

Vapor Intrusion: What Does it Mean for Cleanups in Missouri?

**2016 Missouri Hazardous
Waste Seminar**

October 18, 2016

Overview

- ▶ Vapor Intrusion Chronology
- ▶ How did we Look at VI Then?
- ▶ How Do We Look At VI Today?
- ▶ What Does This Mean for Us in Missouri?



Vapor Intrusion Chronology

- ▶ Late 1990s – First large VI site came to public attention
- ▶ USEPA 2002 – Draft OSWER VI Guidance
- ▶ ITRC 2006 – Vapor Intrusion Pathway
- ▶ **MDNR 2006 – MRBCA Guidance**
- ▶ ASTM 2008 – Standard Practice for Assessment of Vapor Intrusion into Structures on Property Involved in Real Estate Transactions
- ▶ ASTM 2010 – Standard Guide for Vapor Encroachment Screening on Property Involved in Real Estate Transactions
- ▶ USEPA 2008-2013 – VI Research Papers
- ▶ ITRC 2014 – Petroleum Vapor Intrusion
- ▶ USEPA 2015 – OSWER/OUST VI Guidance Documents

How Did We Look at VI in 2006?

▶ USEPA 2002 OSWER Guidance

- VI Evaluated on site-wide basis
- Generic screening using default attenuation factors
- Semi-specific screening using modeled attenuation factors based on soil type

▶ Modeling commonly used in evaluations

▶ Investigations focused on exterior of buildings

- Groundwater
- Near-slab soil gas

▶ Single line of evidence

What's in the 2006 MRBCA Guidance?

- ▶ Tier 1 RBTLs for VI
 - Indoor Air
 - Subsurface Soil – Modeled
 - Groundwater – Modeled
 - Soil Gas – Modeled

- ▶ Tier 2 – Semi Site-Specific
 - Site-specific fate and transport parameters
 - MRBCA equations

- ▶ Tier 3 – Site-Specific

How Do We Look At VI Today?

- ▶ USEPA released two guidance documents in 2015
 - OSWER – Assessing and Mitigating the Vapor Intrusion Pathway from Subsurface Vapor Sources to Indoor Air
 - OUST – Addressing Petroleum Vapor Intrusion At Leaking Underground Storage Tank Sites

The screenshot shows the EPA website page for Vapor Intrusion. At the top, there is the EPA logo and the text "US Environmental Protection Agency". Below this is a navigation menu with links for "Learn the Issues", "Science & Technology", "Laws & Regulations", and "About EPA". A search bar is located on the right side of the navigation menu. The main content area is titled "Vapor Intrusion" and features a large image of a landscape with a river and mountains. A text box over the image explains that vapor intrusion occurs when vapor-forming chemicals migrate from any subsurface source into an overlying building. To the right of the image is a "Related Information" section with links to "Vapor Intrusion Information for On-scene Coordinators" and "CLU-IN". Below the image is a "Learn About Vapor Intrusion" section with links to "What is Vapor Intrusion?" and "Vapor Intrusion at Superfund Sites". To the right of this is a "Technical Information" section with a link to "Technical Resources". Further right is a "Current Guidance" section with links to "Assessing and Mitigating the Vapor Intrusion Pathway from Subsurface Vapor Sources to Indoor Air" (June 2015) and "Addressing Petroleum Vapor Intrusion At Leaking Underground Storage Tank Sites" (June 2015). At the bottom of the page, there is a "Contact Us" link and a footer with links to "EPA Home", "Privacy and Security Notice", and "Accessibility". The footer also includes social media icons for Hotline, News, Blog, Apps, and Widgets, and a "More social media at EPA" link. The EPA logo is in the bottom right corner.

Key Points in OSWER Guidance

- ▶ Scope includes non-UST petroleum sites and all other VOC types
- ▶ Use of multiple lines of evidence
- ▶ Updated attenuation factors
- ▶ Reflects research on chlorinated solvents
- ▶ Generally not prescriptive
- ▶ Preemptive mitigation actions when appropriate

Closer Look at OSWER Guidance

► Preliminary Analysis

- Vertical and lateral separation distance of 100 ft
- Risk-based screening of existing data
- Updated attenuation factors
- Difficult to eliminate VI concerns based on preliminary screening

