From Dry Cleaners to Gas Stations

Environmental Assessments, Historical Contamination, and Conceptual Site Models for Vapor Intrusion

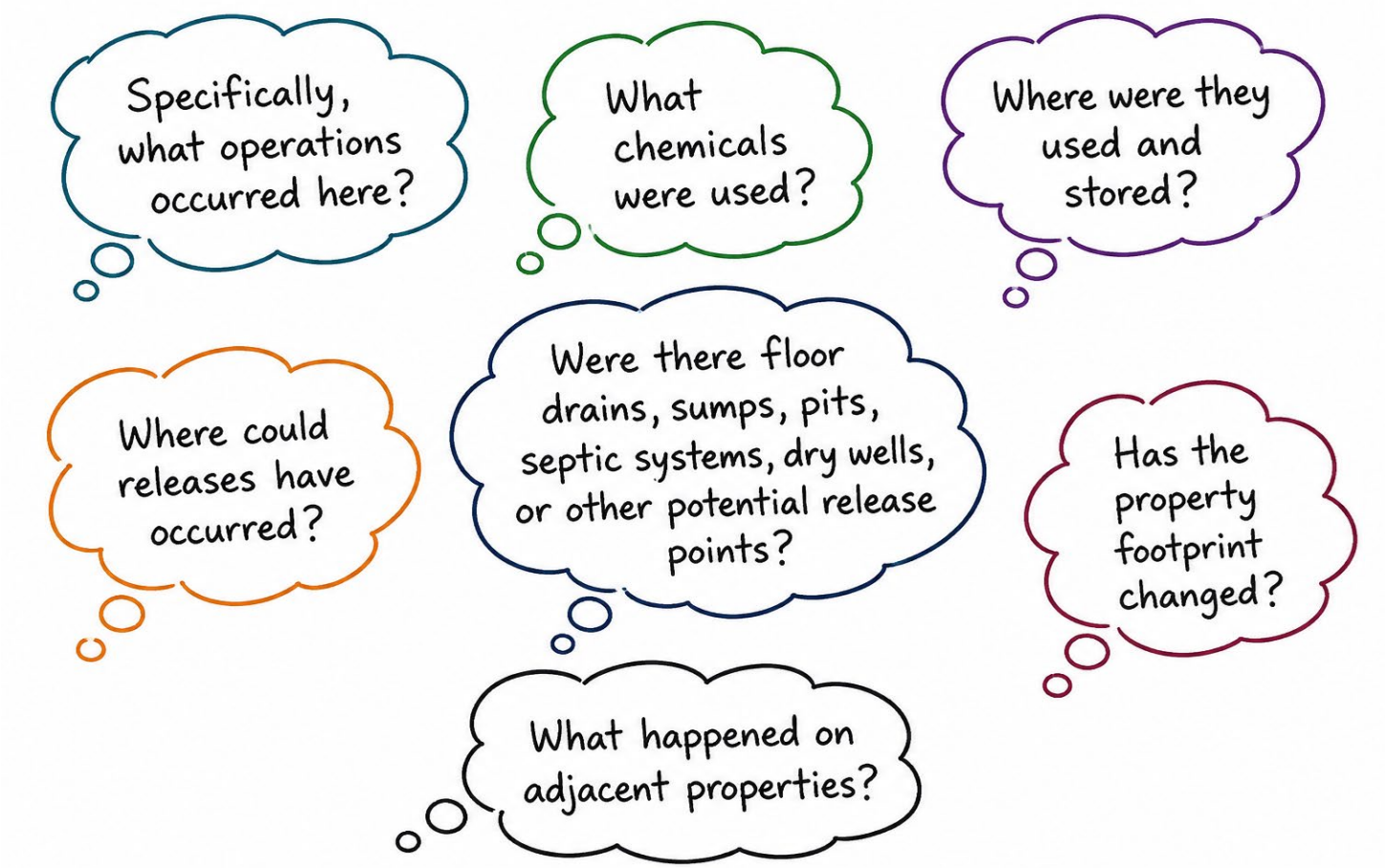
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Before We Investigate VI…
We Need to Understand the Property

What does a Phase I ESA tell us?

It helps us identify "what could have happened here?"

But did the Phase I go into enough detail?



Historical Property Use Creates the Initial Contaminant Hypothesis



Former Dry Cleaner

- PCE, TCE, other chlorinated VOCs
- Where was solvent used/stored?
- Where was equipment located?
- Where did wastewater go?
- Could a release have occurred through a floor drain?

Historical Property Use Creates the Initial Contaminant Hypothesis

Former Gas Station

- BTEX, Potential LNAPL
- Where were the USTs?
- Where were the product lines?
- Where were dispensers?
- Where is groundwater?



Historical Property Use Creates the Initial Contaminant Hypothesis

MANUFACTURING

- Potentially much broader list of contaminants
- How were the products used?
- What were disposal practices?

ADJACENT LANDFILL

- VOCs, methane
- What are the preferential pathways to your property?

Testing the Initial Hypothesis
the Phase II Investigation

SOIL

- Source areas
- Contaminant concentrations
- Distribution with depth

GROUNDWATER

- Presence and concentration
- Groundwater flow
- Dissolved plume distribution

SOIL VAPOR

- Presence of volatile contaminants
- Vapor distribution
- Potential vapor source

The Phase II investigation tests the CSM developed from the property history and Phase I ESA.

