



Soil Vapor Extraction (SVE) as a Tool for Soil Gas Management in Neighborhoods

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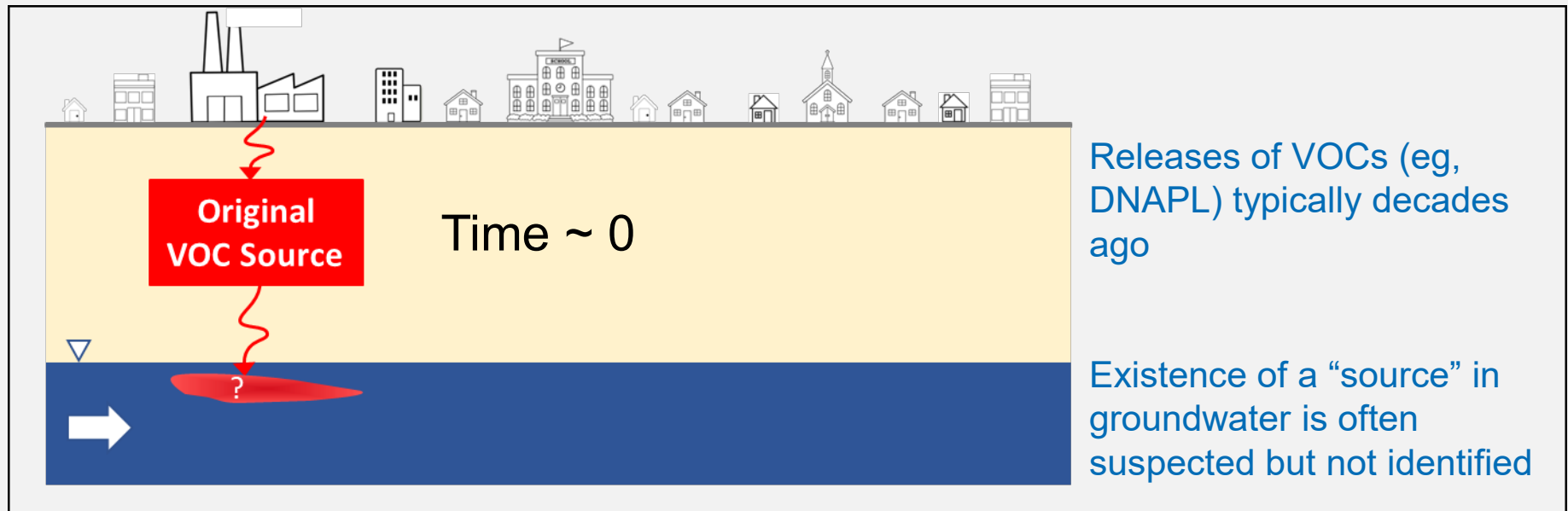
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Overview

- Various Definitions of Source(s)
- Summary of EPA Field Study Results
- Preliminary Design and Operational Concepts for VI Mitigation with SVE in DOWNGRADIENT areas

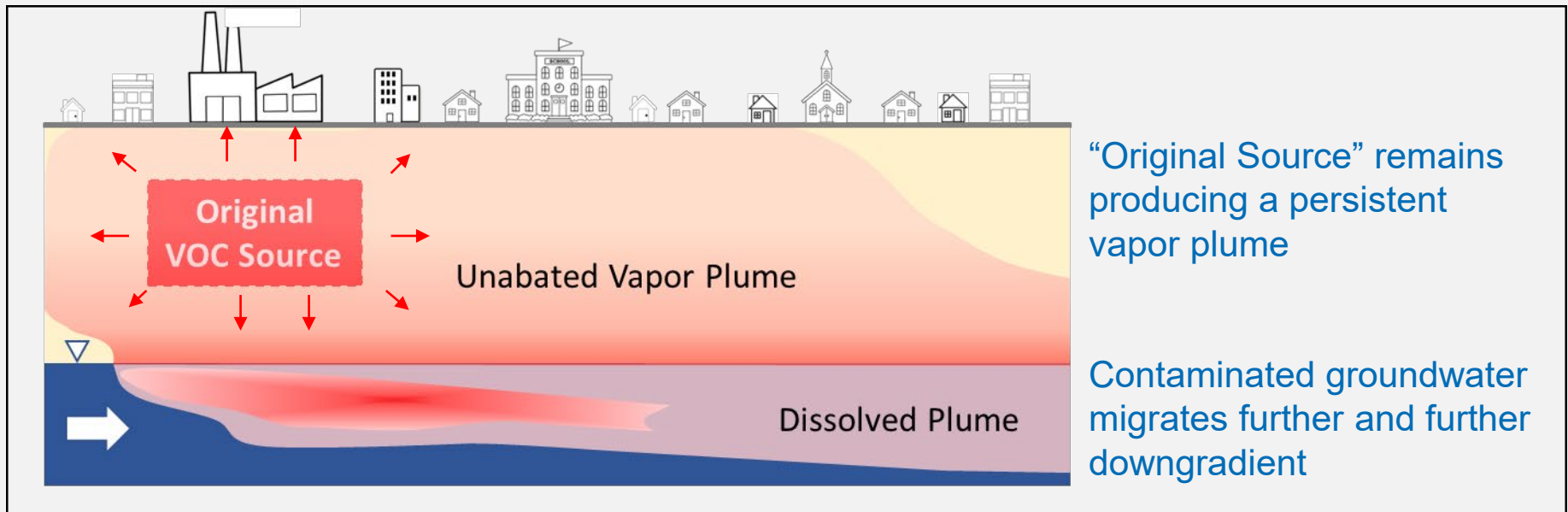
The Evolution of “Sources”

