In Flux: A Case Study of Transition from Active to Passive Sub Slab Depressurization Systems for Vapor Intrusion Sites

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Background/Objectives. We summarize a creative approach to vapor intrusion (VI) mitigation and risk communication that led to a more sustainable and less costly remedy that still achieved permanent closure in a reasonable time frame. Demand for urban housing has driven redevelopment of numerous former industrial properties into multiunit residential use. In some instances, the magnitude of legacy contamination and potential for VI were not sufficiently considered during redevelopment. Our case study is a former manufacturing facility in southeastern Massachusetts, which was redeveloped into 38 residential condominium units in 2004-2005. Shortly after occupancy, a complete VI pathway for chlorinated volatile organic compounds (cVOCs), particularly trichloroethene (TCE), was identified in several residences. Tight deadlines driven by regulatory and homeowner concerns required immediate action with the goal of complete elimination of the VI pathway, while minimizing impact to the condominium buildings and residents, and providing for long-term operation and maintenance.

Approach/ Activities. We refined the conceptual site model by integrating soil, groundwater, and air quality data, and concluded that vapor-phase cVOCs in soil were the likely source of the VI pathway rather than the more commonly suspected shallow aquifer. We utilized these data as the basis for a risk-based approach to identify individual units requiring VI mitigation. Various alternatives for the use of sub-slab depressurization systems (SSDS) were considered. Active SSDS were required given the need to rapidly address the pathway in occupied units, but the active SSDS was specially designed to allow for transition to a passive system when justified based upon site data. The potential for transition to a passive system was important to residents because it was more sustainable and required less attention than active systems. Monitoring and indoor air quality data collected over approximately 1.5 years of active system operation demonstrated the active systems were effective, thus pilot tests were performed to assess indoor air quality with the systems in passive mode.

Results/Lessons Learned. Four rounds of passive mode pilot tests, ranging in duration from one to three weeks, have been performed in each of the affected units. Comparison of data from pre- to post-SSDS installation indicates that the SSDS has reduced sub-slab soil vapor concentrations and effectively mitigated exposures to TCE in all of the affected units. Furthermore, comparison of active- vs. passive-mode SSDS operation indicates that the passive systems are effective at maintaining cVOC concentrations below background and health-based concentrations. These data demonstrate how design adaptability and monitoring can permit transition from active to more sustainable and cost effective passive SSDS as a protective closure strategy.