Design of an Active Vapor Mitigation System to Allow Residential Reuse of a Multistory Historical Building with a Challenging Foundation Plan

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Background/Objectives. Vapor intrusion to indoor air is a major concern for developers of impacted commercial and industrial properties. In particular, retrofitting vapor mitigation systems to existing structures can be a significant challenge, especially when the building has historical elements that must be preserved. While there is a wealth of guidance on vapor intrusion sampling and evaluation methods, there are only general guidelines on how to actively mitigate the vapor exposure pathway during a retrofit. Much of the available guidance is still based on radon mitigation practices or passive systems which may not be applicable for complex commercial/industrial structures that are undergoing renovations. Health department guidelines are also becoming more stringent and are more often requiring active vapor mitigation systems that are engineered from the ground up to demonstrate vapor control. Vapor mitigation systems must also be designed to meet client/owner risk management objectives. This case study focuses on design principles and lessons learned dealing with a historical monument building with mixed foundation types.

Approach/Activities. Active vapor mitigation designs can be based in principle on in situ remediation concepts and may require hybrids of several vapor control technologies to achieve the required performance goals. A vapor mitigation system was designed to address potential BTEX and TCE vapors from entering a multi-story historical building undergoing renovation for residential reuse. The building contained a complex foundation due to phased expansion of the structure using various construction techniques (including basements, slab on grade, crawlspaces, elevator shafts, and utility corridors). Parts of the foundation were also installed within saturated clay soils which introduced the potential for water saturation affecting system performance. Innovative designs were used to create active vapor control, including slab-on-slab depressurization design, utility corridor isolation techniques, vapor barriers, and air exchange systems, to create a system that could be optimized and effectively monitored to meet the performance requirements.

Results/Lessons Learned. Providing a clear methodology and a plan to provide multiple lines of evidence to demonstrate that vapor intrusion control is performing as designed is key to regulatory and municipal acceptance of the design. If well planned, standard monitoring strategies can be used to present a practical and defensible model for a real world system.