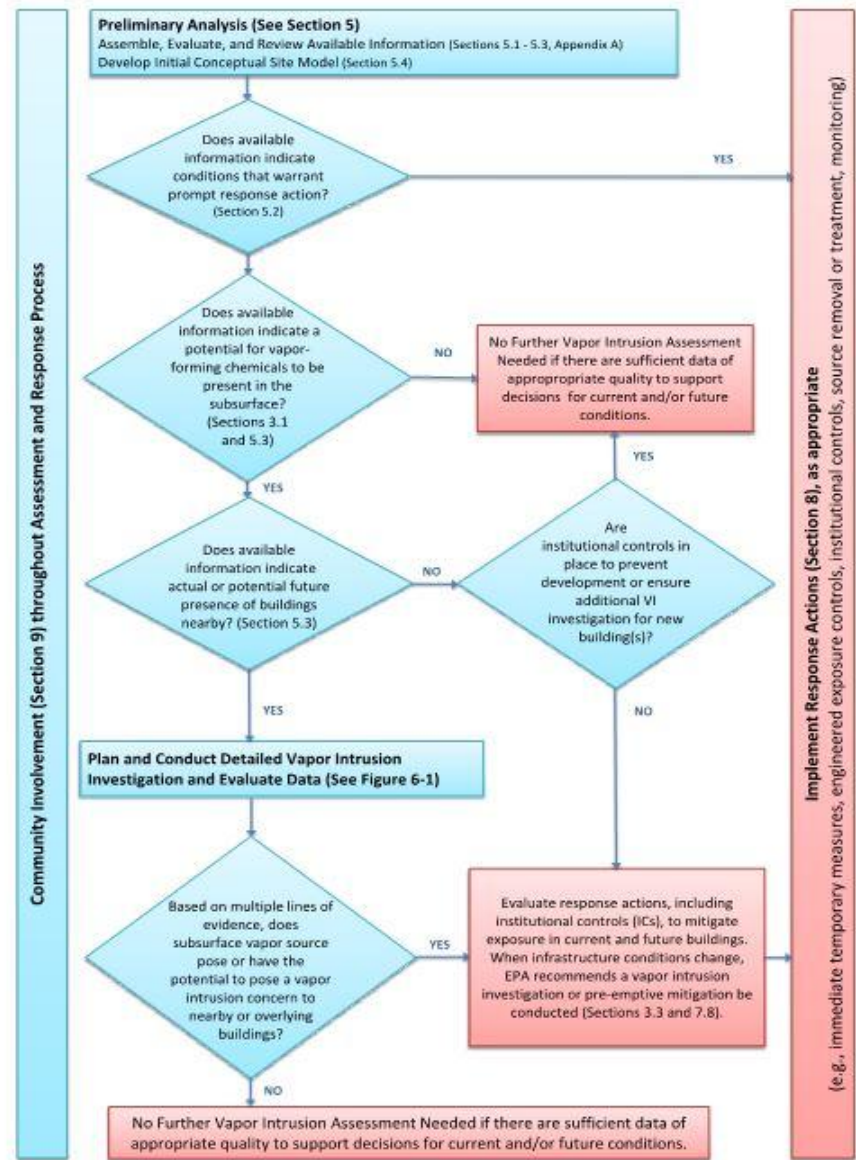


Figure 3-1 Overview of Recommended Framework for Vapor Intrusion Assessment and Response Action

Detailed Investigation

- ▶ Allows use of soil data to qualitatively characterize vadose zone sources
- ▶ Allow use of groundwater data as a line of evidence
- ▶ Focuses on indoor sampling
 - Subslab soil gas
 - Indoor air
- ▶ Increased focus on characterizing background
- ▶ Temporal and spatial variability
 - Multiple rounds of sampling
 - Multiple samples per building
 - Longer duration indoor air samples



Data Evaluation

- ▶ Multiple lines of evidence
 - Subsurface data (soil gas, groundwater)
 - Vadose zone factors (soil type, preferential pathways)
 - Building factors (construction, HVAC)
 - Indoor air data
 - Background
- ▶ Lines provide conflicting data
 - Additional data collection
 - Mitigation
- ▶ Pre-emptive mitigation

Attenuation Factors

2002 Draft Guidance

- ▶ Groundwater – 0.001
- ▶ Sub-slab/soil gas
 - shallow - 0.1
 - deep – 0.01
- ▶ Crawl Space = soil gas

