



**Department of the Environment**

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# Land Restoration Program

August 7, 2008

## Vapor Intrusion

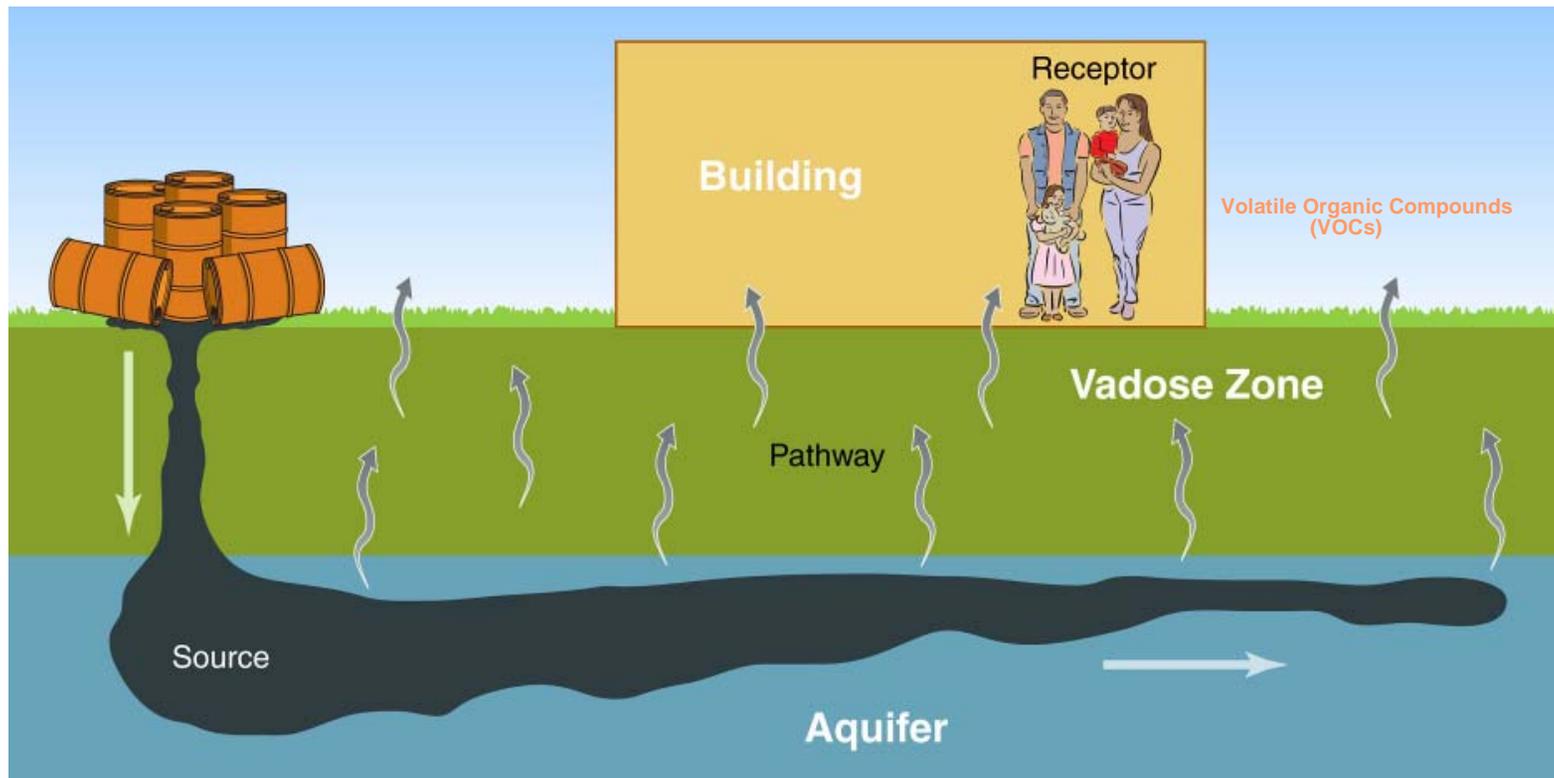
**Pathway/Typical Scenarios**

**Investigative Approaches**

**Case Studies**



# Vapor Intrusion - Basic Conceptual Model



ITRC Website: [www.itrcweb.org/vaporintrusion](http://www.itrcweb.org/vaporintrusion)



