Building Survey, Indoor Source Identification and Vapor Mitigation Lessons Learned at a Superfund Site

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Background/Objectives. In 2013, the United States Environmental Protection Agency (EPA) and Regional Water Quality Control Board (Water Board) required nine Superfund sites in Silicon Valley, all of which have trichloroethene (TCE) or perchloroethene (PCE) as contaminants of concern in groundwater, to perform vapor intrusion (VI) assessments. Initially, the phased VI study evaluated commercial/industrial buildings overlying 100 micrograms per liter (µg/L) of TCE in groundwater and residential properties overlying 50 µg/L of TCE in groundwater. The 3 December 2013 letter from the EPA proposed a phased approach to expand the study area to the area overlying TCE in shallow groundwater greater than 5 µg/L.

Approach/Activities. Eleven onsite buildings and 18 off-site buildings were identified for VI assessment. Of the 29 buildings, only one building was a high density residential apartment complex, the remaining 28 were commercial buildings. Indoor air sampling, with heating, ventilation and air conditioning (HVAC) systems on and off, was the primary means of vapor intrusion assessment used to evaluate potential TCE exposure risk. Twenty-two buildings were sampled by Langan and the remaining seven buildings were sampled by others and did not require resampling due to no VI concerns. Prior to indoor air sampling, the buildings were surveyed and screened with a ppbRAE to identify worst case sample locations.

Results/Lessons Learned. Our building survey approaches helped us understand the complexity of vapor intrusion into existing buildings and better anticipate building air flow dynamics prior to sampling. The 28 commercial buildings were all different in shape and construction. Vapor intrusion was determined not to be a significant issue in 15 of the buildings. The residential apartment complex with podium garage, also had no VI concerns. Three commercial buildings had VOCs detected that were attributable to indoor sources. The remaining four either required mitigation or had VI issues when HVAC was not operating. Lessons learned to be discussed are noted below:

1. Understanding how HVAC systems function in buildings is important in the VI evaluation – HVAC system operation can help or exacerbate VI.
2. The operation of exhaust fans in particular spaces (i.e., bathrooms) may generate localized areas of lower pressure relative to subslab pressure that can drive advection-driven VI. Increasing the room pressure to create a ‘positive-pressure’ environment can help alleviate VI issues. Installation of louvers in doors can also help balance pressure and reduce negative pressure effects.
3. Portable gas chromatograph/mass spectrometer (GC/MS) can be used as a screening tool for preferential pathway evaluation.
4. Impurities in other permitted chemicals used at an industrial facility can contribute to TCE in indoor air – film cleaners utilized at a commercial facility contained 1,1,1-trichloroethane (1,1,1-TCA). TCE is a known impurity in technical grade 1,1,1,-TCA, with concentrations of up to 7.6%. Comparing ratios of detected 1,1,1-TCA to TCE concentrations in indoor air helped us determine the source of TCE.

5. Prior to installing a subslab depressurization system, sealing of penetrations and coating areas of concern can eliminate the VI pathway.