Detailed Field Evaluation of Soil Vapor Extraction to Prevent Vapor Intrusion

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SVE to Prevent VI - Background

 Soil vapor extraction (SVE) technology is commonly applied to remove VOCs from contaminated soil

 Although SVE typically focuses on VOC mass removal to remediate the soil, a vacuum is applied to extract VOC vapors in soil gas that may be useful at VI sites.

• By applying a vacuum, an SVE system may offer a double benefit in controlling flow across the slab, analogous to an active subslab depressurization (SSD) mitigation system, as well as a means for removing soil gas containing VOC vapors from the subsurface.



Objectives

- Monitor the effectiveness of an SVE system in reducing or preventing VI in neighboring buildings, and thus eliminate the need for a separate mitigation system?
- Determine the cost effectiveness and feasibility of deploying SVE for VI control



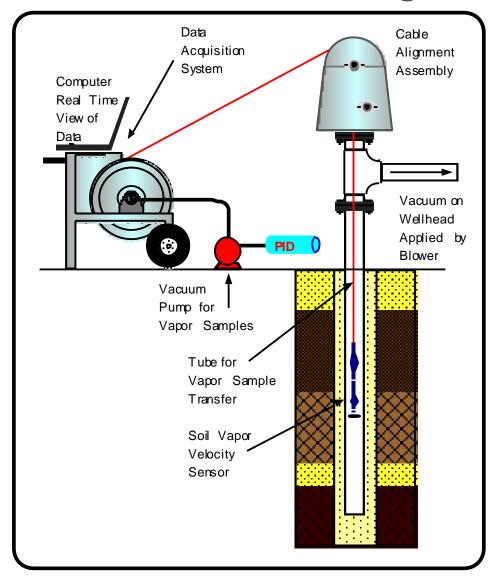
 Examine "how long" an SVE system has to be operated and maintained before "remedial success" can be declared with regard to VI and the system can be deactivated and removed.

Site Characteristics

- Dense urban environment
- Site was a metal plating shop using solvents – with much of one building destroyed by fire (only slab remains)
- Site underlain with fairly coarse alluvium
- Deep water table (60')
- Regional solvent plume(s) and possible local sources in the vadose zone
- Prior limited SVE and excavation remedies; VI indicated in some buildings
- Monitored buildings for current project are slab on grade typically one and two story, variety of commercial occupants



What is PneuLog®?



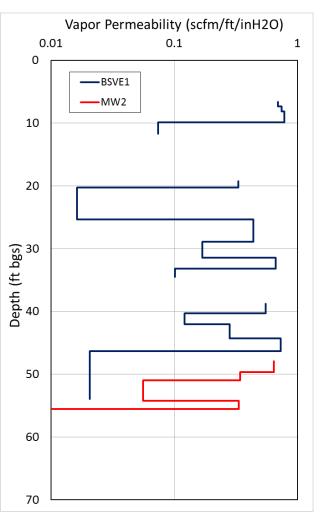
Diagnostic Tool:

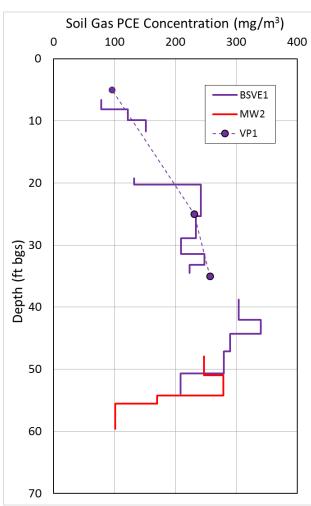
measures contaminant and air permeability in vadose zone soils during vapor extraction along the well screen; analogous to a water well spinner log but includes vapor sampling at discrete depths