## Conceptual Site Model Confounding Factors

- Background VOC contributions
- Preferential flowpaths, utilities, sewers
- Poorly designed or antiquated facilities, older shopping centers and commercial buildings
  - 1. Dry cleaner stuck between other tenants**
  - 2. Cleaning activities cross contaminate IA**
  - 3. Multiple sources of IA impact, HVAC, VI, insulation**
- Inadequate data from historical reviews





## Vapor Intrusion Pathway Typical Scenarios

- Gas station in residential neighborhood
- Drycleaner in strip mall located adjacent to neighborhood
- Industrial facility with plume under residential & commercial buildings
- Vacant lot with proposed Brownfield development over groundwater plume
- Vacant large commercial building with warehouse space and office space
- Apartment building with parking garage over groundwater plume



# Vapor Intrusion Pathway

## Screening Levels Based on the Appropriate Scenario

**Commercial/Industrial Worker**

Working over Plume

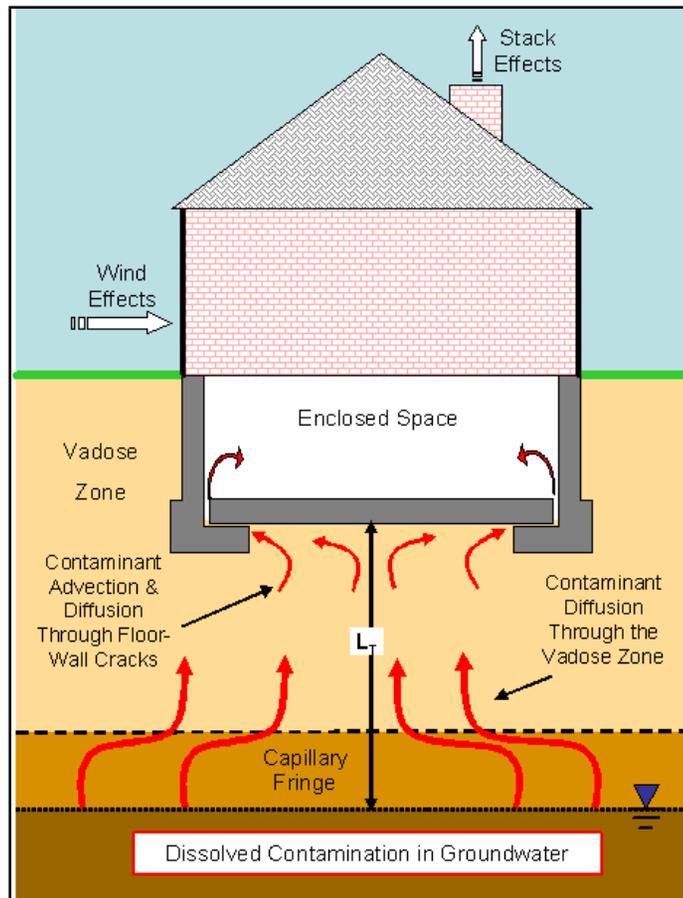
**Residential Living over Plume**

Basement

Without Basement



# Vapor Intrusion Investigation



- ❑ Site-specific conceptual model
- ❑ Building construction & current condition
- ❑ ASTM Tier 2 and Tier 3 Screening
- ❑ Sampling
  - ❑ Soil gas sampling
  - ❑ Groundwater sampling
  - ❑ Indoor air sampling
  - ❑ Soil sampling