– depends on your perspective and timing



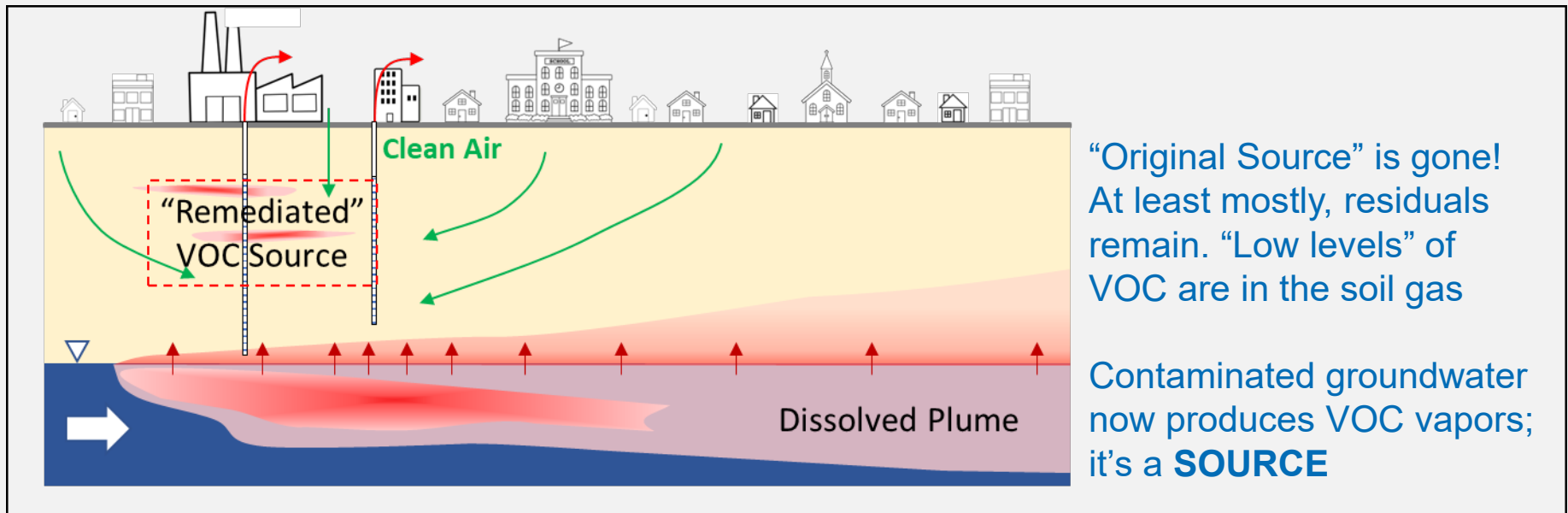
What is a “Source of VOCs”?

- Step forward a decade or so after release to subsurface



What is a “Source of VOCs”?