Upcoming Guidance

- ▶ Groundwater
 - generic - 0.001
 - fine grained - 0.0005
- ▶ Sub-slab – 0.03
- ▶ Exterior Soil Gas – 0.03
- ▶ Crawl Space – 1

Attenuation Factors

2002 Draft Guidance

- ▶ Groundwater – 0.001
- ▶ Sub-slab/soil gas
 - shallow – 0.1
 - deep – 0.01
- ▶ Crawl Space = soil gas

2015 Guidance

- ▶ Groundwater
 - generic – 0.001
 - fine grained – 0.0005
- ▶ Sub-slab – 0.03
- ▶ Exterior Soil Gas – 0.03
- ▶ Crawl Space – 1

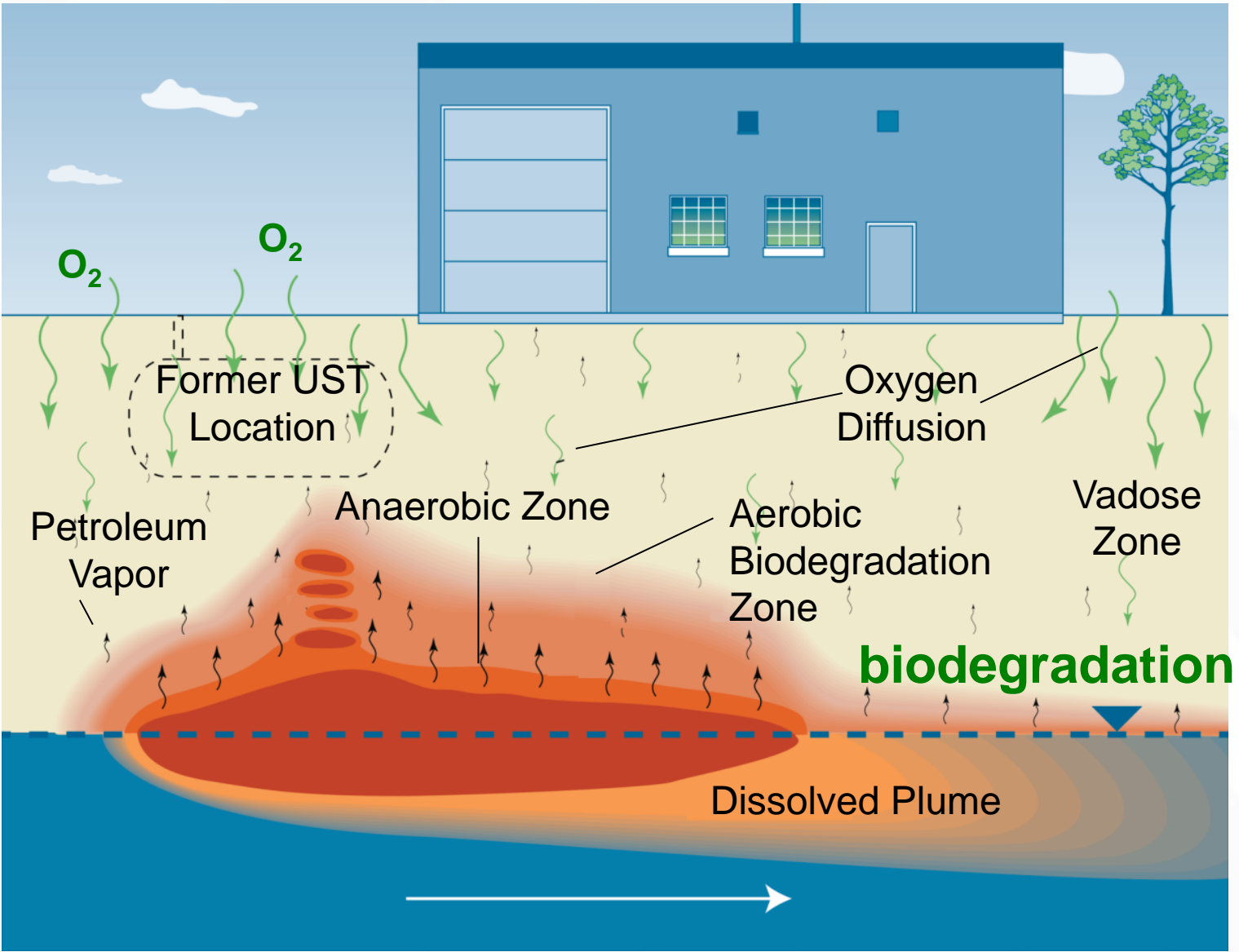
TCE

- ▶ Accelerated response actions from USEPA and most states
- ▶ Toxic effect of concern - fetal heart malformations
- ▶ Current action levels based on 3-week exposure duration
- ▶ Potential for action level to decrease based on 1-day exposure duration

