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Evaluation of Indoor Air Concentrations and Exposures and Implications for Indoor Air Sampling Approaches

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Background/Objectives. Vapor intrusion (VI) continues to remain an important exposure pathway both at impacted industrial facilities and in off-site areas. Volatile organic compounds (VOCs) have the potential to cause VI issues at nearby properties, both residential and commercial. When sampling indoor air at any off-site property, it is unclear how much sampling is required to sufficiently document potential exposures. Holton et al. (2013) evaluated temporal variability in the indoor air at one residential home located over a VOC groundwater plume. The Holton et al. (2013) analysis indicated that sampling had the potential to miss elevated exposure concentrations, depending on the timing of sampling. USEPA continues to investigate how vapor intrusion exposures may change over time and how to best characterize and quantify these exposures. While previous papers (Lowe, 2012, 2014; Weinberg et al., 2014) explored some of these same issues in this and a second residential structure, this paper extends that work by also evaluating data considering target concentrations and acceptable exposure levels

Approach/Activities. In this paper, we examine how estimates of exposure to VOCs in indoor air can differ depending on what, when, and how much indoor air concentration data are collected.The authors use a large data set available from a USEPA-sponsored testing of an Indianapolis duplex and apply a similar methodology explored in Holton et al. (2013) to use continuous monitoring data to investigate the effects of different sampling strategies on indoor air exposure estimates. Using this methodology, we estimate potential indoor inhalation exposures based on a daily and continuous set of weekly indoor air concentrations. Taking advantage of this time series, we evaluate how different concentration statistics calculated through time could influence exposure estimates in residences. For example, how do a concentrations based on single measurements taken at different points in the time series compare with average concentrations over different time periods? The potential variation and range in exposure estimates are discussed, as well as how those results could change if only a subset of the data was available for analysis - for example, the amount of data that would be collected using typical indoor air sampling strategies for VI sites.

Results/Lessons Learned. We evaluate indoor air data from the Indianapolis duplex testing program to determine whether (1) different sample durations (daily versus weekly) would yield different exposure estimates, (2) different sampling scenarios (i.e., how many samples and over what time period) would provide different exposure estimates, and (3) different sampling strategies provide a better or more conservative estimate of the “true” exposure concentrations, as represented by the full experimental dataset. For example, how well do daily sampling results in this dataset represent long-term average exposure concentrations and how often and under what circumstances might they miss estimating reasonable maximum exposure concentrations? Results include comparisons of different discrete sampling strategies for estimating long-term or short-term exposure, a comparison of the data results to target concentrations, and a

discussion of which strategies may provide the best estimate of indoor air exposure concentrations represented by the full Indianapolis duplex data set or shorter exposure periods of interest.