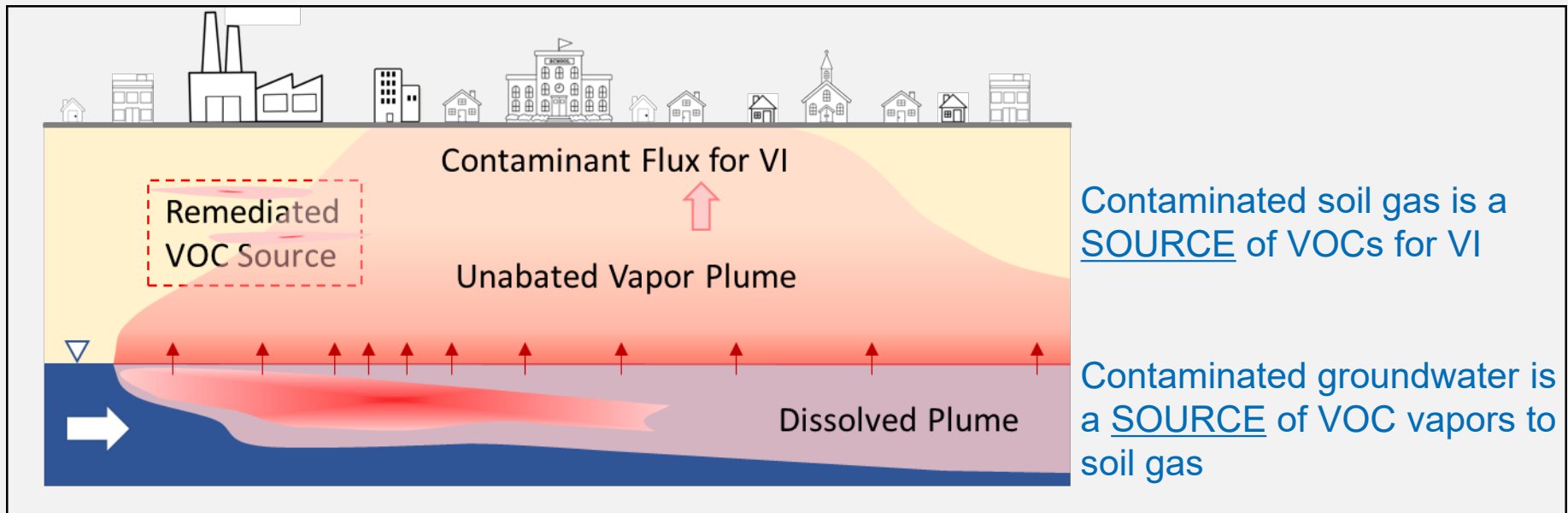
- First step in active remediation is usually soil vapor extraction (SVE) in vadose zone



- After some years of operation, SVE mass recovery is asymptotically low and “not worth continuing”

What is a “Source of VOCs”?

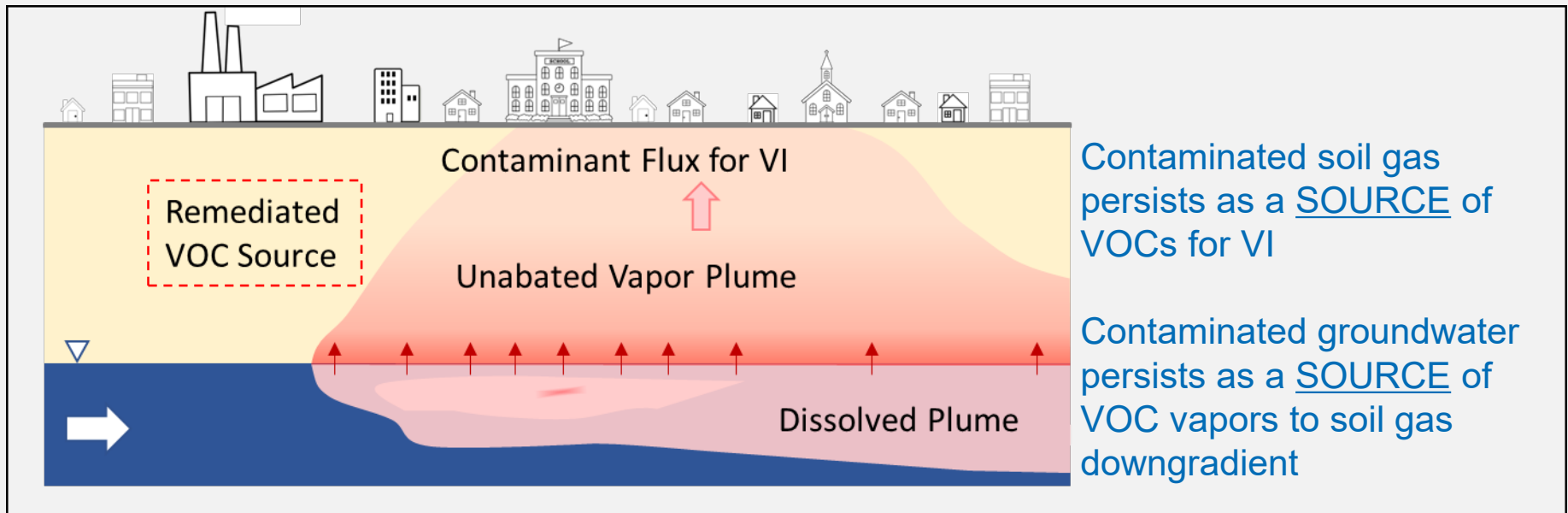
- Step forward a few years or a decade **AFTER SVE ceases**



- Sources for vapor intrusion persist in the groundwater and residuals in soils

What is a “Source of VOCs”?