OUST Guidance

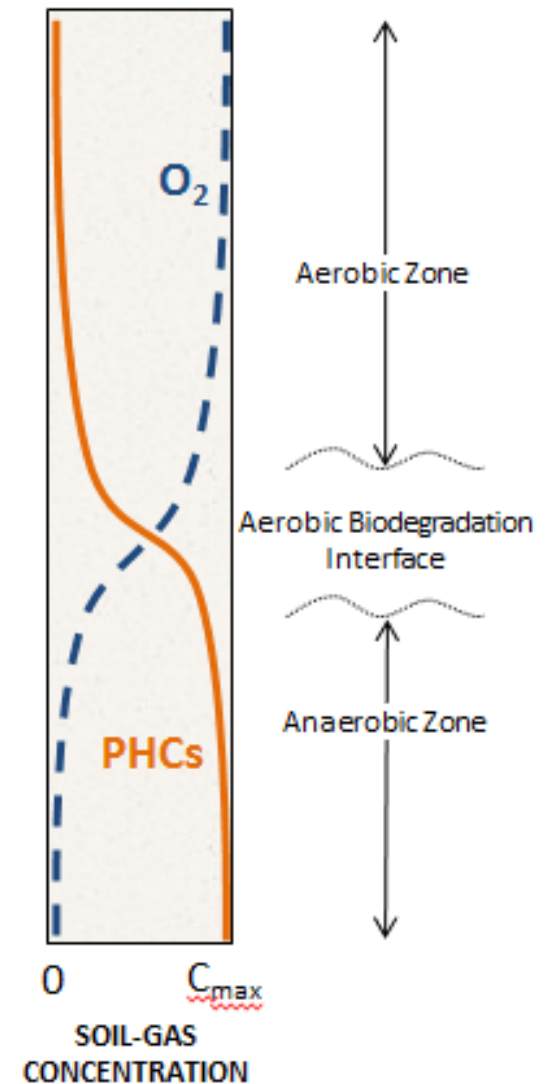
- ▶ Addresses petroleum VI
 - Underground storage tank (UST) sites
 - Jurisdictional limitation
- ▶ Biodegradation
- ▶ Completely new evaluation process based on separation distance

PVI – General Conceptual Site Model (CSM)



