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The Use and Effectiveness of Subslab and Subsurface Vapor Extraction for Simultaneous Contaminant Mass Removal and Exposure Control

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Background/Objectives. Currently, subslab and submembrane mitigation for the control of occupant exposure to subsurface volatile organic compounds (VOCs) is considered a necessary engineering control that allows for continued occupancy of a structure or property that could otherwise pose a health risk for the occupant. The science behind and effectiveness of these methods have been established for decades – first for the mitigation of Radon exposure and then for the mitigation of vapor intrusion (VI) by VOCs.

Soil vapor extraction (SVE) has historically been utilized as a method for contaminant removal in instances where other remediation options, such as source removal, chemical oxidation, or bioremediation, are not economically or logistically viable. SVE is also utilized as a means of enhancing other remediation technologies or as a finishing step to remove contaminants that remain after other remediation options.

Protect Environmental (Protect) is currently evaluating the effectiveness of a sub-slab vapor extraction system – currently and historically utilized for indoor air mitigation and exposure prevention – as a means of long-term contaminant mass removal from a contaminant source located beneath an actively occupied slab-on-grade structure. The goal of this research is to evaluate the effectiveness of sub-slab vapor extraction as a cost-effective and low-maintenance means of substantial contaminant mass removal while simultaneously controlling building occupant exposure through the VI pathway to the hazardous and potentially hazardous VOCs.

Approach/Activities. Protect has installed a series of subslab vapor extraction systems at an actively occupied facility in Indianapolis, Indiana. Subslab concentrations of the target VOCs were initially measured at over 1,000,000 µg/m^3. The initial extraction effluent concentrations were initially measured at over 500,000 µg/m^3. These concentrations will be routinely monitored in order to evaluate the contaminant removal rate as the system moves from the initial contaminant mass removal rate and reaches secular equilibrium and the associated steady mass removal rate.

Results/Lessons Learned. Initial projections of contaminant mass removal were determined to be in the range of single-digit pounds per day and single-digit tons per year. In terms of cost efficiency, the sub-lab vapor extraction systems reported an initial cost per pound of VOC removed at less than $1.00 USD when amortized over a five-year window.