Vapor Intrusion Mitigation: A Different Spin on HVAC Systems

Omer Uppal (ouppal@langan.com), ***Matt Ambrusch***, and Andrew Quinn
(Langan Engineering, Parsippany, NJ, USA)
Ryan Andersen and Caryn Barnes (Langan Engineering, Philadelphia, PA, USA)
Stewart Abrams (Langan Engineering, Lawrenceville, NJ, USA)

Background/Objectives. The issue of intrusion of contaminated soil gas into occupied buildings has gained much attention in the environmental industry and scientific community. Vapor intrusion can pose significant exposure risks to human health. With the better understanding of these risks and the improved sampling and detection methodologies, regulatory framework has become more stringent and widespread. Complex sub-slab environments, existing building infrastructure and the different fate and partitioning behavior of various contaminants have necessitated the development of innovative vapor intrusion mitigation strategies. Through the use of well-established pneumatic principles and protocols, once such strategy is the use of existing heating, ventilation and air conditioning (HVAC) systems to mitigate vapor intrusion; whether through applying a positive pressure throughout the building or enhancing the number of room flushes achieved in a given day. This presentation is designed to identify the potential applicability of HVAC systems in mitigating the intrusion of contaminated vapors, the site-specific characteristics that must be considered, and the operating parameters that must be monitored and maintained through the evaluation of a unique case study in northern New Jersey.

Approach/Activities. At the site of a large trichloroethylene (TCE) groundwater plume, a large-scale vapor intrusion investigation was completed in a number of buildings on site. As a result of this investigation, indoor air concentrations of TCE were found to be in exceedance of its respective New Jersey Department of Environmental Protection (NJDEP) non-residential indoor air screening level. As such, potential strategies to mitigate the vapor concern were evaluated, considering the existing building infrastructure, the current use of the building, and the relative concentrations of TCE in indoor, as compared to in soil gas. Due to minor exceedances, and more importantly the active and sensitive nature of the current building use, the use of the existing HVAC infrastructure as a means to mitigate the vapor concern was evaluated. The building of interest had an extensive network of ceiling mounted HVAC extraction fans that were only typically operated during times of high ambient temperatures. In addition, due to the operations of the building, building windows and doors were open throughout the day making it potentially difficult to apply and maintain a pressure within the building, as is typical for a HVAC vapor mitigation system. Considering these factors and others, such as the presence of Class I, Division 2 classified room within the building, the ultimate vapor mitigation design relied on volume flushes of the building with fresh ambient air via continuous operation of some of the existing HVAC equipment.

Results/Lessons Learned. The implemented vapor intrusion mitigation system relies on the continuous flushing of the room air, as such, the system required a means in which to ensure the HVAC equipment was continuously operating and operating within the design ranges. This was accomplished through the modification of the existing HVAC infrastructure with unit-specific instrumentation and associated alarm interlocks and remote telemetry system. Of utmost importance was the prevention of a vacuum gradient within the building as a result of the extraction/flushing air from the building, which could potentially induce the intrusion of vapors. To prevent such conditions, passive air inlet vents, allowing process makeup air from outside of the building were installed and building pressure is monitored. Based on the remote monitoring

of the system and system performance verification sampling, it has been confirmed the system has, and continues to, effectively mitigate the vapor concern.