- Step forward a few years or a decade AFTER “source” groundwater cleanup



- Now what? The “Source Zone” is cleaned up

SVE to Mitigate VI – Field Study

- SVE can mitigate through two processes:
 1. *Remove soil gas containing VOC vapors*
 2. *Create subslab depressurization (SSD)*
- Problem: Can SVE operation mitigate VI over significant distances?
- Consideration: Typical SVE for “cleanup” is large, permitted, and relatively expensive to operate.

Can a small SVE system handle downgradient “sources”?

EPA Field Study of SVE for Cleanup & Mitigation

- *applicable to Soil Gas Safe Communities*

Install and operate SVE for cleanup
& VI control to:

1. Monitor area-wide ***effectiveness***
2. Assess ***cost effectiveness***
3. Develop ***preliminary design concepts*** for VI control



● Suspected Surface Release Points



Suspected Groundwater Source Mass (Plume)

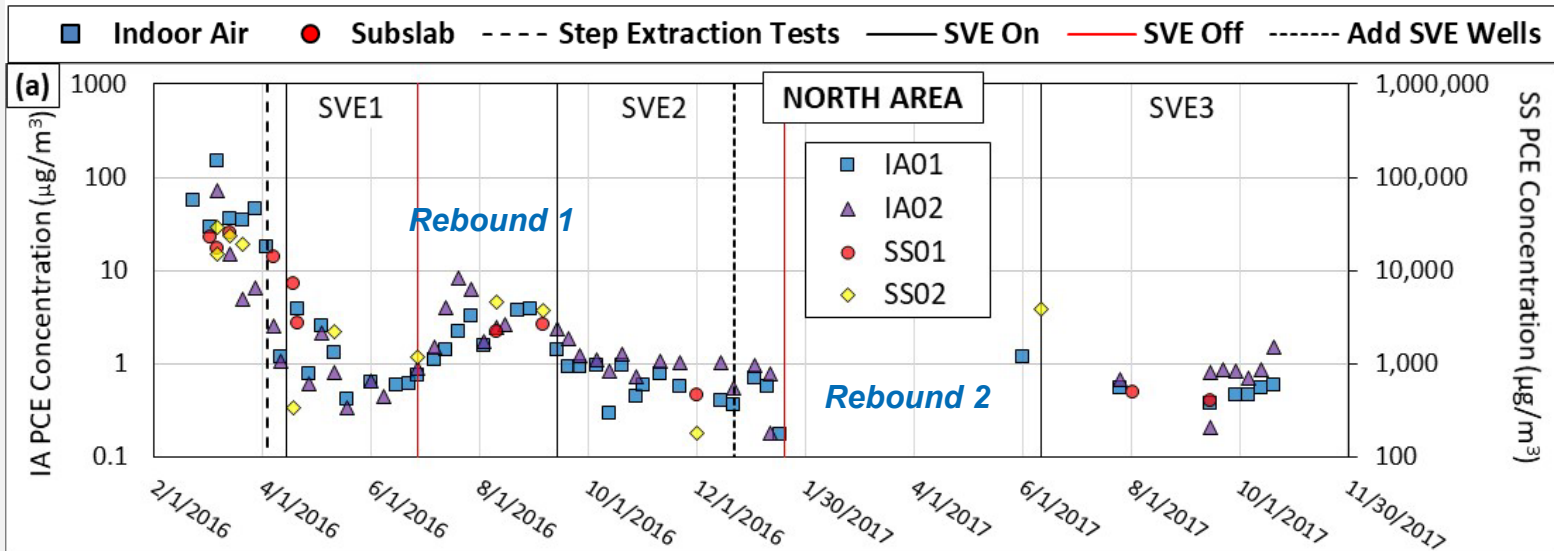
- SVE Well
- Subsurface Points
- SS/IA Sampling



