U.S. EPA "State of VI Science" Workshop

Reducing Vapor Intrusion Uncertainties by More Frequent Simple Measurements and Community Involvement

Other ORD Research Efforts

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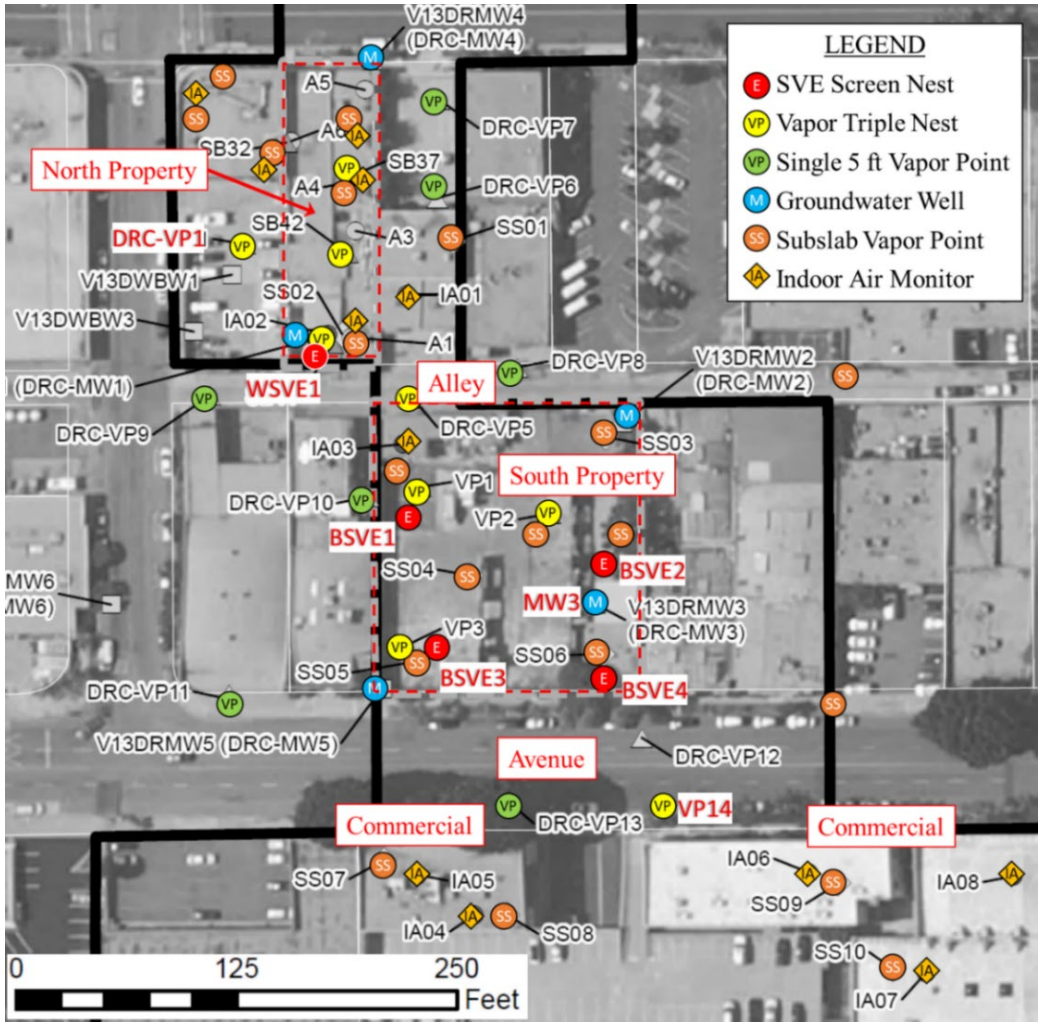
30th Annual International Conference on Soil, Water, Energy, and Air, A Virtual Conference, March 22nd, 2021

