

Vertical Separation Distance Criteria to Evaluate Vapor Intrusion Risk from Lead Scavengers (1,2-DCA and EDB)

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Background/Objectives. The 2015 petroleum vapor intrusion (PVI) guidance by the USEPA established vertical separation distance criteria for benzene. Based on this guidance, additional PVI investigations were deemed unnecessary at certain petroleum underground storage tank (UST) sites if the vertical distance between the source of benzene vapors and the overlying building was greater than 6 ft. for dissolved source and greater than 15 ft. for LNAPL source. However, it identified the presence of lead scavengers, 1,2-dichloroethane (1,2-DCA) and ethylene dibromide (EDB) at the site as a 'precluding factor' to apply this screening approach. Although 1,2-DCA and EDB biodegrade under both anaerobic and aerobic conditions, the ubiquity and kinetics of these biodegradation processes in the vadose zone is not well understood. Therefore, the 2015 USEPA PVI guidance document stated that *"vertical separation distances recommended in this guide may not be sufficient for petroleum fuel releases that contain EDB and 1,2-DCA and additional investigation may be necessary to assess their potential for vapor intrusion"*.

The lowest reporting limit for EDB in soil vapor from the available PVI investigation data is higher than the soil vapor screening level for EDB ($1.6 \mu\text{g}/\text{m}^3$ for 10^{-5} incremental cancer risk). Therefore, these data are not adequate to empirically evaluate vertical separation distance for EDB.

Approach/Activities. This study presents data from 14 UST sites from across the US with recent 1,2-DCA and EDB detections in groundwater exceeding the vapor intrusion screening levels. Concurrent groundwater and soil vapor samples for 1,2-DCA and EDB were collected from these sites in 2017. The soil vapor samples were analyzed with a modified EPA TO-15 method using a series of GC columns, Dean switches and trapping steps and a time of flight-mass spectrometer detector that was able to achieve reporting limits of $<0.16 \mu\text{g}/\text{m}^3$ for EDB and $<3.6 \mu\text{g}/\text{m}^3$ for 1,2-DCA. First order aerobic biodegradation rate constants were extracted by calibrating select soil vapor profiles from this data using the API Biovapor model. These rate constants were used to estimate vertical separation distances for 1,2-DCA and EDB using a range of source concentrations in groundwater.

Results/Lessons Learned. The results indicate that vertical separation distances established for benzene (6 ft for dissolved source and 15 ft for LNAPL source) appear to be protective for vapor intrusion from EDB. However, a minimum of 15 ft of vertical separation distance may be required for 1,2-DCA.