Field Application of CSIA for Vapor Intrusion/Indoor Air Quality Assessment: Determination of TCE Source in Residence

Devon Rowe (drowe@ramboll.com)
(Ramboll Environ US Corporation, Vancouver, WA, USA)
Carol Serlin (cserlin@ramboll.com), Safaa Dergham (sdergam@ramboll.com), and Erik Pearson (epearson@ramboll.com) (Ramboll Environ US Corporation, Irvine, CA, USA)

Background/Objectives. CSIA is increasingly being included as key data to support our understanding of site characterization and remedial progress, usually in groundwater studies. Advances in vapor phase sampling and analysis techniques now allows us to incorporate CSIA for soil vapor and indoor air studies. We provide a brief overview of how CSIA can be applied at project sites to assist with vapor intrusion/indoor air quality assessments, the typical objectives of which are to evaluate whether measured indoor air concentrations of target contaminants (e.g., trichloroethene [TCE]) are sourced from the subsurface (i.e., soil vapor or groundwater plume), or are derived from other items (consumer products, chemicals, etc.) that may be located indoors.

Approach/Activities. Over the last decade or so, Ramboll Environ has conducted remediation of a chlorinated solvent plume, where TCE is the primary chemical of concern. A hydraulic containment system (HCS) located along the downgadient site boundary has been used to capture the TCE plume in one area of the site, and to limit further migration of contaminants beneath a residential community, where TCE has been identified in shallow soil gas near certain homes. Indoor air sampling has historically been conducted in several residences to monitor TCE concentrations, and mitigation (subslab depressurization systems [SSDS]) has been installed in some residences. At one residence in particular, TCE concentrations in indoor air were measured in 2015 at nearly twice the historical maximum values for that residence, after the SSDS had been in operation. The unusual results prompted the regulatory agency to request additional testing – Ramboll Environ conducted various rounds of IAQ testing in 2015 and 2016 to further understand the IAQ conditions, and included CSIA (carbon) of TCE in vapor samples from nearby soil gas probes, groundwater from nearby monitoring wells, and indoor air from the residence. The CSIA sampling was intended to provide a dataset that would allow comparisons of isotopic signatures from the potential subsurface sources (soil vapor, groundwater) to the isotopic signature of indoor air.

Results/Lessons Learned. The CSIA results were included as a key contributor to a multiple lines of evidence (MLE) approach that ultimately provided a clear conclusion regarding the source of the TCE in indoor air. Although the CSIA results were similar to some case studies reported in the literature, because the specific sampling techniques, analytical methods, quality control procedures and methods of data interpretation were unfamiliar to the regulatory agency, the CSIA results were met with some scepticism on the part of the regulatory staff. Results from a second sampling event to be conducted in late 2017, designed to address the agency concerns will be presented to highlight how CSIA ultimately provided convincing evidence of the TCE source.