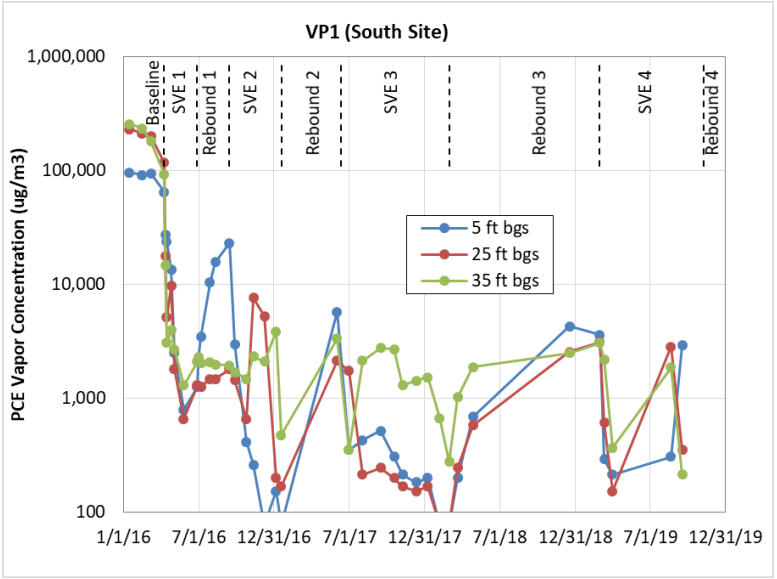
SVE for VI Mitigation

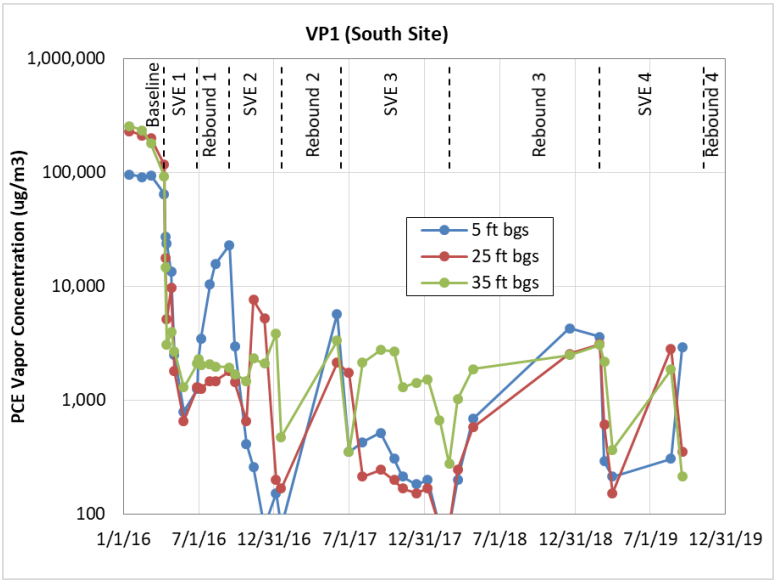
- As a refresher:
  - Research done at DriLube site in Glendale, CA
  - SVE not only remediated the site but provided mitigation of VI in surrounding neighborhood
  - Testing run from 2016 to 2020 with multiple (4) SVE on/off period to allow for examination of rebound effects



SVE for VI Mitigation

- Major findings:
  - Rebound effects were seen in the external soil gas response with ever decreasing starting points when the SVE turned on at all 3 screened well depths
  - Similarly, subslab concentrations followed the same general pattern of responses to SVE on/off cycles
  - General reach of the vacuum when the SVE was in operation ranged out to 150+ ft