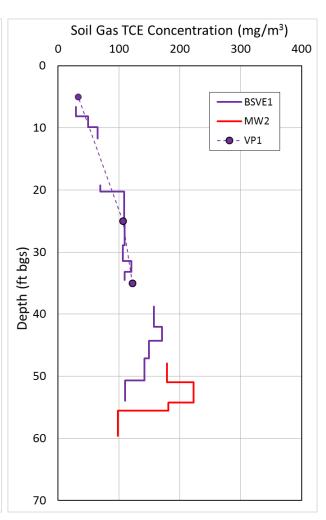


Pretest Site Characterization with PneuLog®

BSVE1









Methods – Phase 1 and Phase 2

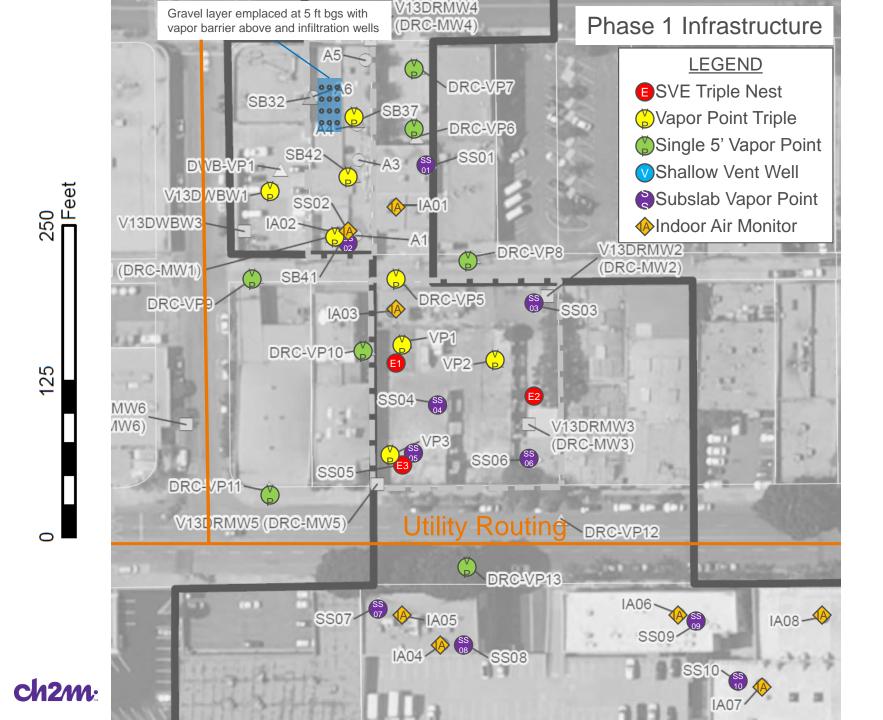
Phase 1 System:

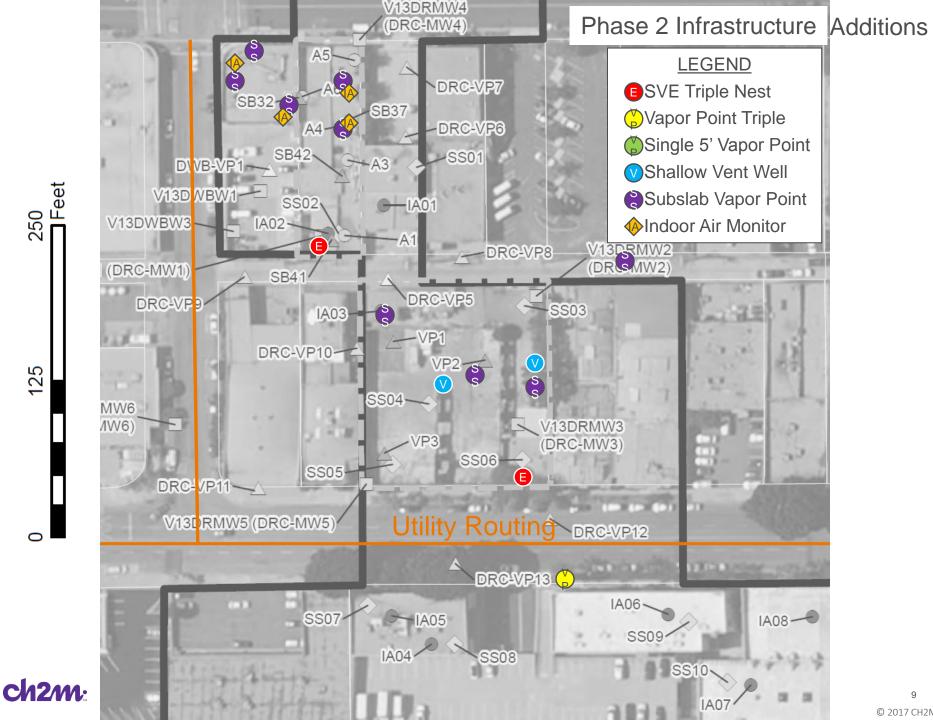
- Three, 3-level SVE wells with influent/effluent monitoring. 20 HP blower.
- Numerous soil gas monitoring points, multilevel and beneath slabs
- Monitoring pressure/vacuum in soil gas and across slabs
- Monitoring VOCs using several methods in seven buildings
- April 2016 initial step testing transitioning to all zone operations
- June 2016 Start Rebound
- September 2016 restart SVE

Phase 2 Additions:

- Additional SVE wells to decrease VOCs in gaps of original wells' influence
- 2 vent wells to ameliorate high VOC levels or dead zone buildup under outdoor slab
- Additional soil gas monitoring points to address high VOC areas and new treatment zones
- Monitoring VOCs using several methods in two additional buildings
- December 2016 Phase 2 system on

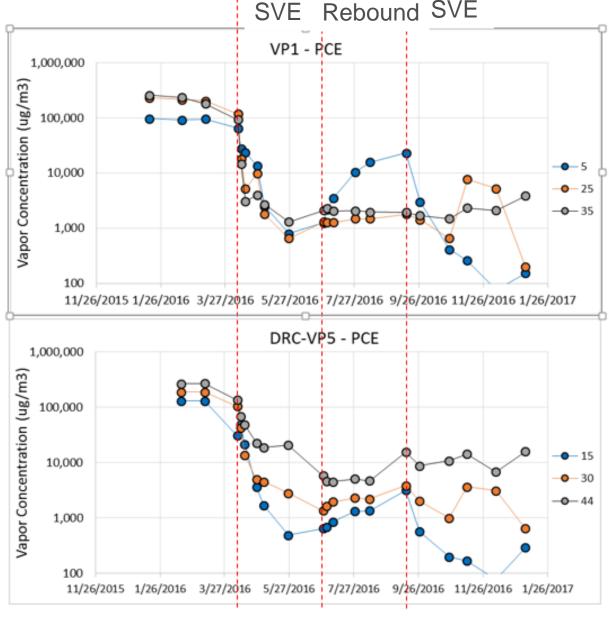






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Example Soil Gas Results



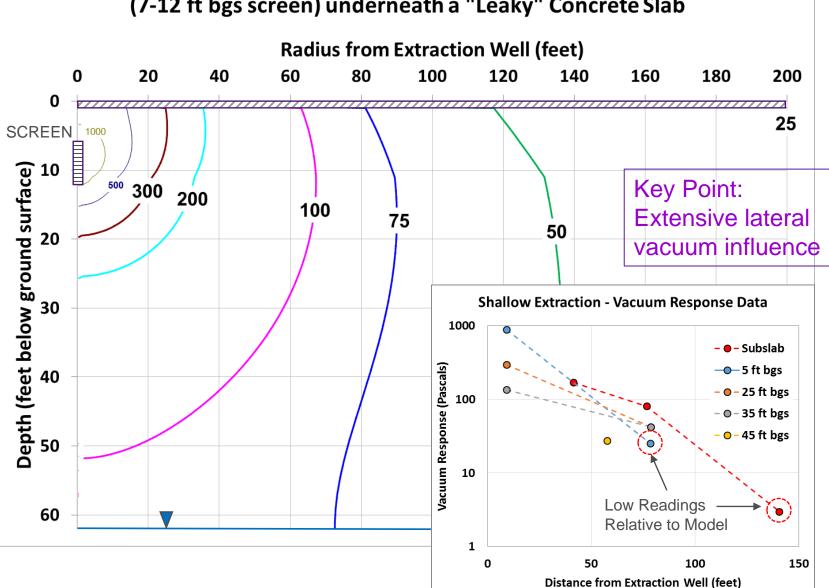
- Near source zone and <20 ft. from Phase 1
 Extraction Well
- Rapid reduction at all depths

- Across Alley and 175
 ft. from Phase 1
 Extraction Well
- Slower response than VP1
- Lesser response with increasing depth