## Sub-slab Soil Gas Sampling

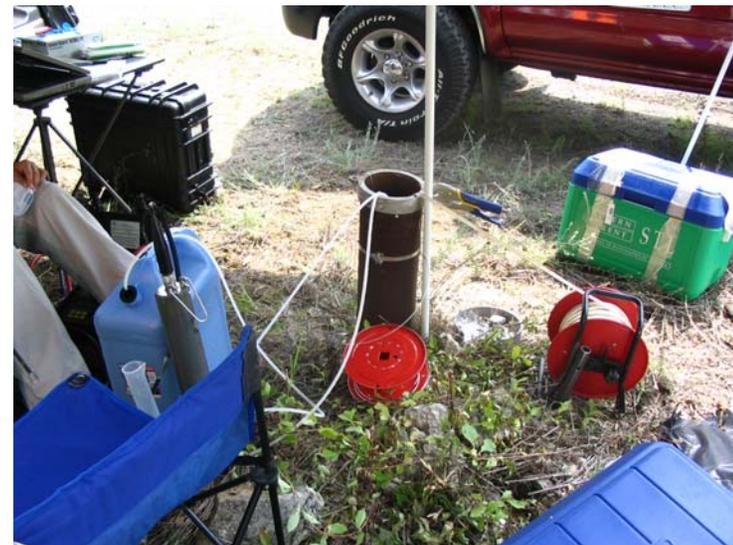
- Sampling & analytical methods
  - Sorbent, summas, tedlar bags, syringes
  - Active and passive approaches
- Reporting Limits
- Quality Assurance
  
- May detect chemicals originating within building
- Collect indoor air concurrently for comparison
- Sample at slab base and/or at depth
- Permanent or temporary sample points
- Near slab soil gas may be alternative



Active Sampling

# Groundwater Sampling

- Focus on contaminants of concern
- Locations
- Need vertical/horizontal extent of contamination
- Sampling & analytical methods
- 8260 waste, 524.2 Drinking water
- Reporting Limits
- Quality Assurance



Examples of ground water sampling

## Indoor Air Sampling

- Generally performed after subsurface sampling or groundwater sampling
- Pre-sampling building survey
- Focus on contaminants of concern
- Locations
- Sampling & analytical methods
  - TO15, TO17 or equivalent
- Reporting Limits
- Quality Assurance



Examples of sampling canisters

## Soil Sampling

- Least effective assessment tool for VI
- Can be helpful in defining removal areas, typically involves significant # of samples
- Must use collection method 5035 or equivalent
  - En Core or Terra Core
- Analysis should be rapid
- Limit sampling to source areas



## Screening Criteria

- OSWER Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air from Groundwater and Soils (11/2002)
- Table 2b, HQ=1,  $1 \times 10^{-5}$  cancer risk,
- Johnson and Ettinger Modeling
- Need for high quality data, boring log,
- TCE/PCE New Screening Table
- [epa-prgs.ornl.gov/chemicals/download.shtml](http://epa-prgs.ornl.gov/chemicals/download.shtml)
- PCE will follow table
- TCE under review



# Mitigation

- Site remediation
- Takes uncertainty off the table
- Institutional controls
- Building controls
- ASTM Figure 1
  - Passive barriers
  - Sub-slab depressurization
  - Sub-membrane depressurization
  - Passive venting/Active venting
  - Indoor air treatment
  - HVAC modifications

## Sub-slab Depressurization



- ❑ Most widely applied and successful building control
- ❑ \$1500 to \$3000 to install (small scale)
- ❑ Advantages
  - ❑ Successful track of performance, 90-99% reduction typical, 99.5% or greater reduction possible with well designed systems
  - ❑ Acceptable technology, applicable to a wide variety of site conditions and geology
  - ❑ Can be applied to new and existing structures



## Community Issues

- ❑ Sensitive topic in community
- ❑ Strong community outreach helps inform and prepare (letters, fact sheets, tox data, public meetings)
- ❑ Access Issues
- ❑ Qualified & Experienced Consultants





## Closure

- Thorough investigation, follow the guidelines
- Involve regulators early
- Define responsibilities early in process
- Define mitigation strategies and cleanup objectives