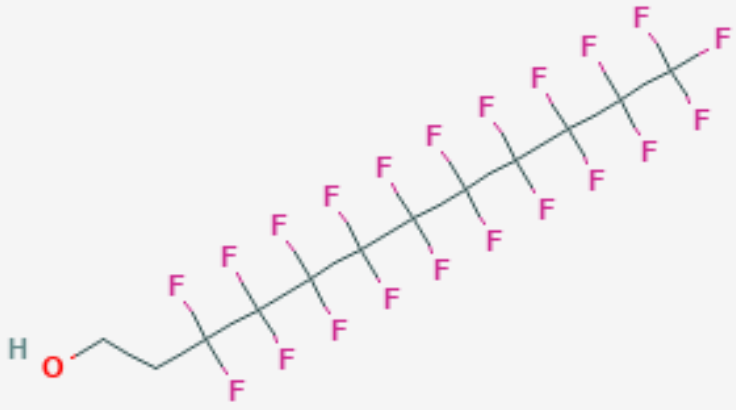


SVE for VI Mitigation

- Publications:
  - Stewart, L., C. Lutes, R. Truesdale, B. Schumacher, J. Zimmerman, and R. Connell. 2020. Field Study of Soil Vapor Extraction for Reducing Off-Site Vapor Intrusion. Groundwater Monitoring & Remediation 40(1):74-85.
  - Stewart, L., C. Lutes, R. Truesdale, B. Schumacher, J. Zimmerman, and R. Connell. In press. Effectiveness and limitations of soil vapor extraction (SVE) for reducing vapor intrusion (VI) by chlorinated VOCs. Groundwater Monitoring and Remediation (In press)
  - Lutes, C., L. Stewart, R. Truesdale, J. De Loera, J.H. Zimmerman, and B. Schumacher. Cost Comparison of Soil Vapor Extraction and Subslab Depressurization for Vapor Intrusion Mitigation. Groundwater Monitoring & Remediation. (Accepted)
- What's next?
  - Release an EPA report style document with rest of results and more discussion
  - Release the database to the general public

PFAS Vapor Intrusion Potential

- At request of OLEM, ORD has initiated research on the potential for PFAS compounds to be a factor related to vapor intrusion.
- Chemically, certain classes of PFAS chemicals are volatile but can and do they migrate through the vadose zone, to subslab, and then potentially into a residence or building
  - Volatile PFAS classes include:
    - Fluorotelomer alcohols – 4:2, 6:2, 8:2, 10:2 and 12:2 FTOH and 7:2 sFTOH
    - Fluoro-1-octansulfonamide (FOSA) – n-Ethyl and n-Methyl
  - Also PFOA, PFOS, PFHxS, PFBA, PFHpA, PFHxA, PFPeA, 8:2FTAL



10:2 FTOH

$C_{10}H_5F_{17}O$

PFAS Vapor Intrusion Potential (cont.)

- Pilot Study:
  - Site selection
    - Have one fluoropolymer manufacturer site
      - CRADA is in the works
      - Preliminary data indicated FTOHs in groundwater
      - Will be able to collect groundwater, soil gas, and subslab gas
    - Looking for other accessible sites
  - Analytical laboratories
    - Have one for groundwater
    - Have one for air/soil gas
      - Research under way to refine soil gas sampling methods

PFAS Vapor Intrusion Potential (cont.)

- What's next:
  - Once CRADA in place, field sampling followed by analyses will commence
    - Basic groundwork has already been performed
- The Future:
  - Full-scale field study including indoor air

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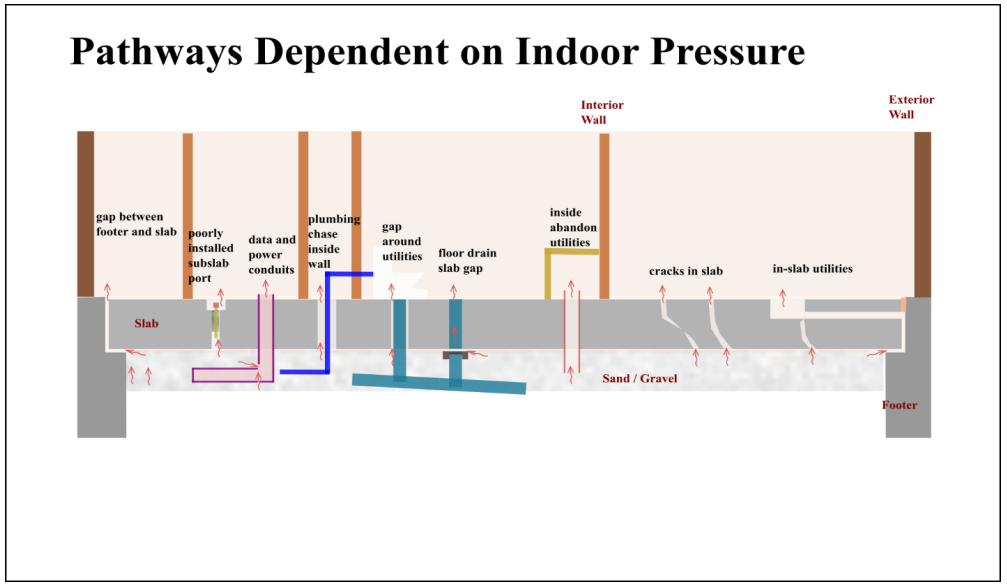
Preferential Pathways Study