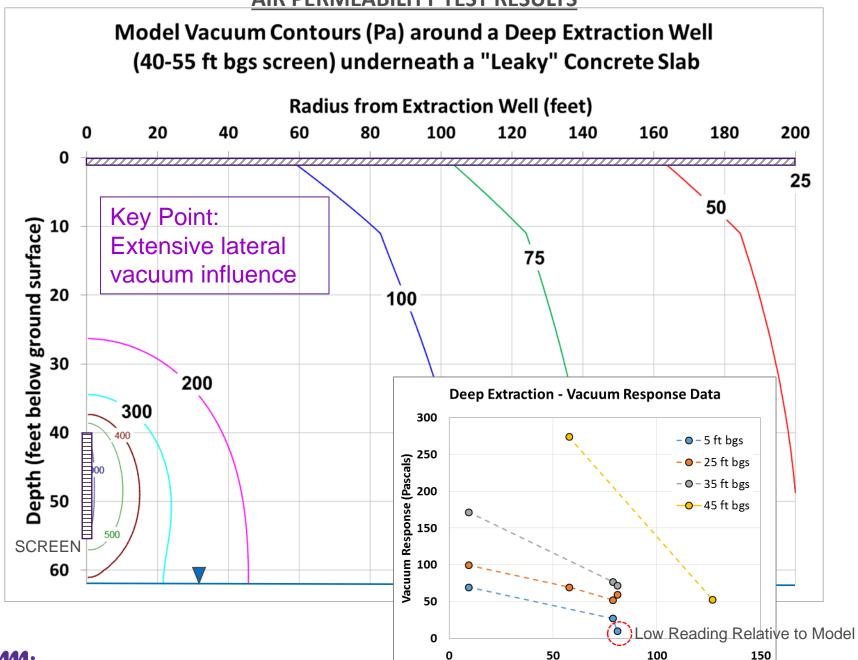
AIR PERMEABILITY TEST RESULTS

Model Vacuum Contours (Pa) around a Shallow Extraction Well (7-12 ft bgs screen) underneath a "Leaky" Concrete Slab





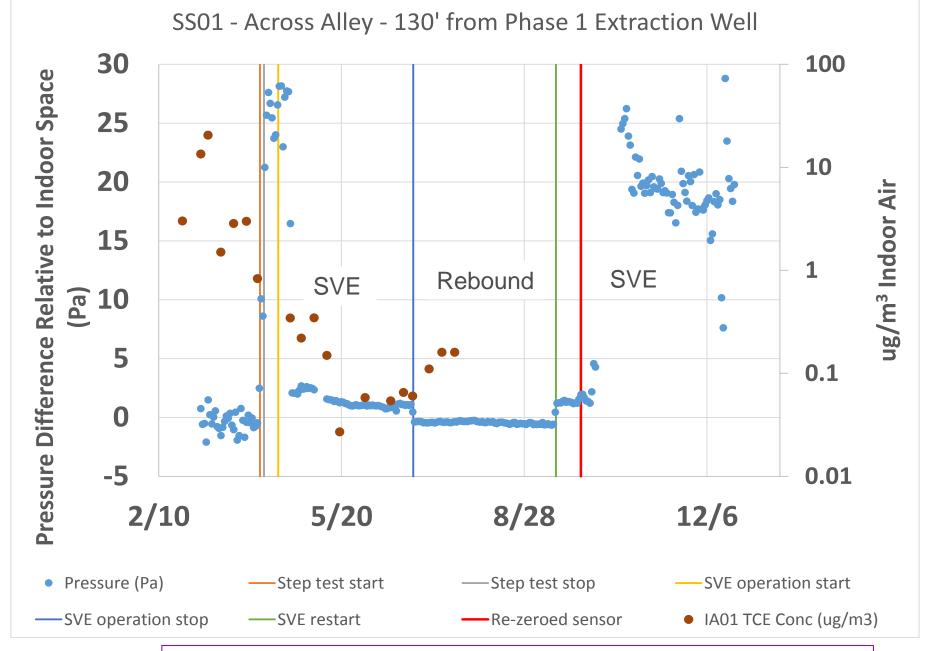
AIR PERMEABILITY TEST RESULTS



Distance from Extraction Well (feet)

