Building Pressure Cycling to Document Due Care Compliance in Brownfields Redevelopment

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Background/Objectives. The impact of vapor intrusion (VI) on indoor air is challenging to assess using conventional monitoring approaches because of temporal variability in volatile organic compound (VOC) concentrations arising from VI and off-gassing of VOCs from background sources, which lead to uncertainty in identifying a reasonable maximum exposure (RME) for the occupants of a building. Regulatory agencies typically have responded to this uncertainty by asking for multiple rounds of sampling over extended time periods to reduce the potential of failing to identify unacceptable risks and recommending building surveys to identify and remove indoor sources before sampling. However, this approach is often complicated because extended sampling periods may be unacceptable to stakeholders, some background sources cannot be removed, and even thorough building surveys can miss important background sources.

In Michigan, documentation of due care compliance (DDCC) for the VI pathway has traditionally required four quarters of conventional sampling to prove no exposure to residents. In the case studies covered in this presentation, the developers of low-income housing on brownfield sites needed DDCC quickly to either secure grant funding or to begin building occupancy. Our objective at these sites was to use the advanced vapor intrusion investigation technique, building pressure cycling (BPC), in lieu of quarterly sampling to show the vapor intrusion pathway was incomplete under reasonable worst-case conditions and gain DDCC.

Approach/Activities. BPC was performed in a half day in each residential unit. The approach involved measuring indoor air concentrations and building ventilation rates both while depressurizing the building, which promotes VI, and while pressurizing the building, which inhibits VI. The difference between the concentrations measured when the building is depressurized versus pressurized represents the contribution of VI to indoor air and is a measure of the RME due to VI alone. The concentration measured while the building is positively pressurized represents the contribution of background sources to indoor air. The physical and chemical data collected during the tests were also used to calculate building-specific attenuation factors.

Results/Lessons Learned. At the three Michigan Brownfield sites, BPC was able to demonstrate no exposure to residents under reasonable worst-case conditions. The technique is mentioned in the April 2021 Addendum to Michigan's Vapor Intrusion Guidance document, "Addressing Acute Vapor Hazards Under Part 213" as a way to support the assertion that a sub-slab acute vapor hazard does not pose a VI risk and does not warrant mitigation. Other environmental agencies are also beginning to include this approach in guidance documents. The results from these and other sites indicate that BPC is an effective alternative to conventional vapor intrusion sampling methods when circumstances require reliable data for risk-management decisions quickly. Other uses of BPC include assessing the leakiness of the building structure and floor slab, estimating building air exchange rates under natural ventilation, and estimating the level of dilution of contaminant concentrations arising from VI. The approach may also be used to stress test mitigation systems to meet system prove-out requirements or facilitate system shutdown.