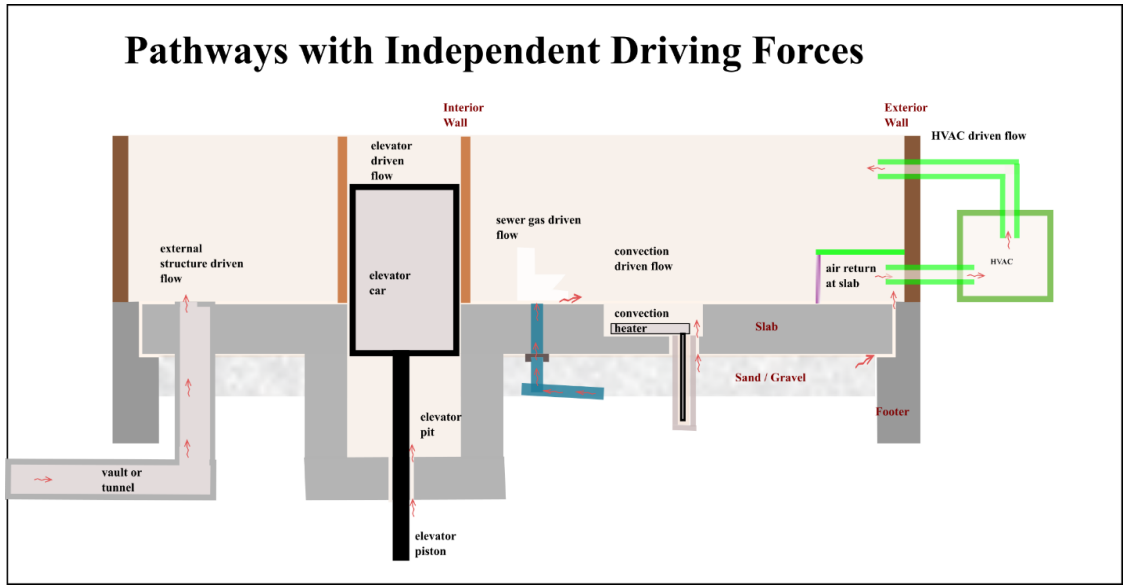
Mathew Plate, USEPA Region 9

30th Annual International Conference on Soil, Water, Energy, and Air, A Virtual Conference, March 22nd, 2021

Preferential Pathways Study

- Vapor entry from identifiable VI pathways
  - Common in non-residential sites with VI investigated in California
- 2018 – 2020 Preferential Pathways Study developed to help understand these pathways

