

Field Measurement of Vapor Intrusion Rates at a PCE Site

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A field study was performed during 2005 to evaluate vapor intrusion (VI) of tetrachloroethylene (PCE) and daughter compounds at a commercial retail site in Dallas, TX. The building is approximately 40 years old and once housed a dry cleaning operation. A comprehensive study was performed to evaluate vapor intrusion at the site.

First, an intensive site characterization effort was performed. A TRIAD approach was used; i.e., real-time or rapid response analytical data were used on-site to reach decisions. The general approach for site characterization was to collect soil, groundwater, and soil-gas samples using direct-push equipment – from both inside and outside of the building – and analyze the samples on-site using EPA Method 8265, direct sampling ion trap mass spectrometry (DSITMS). Analytical run times of approximately three minutes per sample allowed low ppb-level data to be generated at a rapid rate.

The site characterization results were used to select sampling locations for the vapor intrusion study. The general approach for evaluating vapor intrusion was to collect time-integrated canister samples for off-site TO-15 analyses. The compounds of interest were measured in shallow soil gas, sub-slab soil-gas, indoor air, and ambient air. The sub-slab soil gas exhibited relatively high values: PCE up to 2,600 ppmv and tetrachloroethylene (TCE) up to 0.17 ppmv. The α (i.e., attenuation factor) calculated from the ratio of indoor air and sub-slab soil-gas concentrations was unusually low: approximately 10^{-6} based on the maximum sub-slab soil-gas concentration of PCE. The α measured in the field is about 100,000x less than the US EPA default value.

A tracer study was performed to quantify the rate of vapor intrusion. Sulfur hexafluoride (SF_6) was introduced into the sub-slab space at a known rate and measured inside the building once steady-state conditions were reached. The rate of soil gas infiltration, Q_{soil} , was determined and compared with the US EPA default value of 5 L/min per 100 m² of building footprint. Tracer gas measurements also were used to measure the building ventilation rate in terms of both air changes per hour (ACH) and total air flow (ft³/min).