslabs
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MASS FLUX CHAMBER EXPERIMENTAL SETUP

How It Works

1. VOC is loaded into the bottom chamber through the septum with a 5 mL liquid syringe.
2. VOC volatilizes into a gas and diffuses through the concrete which is sealed by heat shrink tubing to prevent gas from circumventing the sample.
3. A constant flowrate of air is pumped through the top chamber inlet to clear the heptane gas, providing a constant mass transfer driving force.
4. Outlet gas is collected in a Tedlar® bag and VOC concentration is tested using a Photoionization detector (PID).

Concrete

Volatile Organic Compounds
Trichloroethylene (TCE)

Primary Uses
- Industrial Solvent
- Degreaser
- Found in adhesives, paint removers, carpet cleaner

Regulations
- OSHA Standard is 100 ppm for 8-hour exposure

Heptane (Experimental Substitute)

Non-toxic VOC
- Similar molecular weight and vapor pressure to TCE
- Easily detected using PID and GC/MS

Decane (Experimental Substitute)

Low Vapor Pressure → Low Concentration
- Easily detected using PID and GC/MS

Mathematical Model

Fick’s 2nd Law:
\[ \frac{\partial C}{\partial t} = D \frac{\partial^2 C}{\partial x^2} \]

BC(s): \[ C(x,0) = C_0 \]
\[ C(0,t) = C_a \]
\[ C(L,t) = 0 \]

Mass Flux Model:

\[ N_p = D \frac{C_a - C_b}{L} \]

COMSOL Multiphysics

Acknowledgements
- Mike Niemet, Ben Thompson, Mike Novak, Jake Donally, Katie Rabe, Blake Wimer, CH2M Sponsors
- Columbia Concrete Sawing Co. - Concrete samples
- King Machine - Fabricated metal components
- Dr. Pomerencik - COMSOL Model support
- Dr. Semprini- Concrete diffusion and adsorption
- Dr. Gibson - Mathematical model
- Dr. Harding - Project guidance and support

References