Fate & Transport

What Happens to a Contaminant After the Release?

- Volatilization
- Dissolution
- Sorption
- Groundwater transport
- Diffusion
- Advection
- Biodegradation
- Partitioning between phases

Building the Conceptual Site Model

SOURCE

- Historical source/ release locations
- Contaminant distribution and phase
- Source zone vs. downgradient plume

SUBSURFACE

- Groundwater flow and plume migration
- Lithology/ stratigraphy
- Soil heterogeneity/ permeability
- Depth to groundwater

VAPOR PATHWAY

- Vapor source
- Potential migration pathways
- Preferential pathways

Testing the Conceptual Site Model:
Is There a Complete Pathway?

Source

- Is there sufficient contaminant mass capable of generating vapor?

Vapor generation

- Can the contaminant partition into the vapor phase?

Subsurface transport

- Can vapor migrate through the vadose zone?

Building interface

- Does vapor reach the foundation?

Entry

- Are there preferential pathways/openings?

Are building conditions conducive to vapor entry?

- Diffusion versus advection
- Pressure gradients
- Soil permeability
- Moisture
- Foundation type
- Utility corridors
- Cracks and joints
- Sumps and drains
- Building HVAC conditions

When the Answer Isn't Obvious

Site A

- High groundwater concentration
- Deep groundwater
- No building above plume

Site B

- Moderate groundwater concentration
- Shallow groundwater
- Building directly above plume

Site C

- Lower source concentration
- But strong preferential pathway into building

WHICH ONE CONCERNS YOU THE MOST?

What Questions Do We Need to Answer Next?

Groundwater – elevated PCE

Soil – low or non-detect

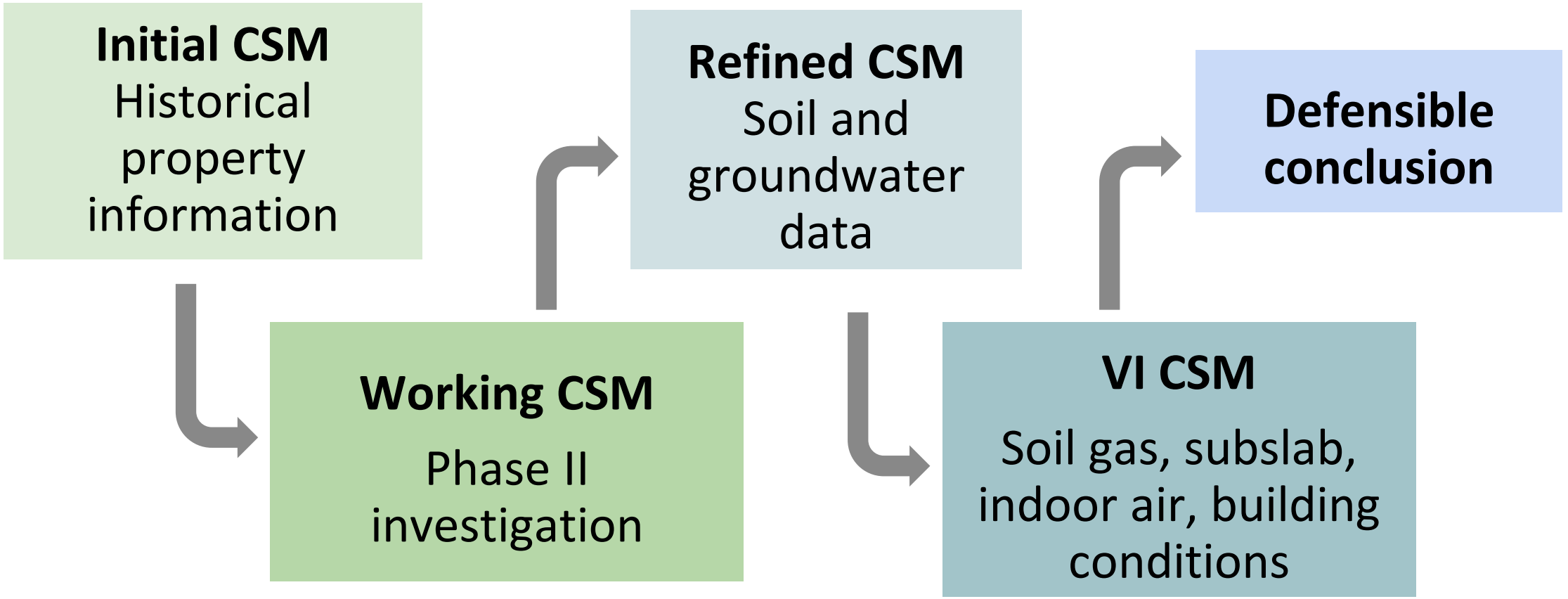
Soil gas – elevated PCE

Subslab – low PCE

Indoor air – non-detect

WHAT WOULD YOU CONCLUDE?

The CSM Is Not a Figure, It Is a Hypothesis



Each new line of evidence should test, support, or challenge the CSM

From Environmental Assessment to VI Risk



The quality of the VI investigation is only as good as the conceptual site model behind it.

Don’t just find the contaminant. Understand its story.