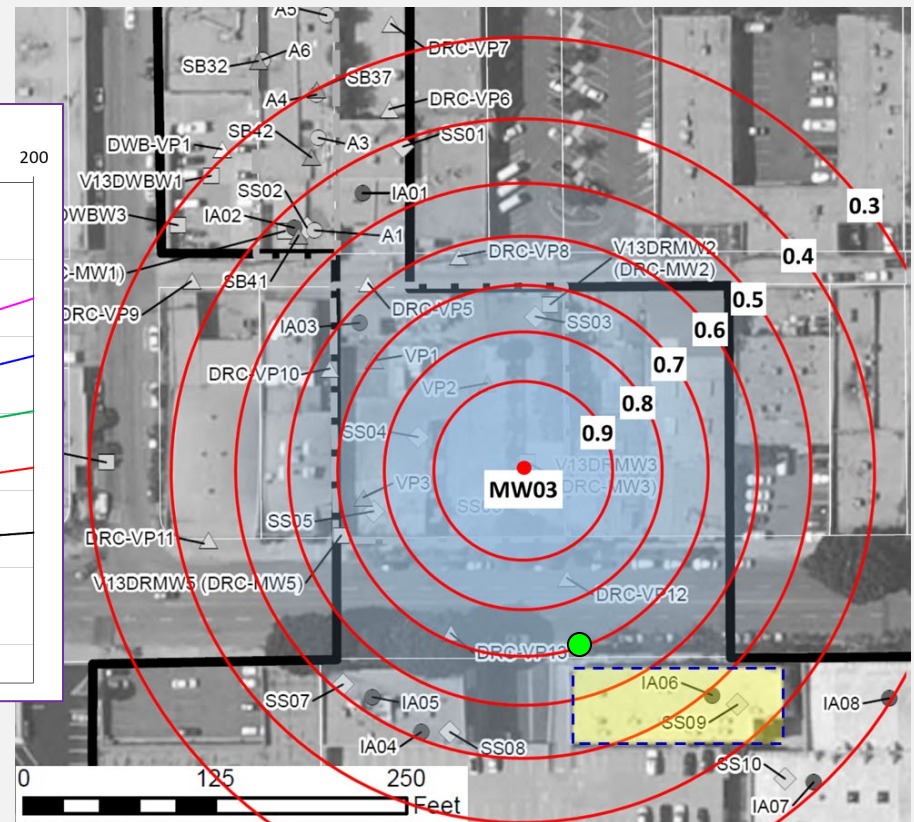
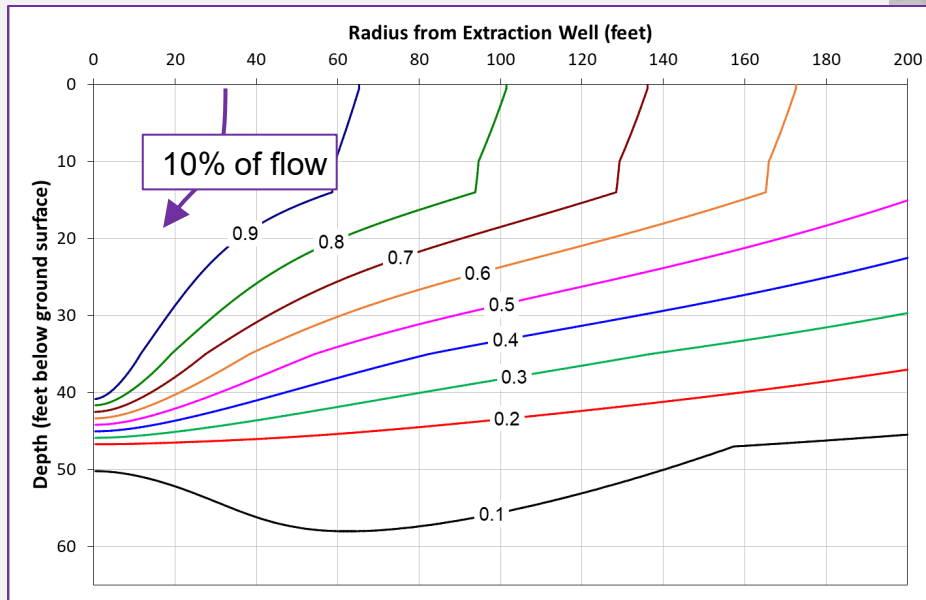
Field Study Results Summary

Monitor area-wide effectiveness

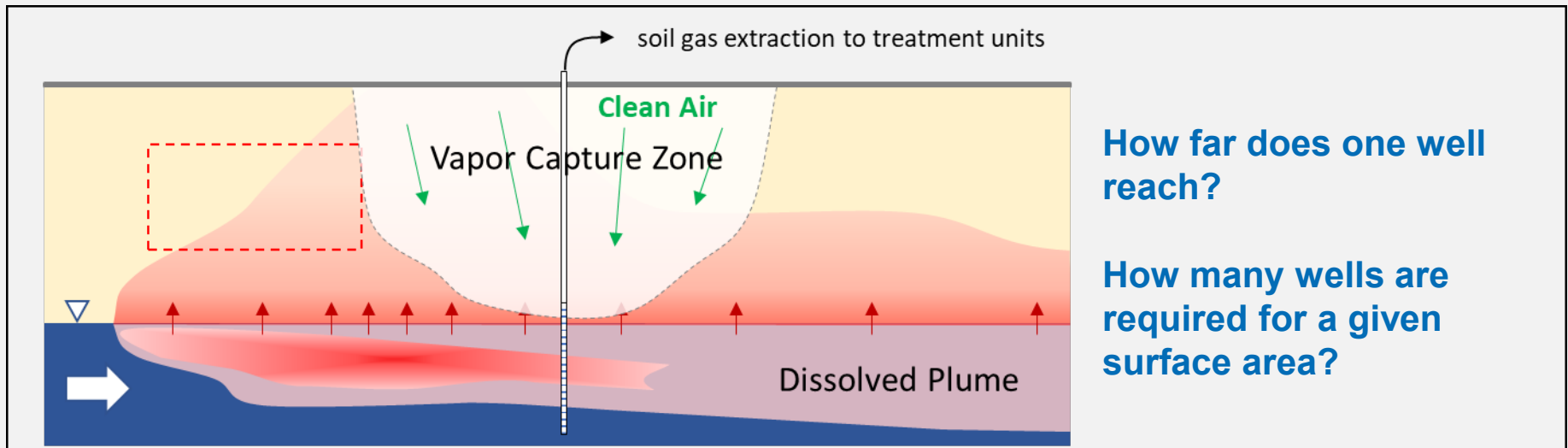
“*Field Study of Soil Vapor Extraction for Reducing Off-Site Vapor Intrusion*”, Groundwater Monitoring & Remediation, January 2020, <https://doi.org/10.1111/gwmmr.12359>