Vertical Separation Distance

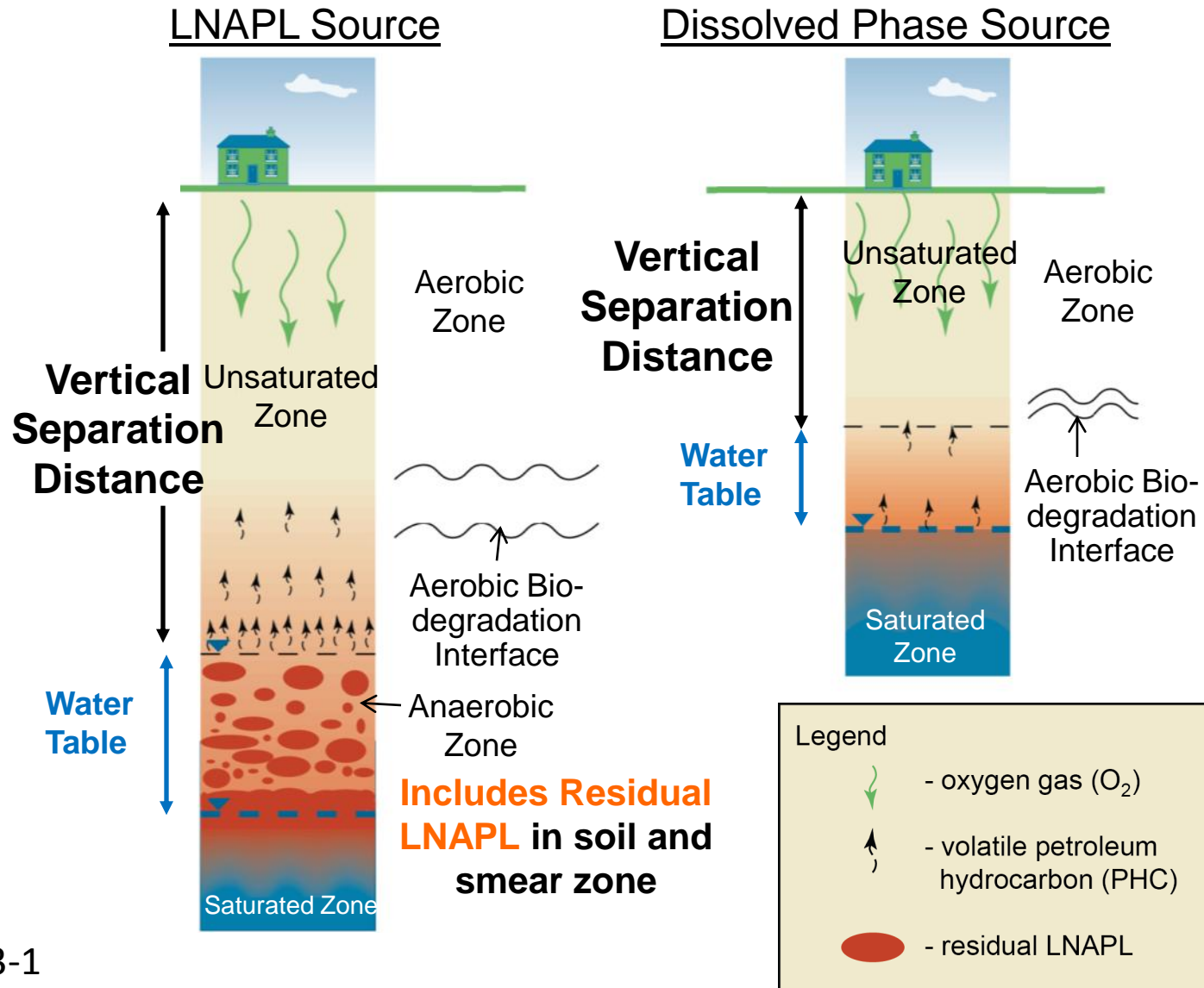
- ▶ Distance between source and building past which VI is not expected to pose unacceptable risk
- ▶ Based on source strength
- ▶ Benzene and TPH



CSM of Vertical Screening Distances

Vertical screening distances

- ▶ 15 feet – LNAPL sources (petroleum UST/AST sites)
- ▶ 5 feet – dissolved-phase sources



What Does It Mean?

- ▶ Minimum separation distances
 - LNAPL = 15 feet
 - Dissolved-Phase = 6 feet

If distance between building and source is greater than minimum, no further VI evaluation is needed.

Precluding Factors

- ▶ Preferential pathways
 - Natural: karst or fractured geology
 - Anthropogenic: poorly-sealed utility line (e.g. sewer, water)
- ▶ Expanding/advancing plume
- ▶ Certain fuel type (e.g., lead scavengers or > 10% vol/vol ethanol)
- ▶ Certain soil types (e.g., peat [foc>4%] or very dry soils [<2% by vol.]

What About Non-UST Petroleum Sites?

▶ ITRC PVI Guidance

- Dissolved Sources = 5 feet
- LNAPL Sources = 18 feet

▶ Limited data



What Does All of This Mean for Us in Missouri?

- ▶ Update to MRBCA
- ▶ Topics under discussion
 - RBTLs for subslab and groundwater
 - Updated sampling methodology
 - Leak detection
 - Canisters/tedlar bags
 - Passive samplers
 - Sampling density and frequency
 - Mitigation vs. remediation
- ▶ PVI
 - UST Program no currently planning to adopt PVI approach
 - Discussion of applicability of PVI approach to Departmental Guidance

What challenges are we facing?

Current VI investigation practice focuses on...

- ▶ Building-specific investigation
 - Data from one building doesn't apply to adjacent buildings
 - Large multi-building sites can be expensive
- ▶ Indoor sampling
 - Subslab with indoor air
 - Longer durations?
 - Can be intrusive and pose access challenges
- ▶ Challenges in data interpretation
 - Temporal and spatial variability
 - Lowering RBTLs
 - More sites "ruled in"
 - Harder to demonstrate no VI

Questions?