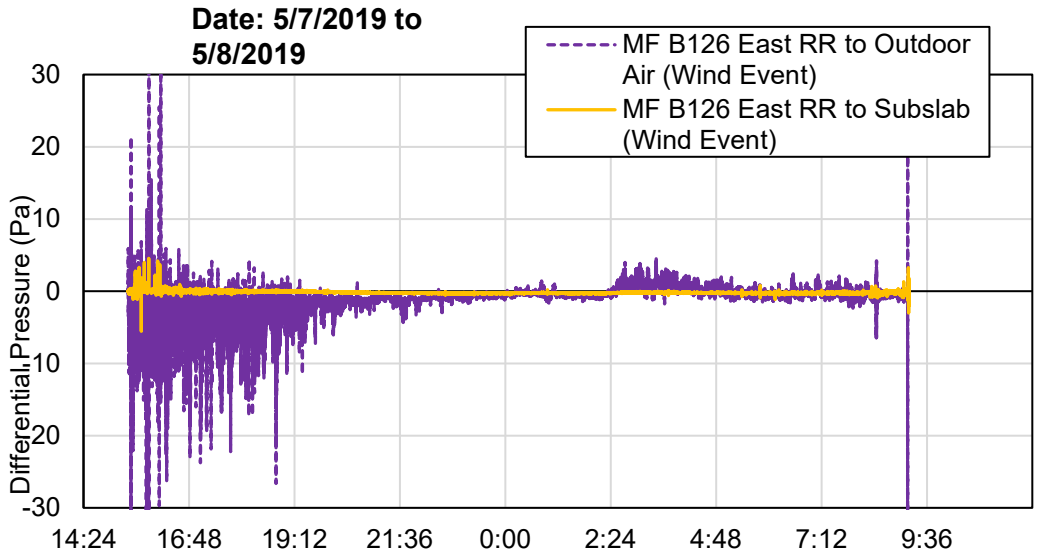


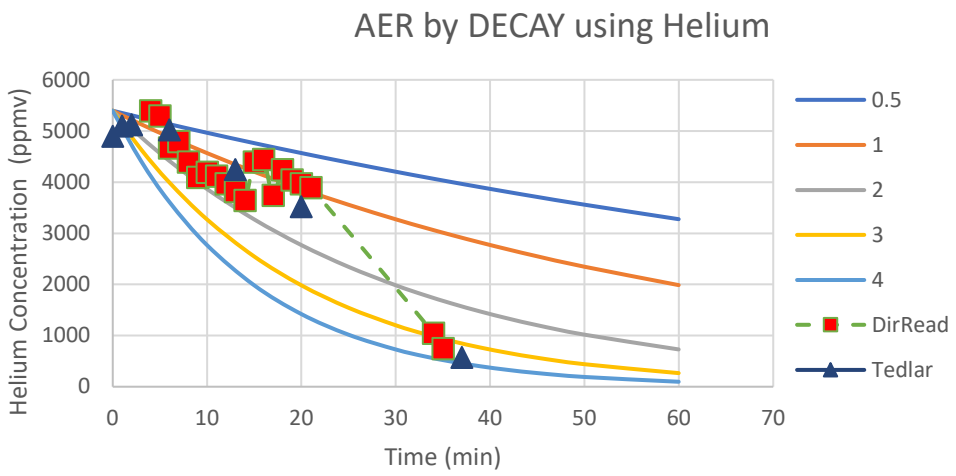


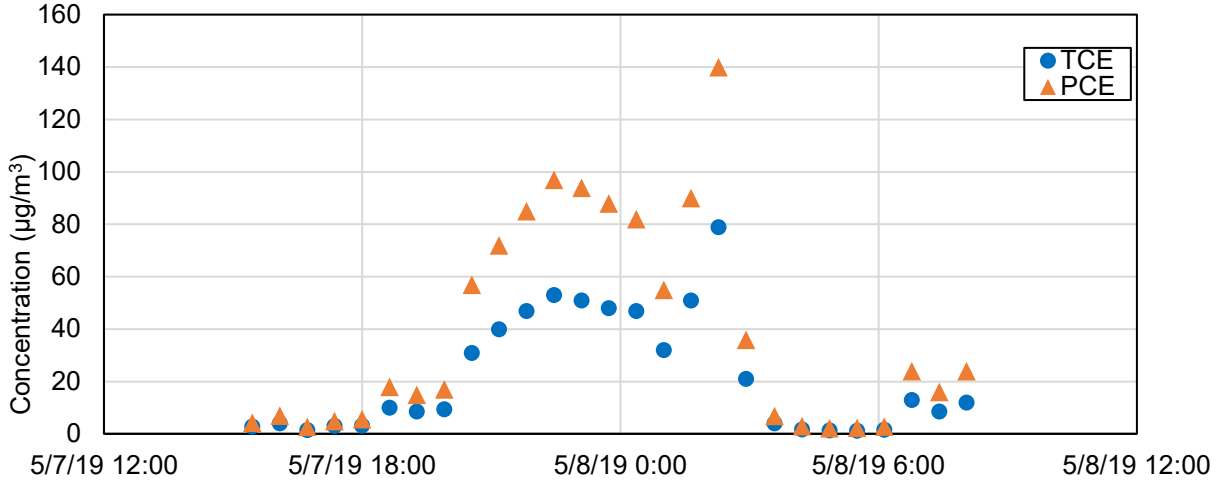
Examples of Pathways we have Observed in California

