Evaluation of the Vapor Intrusion Potential of Volatile Per- and Polyfluoroalkyl Substances

Chase Holton, Ph.D., P.E. (Chase.Holton@gmail.com) (GSI Environmental, Denver, CO, USA)
David Hanigan, Ph.D., P.E. (University of Nevada, Reno, Reno, NV, USA)

Background/Objectives. Per- and polyfluorinated substances (PFAS) represent a significant environmental risk and liability due to their widespread use and recalcitrant properties. Research and site investigation work over the past decade has resulted in a better understanding of the subsurface fate and transport of PFAS in soil and aqueous media but has largely overlooked vapor-phase transport. Published values for various chemical properties of PFAS are increasingly available; however, Henry's Law constants, which are needed for evaluating vapor-formation and subsurface vapor transport, are limited or, in the case of computationally-derived Henry's Law constants, show a broad range of values. This presentation will provide an evaluation of the vapor intrusion potential of select PFAS using newly published experimentally-derived Henry's Law constants. In addition, an assessment of the types of source areas that may pose vapor intrusion risks will be presented.

Approach/Activities. Twenty-seven PFAS were selected for evaluation based on their potential volatility and/or prevalence in the subsurface. Henry's Law constants were measured using the static headspace method and manipulations of the gas- to liquid-phase ratio. Henry's Law constants were compared to computationally-derived values and input into a screening-level VI model to assess partitioning of select PFAS above impacted groundwater and migration into an overlying structure.

Results/Lessons Learned. Fifteen PFAS produced mass spectrometry signals suitable for determination of Henry's Law constants, including select fluorotelomer alcohols (FTOHs), fluorotelomer sulfonates (FTSs), iodinated PFAS, sulfonamides, fluorotelomer olefins, fluorotelomer carboxylic acids, and fluorotelomer acrylates. Compounds with longer fluoroalkyl chain lengths showed greater Henry's Law constants. Perfluorinated sulfonates and carboxylates were generally not volatile enough to be measured, even at pH as low as 1.0. The preliminary results of screening-level VI modeling with the experimentally-derived Henry's Law constants not only highlights a wide range of site conditions in which the potential for vapor intrusion should be considered, but may also change current interpretations of PFAS conceptual site models.