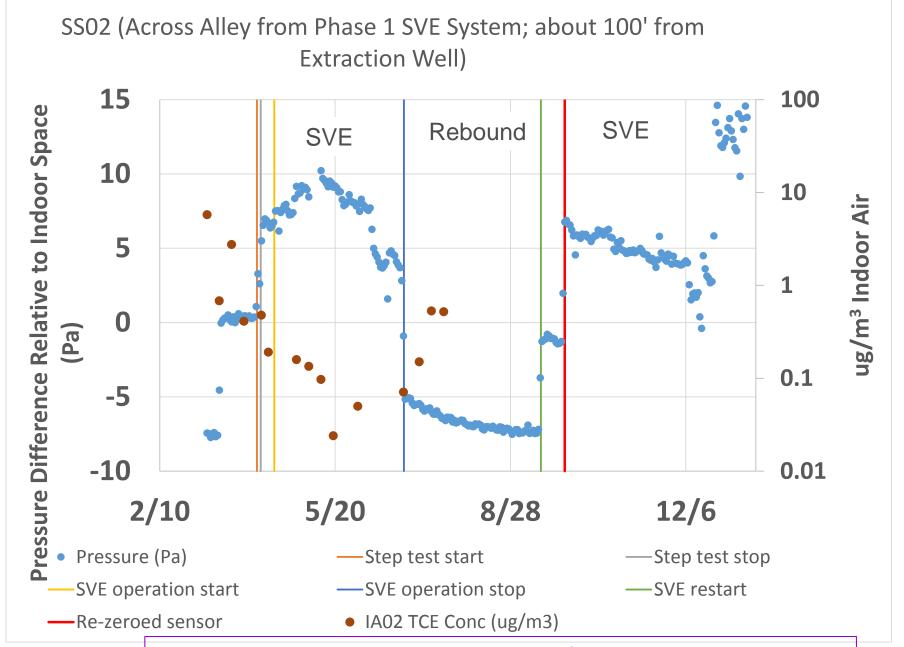
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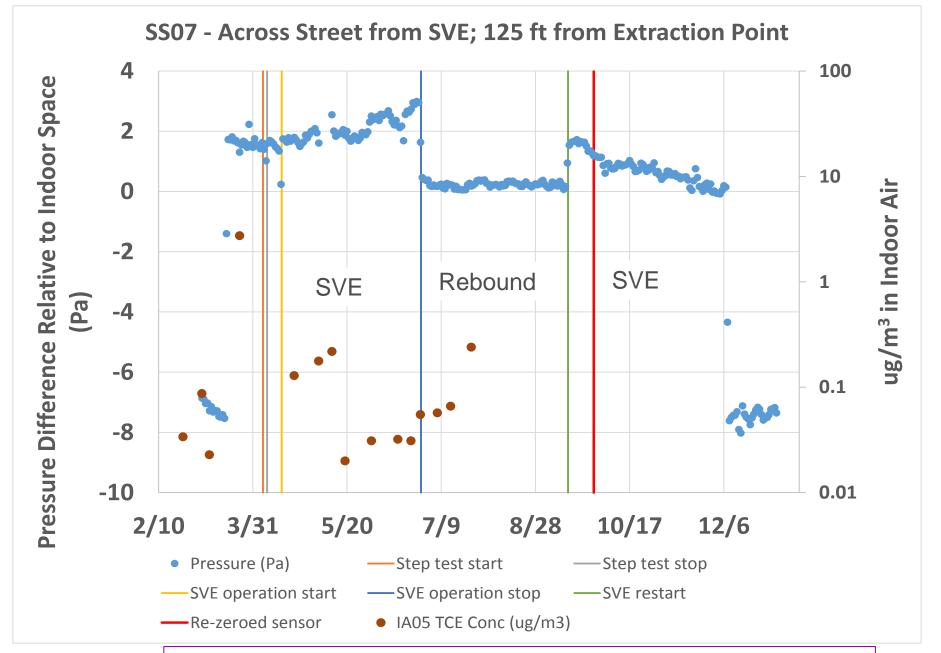


Key Point: At a considerable distance SVE has a beneficial effect on indoor air and cross slab pressure differential.



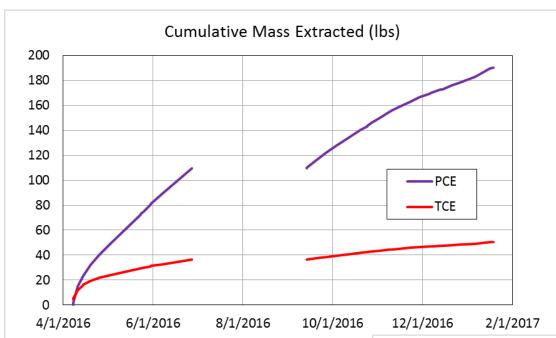


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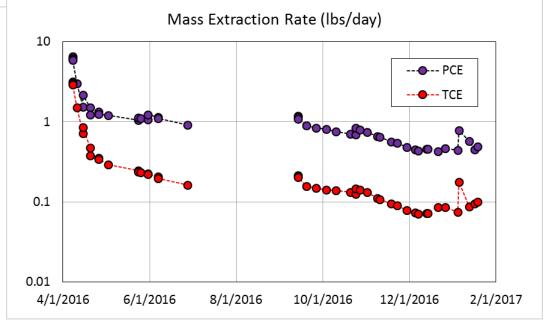


Key Point: Across the street, beneficial effects less clear, perhaps because of utility corridors blocking vacuum effect.



Cumulative Mass Extracted by Entire SVE System

Key Point: Mass removal greatest immediately after startup as expected, but with system adjustments are achieving continued benefits.





Summary to Date

- Phase I SVE reduced VOC concentrations and mass in the vadose zone and indoor air VOC concentrations, bringing the site closer to EPA's final objectives.
- Soil gas concentrations have been reduced to close to target levels in some but not all areas.
- Differential pressures showed that the pressure control for VI protection extends 125 ft or more from SVE wells, especially to the north of the site.
- Indoor concentrations decreased >100 ft from SVE During rebound (SVE off) indoor air VOCs rebounded, increasing for more than a month.

Thank you!

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