Fate and Transport of Vinyl Chloride at VI Sites

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Background/Objectives. Often in vapor intrusion (VI) studies, one of the risk drivers is vinyl chloride (VC). At many sites, initial screening shows potential indoor air impacts for vinyl chloride at unacceptable levels. During follow-up site characterization, however, VC rarely if ever turns out to be an actual problem. This paper sets forth a conceptual model for understanding these results and presents previously unpublished field results to illustrate the concepts.

Approach/Activities. Vinyl chloride can be formed under anaerobic conditions via reductive dechlorination of PCE or TCE. The ultimate fate of any VC that is produced depends on the amount of available oxygen. Under anaerobic conditions, the VC vapors may migrate and reach buildings before the vapors are degraded to ethene. But if oxygen is available, VC will readily undergo aerobic biodegradation. The literature on that topic will be briefly summarized. The rate of aerobic biodegradation is faster than the rate of diffusive transport in soil, so VC vapors generally will be attenuated within a few feet of the vapor source.

Data are presented for multiple field sites to illustrate the fate and transport of VC. The sites are drawn from various regions of the US and cover a range of conditions. At these sites, vinyl chloride was detected at relatively high concentrations in groundwater. It may also have been detected in deeper soil gas, but generally was fully attenuated before reaching shallow soil depths. Indoor air results were consistently non detect (ND). The behavior is also discussed for sites with very shallow groundwater, where VC was found in some sub-slab soil gas samples but not in the overlying indoor air.

Results/Lessons Learned. The behavior of vinyl chloride vapors migrating through the subsurface will be similar to the behavior of benzene and other aromatic petroleum hydrocarbons. An analogous separation distance can be used for screening out VC at many sites (e.g., 5 feet of separation distance for dissolved phase vapor sources). The reasons why this approach is more conservative for VC than for petroleum hydrocarbons will be discussed.