Quantifiable Lines of Evidence for Chemical Vapor Intrusion

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Background /Objectives: The assessment of vapor intrusion (VI) is complicated by variability, across both space and time. This is largely due to compounded variability from the many individual factors that influence the vapor migration pathway from subsurface source to indoor air. Past research on highly variable indoor air data sets have demonstrated that conventional sampling schemes can result in false negative and false positive decisions. While continuous chemical analysis of individual volatile organic compounds (VOCs) is conceptually appealing, it remains largely impractical when a number of buildings are involved and particularly for long-term monitoring. As more is learned about the challenges with indoor air sampling for VI assessment it has become clear that alternative approaches are needed to help guide discrete sampling efforts and reduce sampling requirements while improving confidence in exposure characterization. Indicators, tracers, and surrogates (ITS), which include a collection of quantifiable metrics and tools, have been suggested as a potential solution for making VI pathway assessment and long-term monitoring more informative, efficient, and cost-effective. This presentation will provide a critical evaluation and quantitative analysis of the application of ITS to better understand the VI pathway and improve exposure characterization.

Approach/Activities: An extensive literature review was conducted to identify studies of ITS metrics and tools for use in VI assessment and long-term monitoring. In addition, quantitative analyses were conducted on two robust VI data sets, where numerous supplemental metrics were collected concurrently with indoor air concentration data, to further assess the utility and value of ITS.

Results/Lessons Learned: Preliminary evaluations and analyses show that certain ITS metrics and tools, including differential temperature, differential pressure, and radon concentrations, can provide significant benefits to VI assessment and long-term monitoring. This includes indicators that narrow the assessment period, tracers that enhance understanding of the conceptual site model and aid in the identification of preferential pathways, and surrogates that support or substitute VOC sampling results. ITS tools such as seasonality, temperature, odor, and visual smoke already play various roles in state VI guidance documents. The results of this review and analysis provide insight into the currently scientifically supportable uses of ITS metrics and tools and suggest research needs to support new ways of using ITS for VI assessment and long-term monitoring.