Preferential Pathways Study

- Study to:
  - Identify Pathways
  - Develop Tools for Investigation
  - Understand and Quantify Pathway Contributions to VI
  - Test Pathway Mitigation

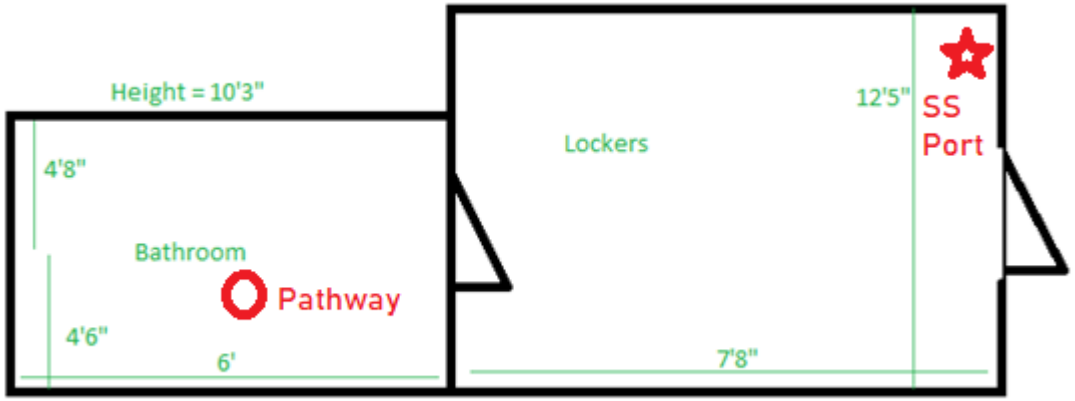


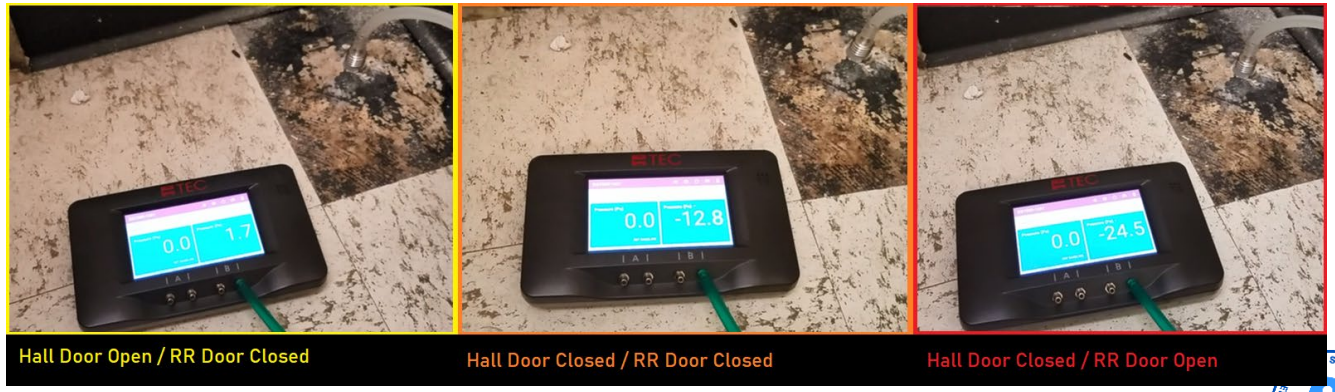




Preferential Pathways Conclusions

- Real time VOC data is sometimes needed to understand pathway VI
- Pressure logging tools are essential
- Flow, Tracer, and Air Exchange tools are helpful
- Radon is helpful at some sites
- Characterizing pathways facilitates mitigation





RR fan & pathway depressurize SS →→ RR fan depressurizes locker room

Preferential Pathways Future Needs

- Easier-to-use real time VOC instruments (CRDS, FTIR, GC, & GCMS)
- VI Pathway identification and characterization guide for building evaluations
- Pathway attenuation
- Further studies with better quantification of pathway entry