Design and Operational Concepts for VI Mitigation with SVE



Design and Operational Concepts for VI Mitigation with SVE



How far does one well reach?

How many wells are required for a given surface area?



Can we perform the extraction with a self-contained, solar-powered system in a parking space?

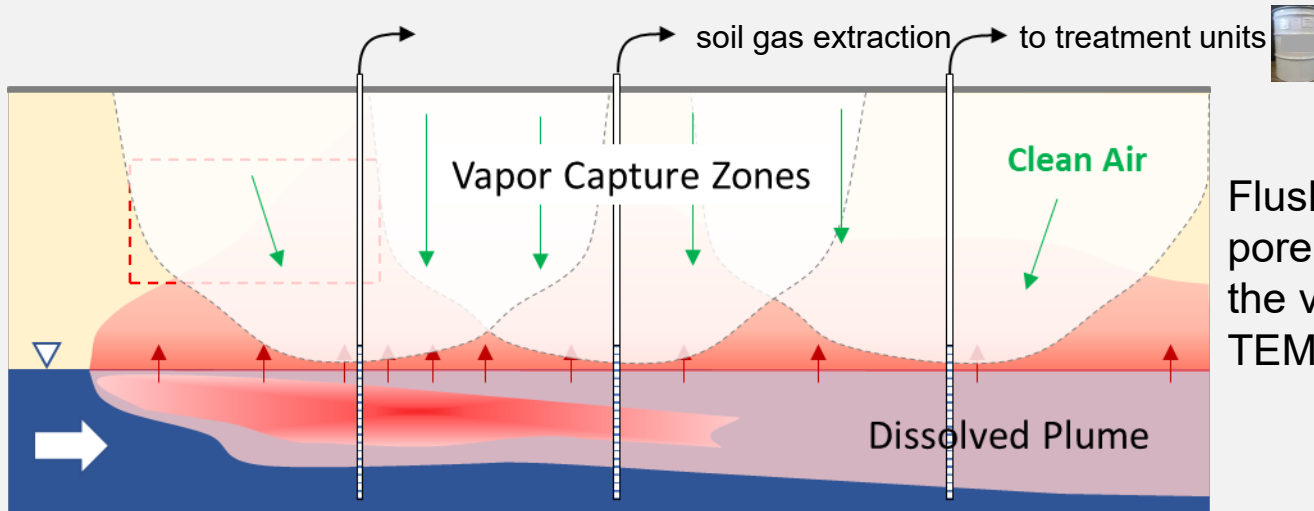
Design and Operational Concepts for VI Mitigation with SVE

[SVE Sweep Rate] > [Vertical Mass Transport Rate] = [No opportunity for VI]

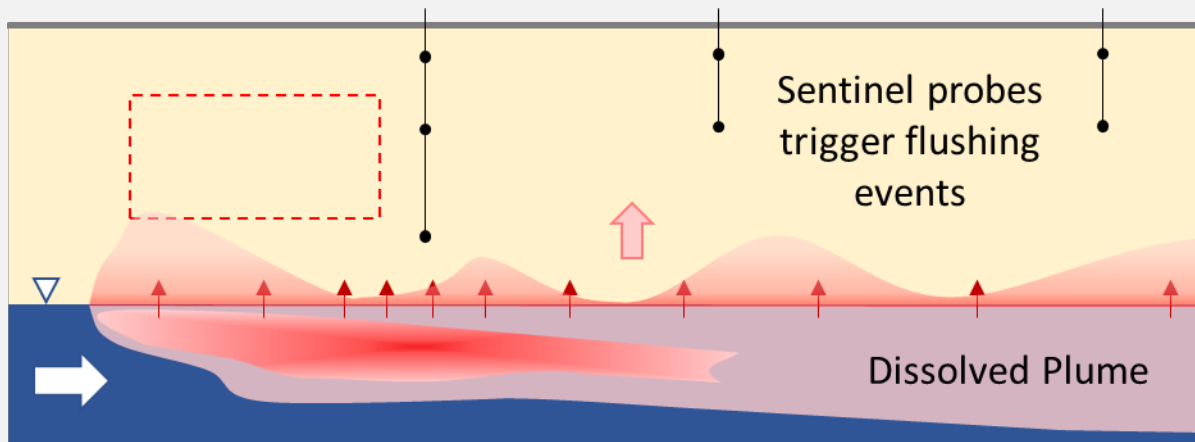
Design Issues:

- How far does SVE reach laterally?
- What flow rate and duration provide adequate flush?
- How frequently does the zone require flushing?
- What are appropriate “sentinel” depths and concentrations?

Design and Operational Concepts for VI Mitigation with SVE



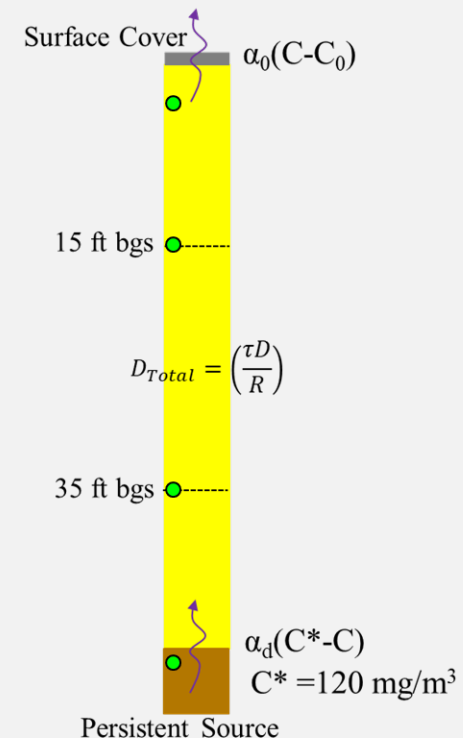
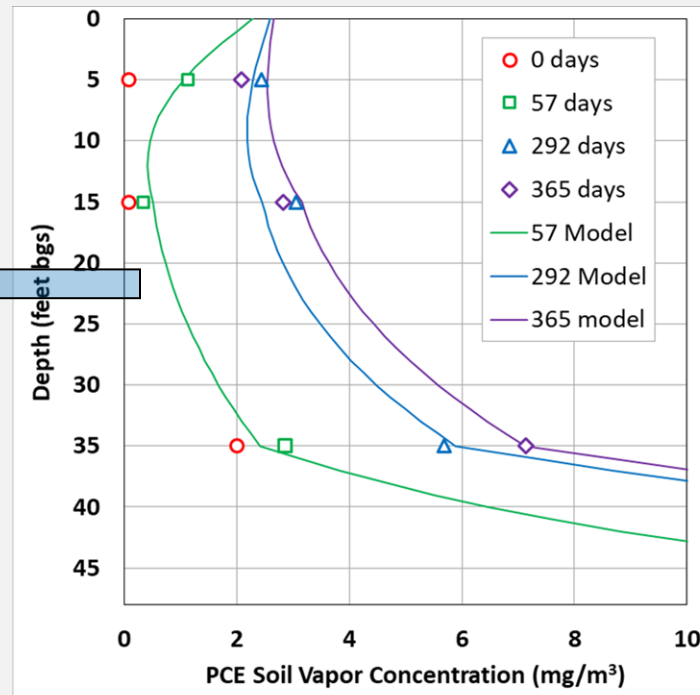
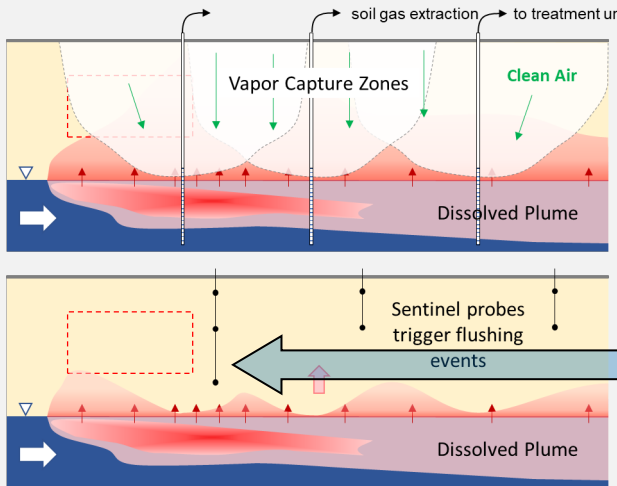
Flushing several soil gas pore volumes suppresses the vapor plume, TEMPORARILY



Periodic monitoring of sentinel probes until a threshold concentration is detected; triggers flushing event

