

HVAC Systems for VI Mitigation in Large Buildings: Reliability and Long-Term Performance Monitoring Considerations

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Background/Objectives. For some commercial and industrial buildings, the use of heating, ventilating, and air conditioning (HVAC) systems to mitigate vapor intrusion (VI) may be preferable to other common mitigation methods, such as subslab depressurization (SSD). Such a preference could be due to building-specific factors such as more favorable feasibility, cost, and/or schedule of implementation of HVAC versus SSD mitigation. However, HVAC systems are often viewed as less reliable than SSD systems. As with any mechanical system, the reliability of using HVAC as an engineering control is dependent upon a proper understanding of how the system configuration and operation contribute to the desired results. The objectives of this presentation are to review how HVAC systems can be used as reliable VI mitigation systems, and the factors for selecting appropriate long-term performance monitoring parameters.

Approach/Activities. Central to the effective use of and reliance on HVAC systems for VI prevention is the recognition that as a mechanical system, similar to an SSD system, certain operating parameters are critical. While the performance parameters for SSD systems are relatively simple (e.g., confirmation of subslab vacuum field), the appropriate monitoring parameters for HVAC systems are not as obvious, and likely to be building-specific and system-specific. Long-term HVAC system performance can be compromised by unintended changes in operating conditions (e.g., air exchange, pressure), or modifications arising from changes in building use and/or occupancy. As with any mechanical system, unintended changes in operations can be caused by equipment malfunction, inadequate maintenance, or other factors. Using large building examples, we will examine the potential vulnerabilities of HVAC operations and discuss how weaknesses can be addressed. We will discuss the value of implementing a Performance Monitoring and Maintenance Plan (PMMP) to ensure that HVAC systems are maintained at conditions consistent with acceptable indoor air quality. Many state-published VI guidance documents recommend more frequent monitoring and confirmatory sampling when HVAC systems are employed for VI control in lieu of SSD, but specific HVAC monitoring parameter recommendations are not typically provided. Periodic confirmatory indoor air sampling is commonly recommended as a default performance measure, but this can be costly over the long-term and not particularly representative or protective of human health risk. We'll discuss whether appropriate HVAC system monitoring can reduce or eliminate the requirement for periodic confirmatory indoor air sampling.

Results/Lessons Learned. If HVAC systems are being relied upon as an engineering control for VI mitigation, then a thorough understanding of the factors that can influence HVAC system performance must be achieved and controlled over the long term. When implemented appropriately, an HVAC PMMP will identify the critical operating conditions and parameters to ensure the long-term effectiveness of VI mitigation. Similar to an SSD system, as long as the critical operating conditions are maintained, the HVAC system should provide consistent, sustained performance for long-term VI mitigation. In addition, an HVAC PMMP represents an improvement over typical VI guidance default recommendations for periodic confirmatory indoor air sampling, such that in some cases, confirmatory sampling could be reduced or even eliminated, consistent with long-term monitoring programs for many SSD systems.