Strategy Used to Distinguish between Potential Vapor Intrusion, Indoor Sources, or Building Systems Malfunction

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Background/Objectives. In the 1950s, Stanford University leased a large portion of its land to manufacturers, laboratories, and offices. Releases at several locations, primarily the Varian Medical Systems and Hewlett-Packard facilities, formed a commingled groundwater plume known as the California Olive Emerson (COE) plume. Since 1981, the San Francisco Regional Water Quality Control Board (RWQCB) has overseen cleanup of the COE plume in Palo Alto, California. The contaminants of concern for the plume are volatile organic compounds (VOCs), primarily tetrachloroethene (PCE) and trichloroethene (TCE). This presentation will describe the strategy used during post-construction vapor mitigation system (VMS) monitoring at a mixed-use development to assess whether the elevated VOC concentrations found in indoor air were attributable to a potential vapor intrusion condition, one or more indoor sources, or a building systems malfunction.

Approach/Activities. Due to detections of PCE in soil gas up to 40,000 µg/m^3 and of TCE up to 150,000 µg/m^3 at the redevelopment site, Langan was retained in 2008 to design a passive VMS system that could be converted to an active system if needed, pending the results of post-construction VMS monitoring. Between 2016 and the present, multiple rounds of monitoring have been conducted to evaluate the effectiveness of the VMS and to assess the risk of vapor intrusion from soil gas into indoor air. The monitoring results were compared to indoor air environmental screening levels (ESLs) established by the RWQCB.

Results/Lessons Learned. Initially, air samples were collected from the basement, commercial spaces, stairwells, outdoor courtyard, and VMS vent risers. The monitoring data indicated that that a systemic vapor intrusion condition was not present at the site; however, sporadic, elevated concentrations of VOCs in indoor air suggested one or more indoor sources of VOCs. Following multiple detections of VOCs above the residential ESLs within the stairwells at both the second- and third-floor residential levels, the sampling program was expanded to assess whether there was an indoor source or another explanation for these elevated concentrations, such as potential short circuiting of the buildings heating, ventilation, and air conditioning (HVAC) system or back-migration of vapors from the sanitary sewer system. Subsequent indoor air sampling revealed that VOC concentrations in the hallways and one of the basement trash rooms were even greater than those within the stairwells. Additional mitigative actions were implemented to protect human health and rule out potential sources, including sealing of the basement-level floor slabs within the stairwells, periodically activating the contingency active blowers for the VMS risers, and extending the risers vertically to increase the distance between the VMS effluent points and HVAC intake points. Ultimately, after a thorough investigation, the source was identified and mitigated. Since then, PCE and TCE have not been detected above residential (or commercial) ESLs. Furthermore, in the most recent monitoring event, all samples in the basement garage, as well as numerous other locations, were lower than their respective concentrations in ambient air. This presentation will provide an overview of the step-by-step process that was used to identify and mitigate the actual source of elevated VOC concentrations in indoor air and demonstrate that the VMS is working properly and effectively.