Design and Operational Concepts for VI Mitigation with SVE

– frequency of flushing events



Design and Operational Concepts for VI Mitigation with SVE

Site Characteristics for Assessing Applicability & Design

- Water table depth
- Soil geology/stratigraphy
- Surface infrastructure / accessibility
- Groundwater/vapor concentrations

Results Summary

Provide preliminary design concepts for VI control in Soil Gas Safe Communities

“Evaluation of VI Mass Flux from Transient Vertical Vapor Concentration Profiles”, Manuscript in Preparation

- AEHS East Presentation slides available

“Analytical Solutions for Steady-State Gas Flow in Layered Soils with Field Applications”, Groundwater Monitoring & Remediation, January 2022, <https://doi.org/10.1111/gwmmr.12496>

“Development and Testing of New Design and Operational Concepts for VI Mitigation with SVE”, Manuscript in Preparation

More Information

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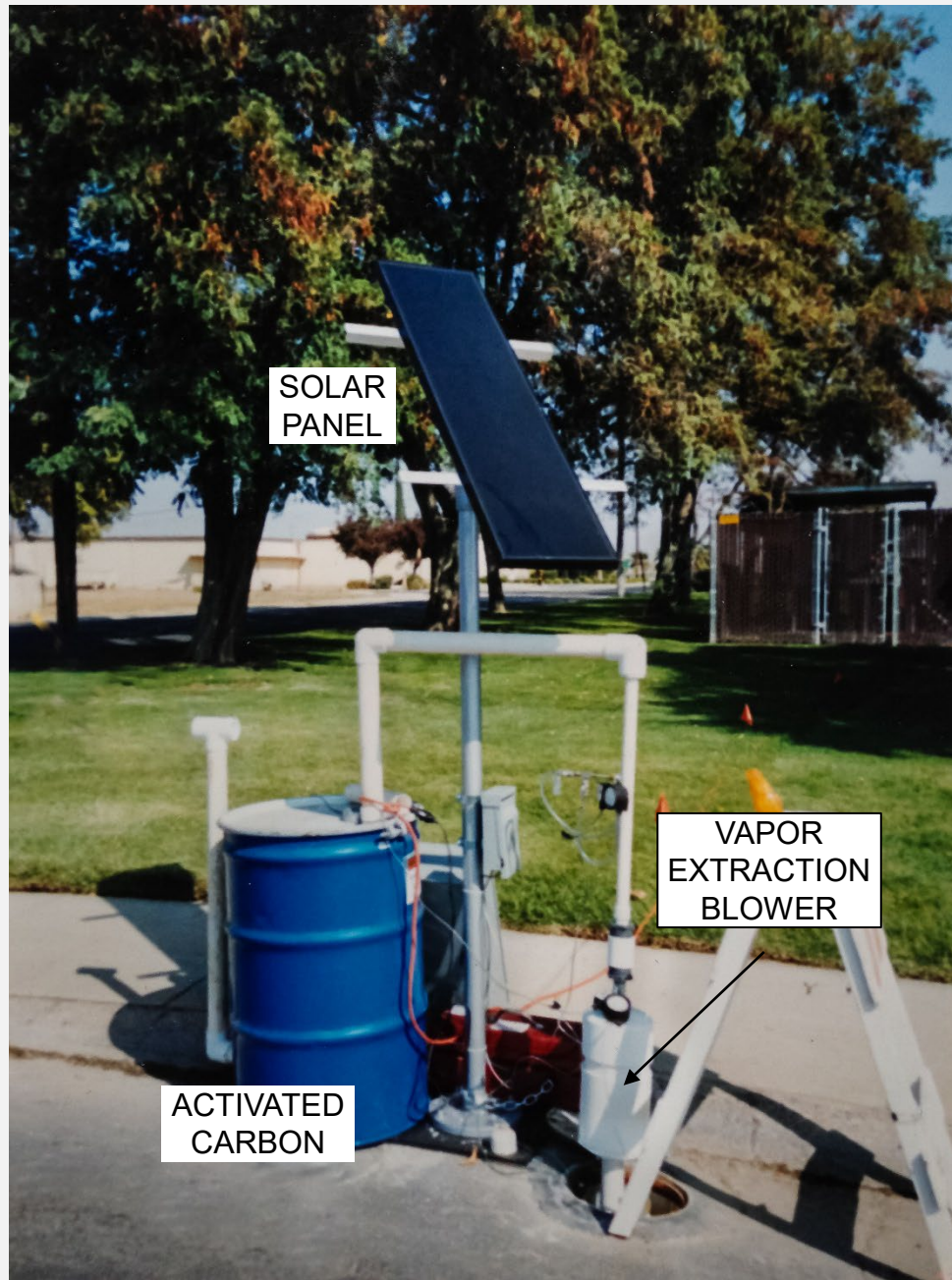
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