Optimizing VI Mitigation Design and Performance: A Case Study

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Background/Objectives. Vapor Intrusion (VI) continues to be a significant liability for private and government entities. VI mitigation systems (VIMS) are frequently installed at sites with a documented complete or potential VI pathway, based on in situ effects, often operating for years while the effects are addressed. VIMS installed on buildings pose unique design and long-term operational challenges, and sub-slab depressurization (SSD) VIMS are commonly based on short-term diagnostic testing and approaches adopted from radon mitigation and soil vapor extraction systems design. These procedures do not fully account for the long-term operational challenges of managing the VI pathway, or for the seasonal and annual variations in subsurface conditions that affect VIMS operation. As increasing numbers of VIMS have been installed and put in service, many operational challenges have been identified, especially at sites where the depth to groundwater is shallow (< 5 feet below ground surface) and seasonally variable. VIMS that do not operate as designed can result in increased liability and notices of regulatory non-compliance, and potentially expose building occupants to a completed VI pathway.

Approach/Activities. This case study analyzed VIMS performance monitoring data collected quarterly from seven industrial buildings retrofitted with SSD VIMS installed in 2012. The study was to leverage lessons learned from a review of these data and provide recommendations on optimizing SSD VIMS design and performance monitoring. Meteorological and precipitation data were also evaluated to determine any clear trends between VIMS operation and meteorological events. This study also evaluated performance monitoring parameter trends over time to determine if the parameters indicate effective system operation.

Results/Conclusions. Reviewing these data provided insight into optimizing VIMS design and long-term performance monitoring. Recommendations that account for seasonal and annual variations in subsurface conditions include: (1) collecting longer-term pressure, groundwater level, and meteorological data during system design; (2) conducting diagnostic testing during the season with the highest precipitation, which can significantly influence subsurface-to-indoor differential pressure; and (3) at sites with shallow water tables, designing systems with more diffuse system vacuums and variable flow rates to minimize system impacts on the groundwater elevation. Recommendations for optimizing performance monitoring and ensuring long-term operational success include: (1) collecting exhaust concentrations for insight into long-term subsurface source strength trends; (2) collecting limited blower flow rate readings and monitoring the system vacuum frequently or with telemetry; and (3) either not collecting or limiting indoor air sampling, which is not typically indicative of system performance and often identifies transient background indoor air sources in industrial buildings.