



Vapor Intrusion Mitigation

NEWMOA Workshop

April/May 2015

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ITRC – Shaping the Future of Regulatory Acceptance



- Host organization
- Network
 - State regulators
 - All 50 states and DC
 - Federal partners
 -  DOE
 -  DOD
 -  EPA
 - ITRC Industry Program
 -  IAP
 - Academia
 - Community stakeholders
- Wide variety of topics
 - Technologies
 - Approaches
 - Contaminants
 - Sites
- Products
 - Documents
 - Technical and regulatory guidance documents
 - Technology overviews
 - Case studies
 - Training
 - Internet-based
 - Classroom

Mitigation



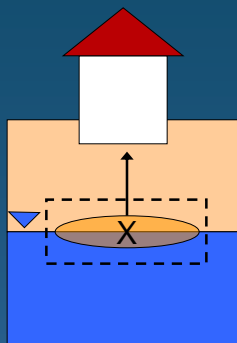
3 General Approaches

- Site remediation
 - Eliminate the source of vapors
- Institutional controls
 - Prevent exposure
- Building controls
 - Prevent entry of vapors

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Site Remediation Options



- Removal
 - Excavation
 - Soil Vapor Extraction
- In Situ Treatment
 - Biodegradation
 - In situ Chemical Oxidation
 - Permeable Reactive Barrier
 - Zero valent iron
- Monitored Natural Attenuation

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Site Remediation

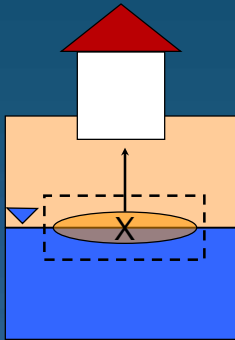


Advantages

- Permanent
- Need to do anyway
- May be lowest cost
- May address other exposure pathways

Disadvantages

- May take too long
- May be too expensive
- Building may be in the way



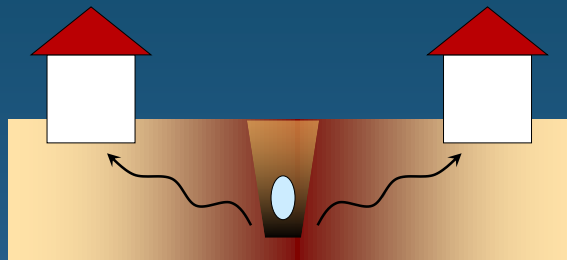
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Site Remediation Example



- DNAPL contaminated sewer backfill
- Site remediation options for controlling VI
 - Excavation
 - SVE



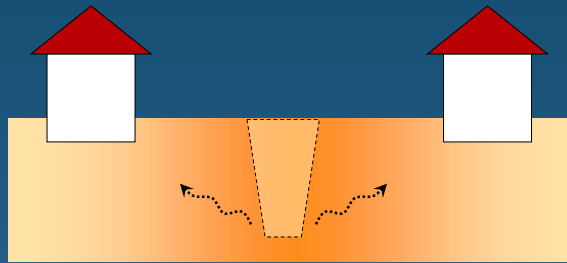
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Site Remediation Example



- Excavation
 - Eliminate or replace sewer
 - Removes source material but not residual impacts
 - Fast



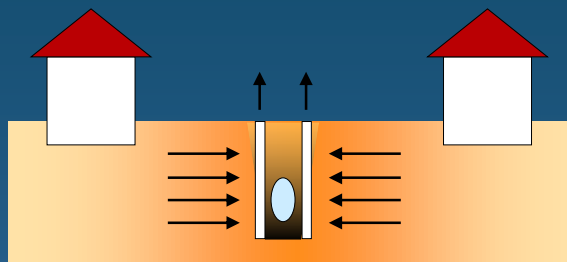
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Site Remediation Example



- Soil vapor extraction (SVE)
 - Removes source material
 - Controls vapors
 - Slower



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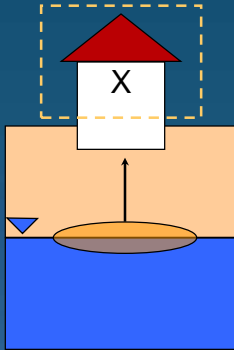
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Institutional Controls



Legal mechanisms

- Deed notice
- Deed restriction
- Covenant
- Zoning requirement
- Use control area
- One-call notification
- Site management plan



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Institutional Controls

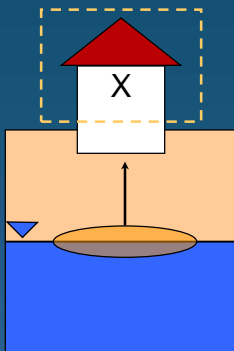


Advantages

- Lower cost
- Quick to implement
- Allows time for site remediation

Disadvantages

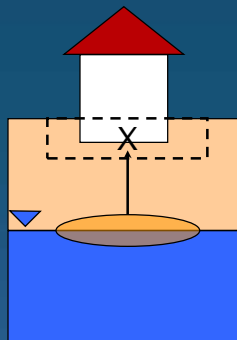
- Limits site use
- Hard to enforce over long periods of time
- Property value?



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Building Controls



- Barriers
- Venting
 - Passive
 - Active
- Pressurization
- Treatment

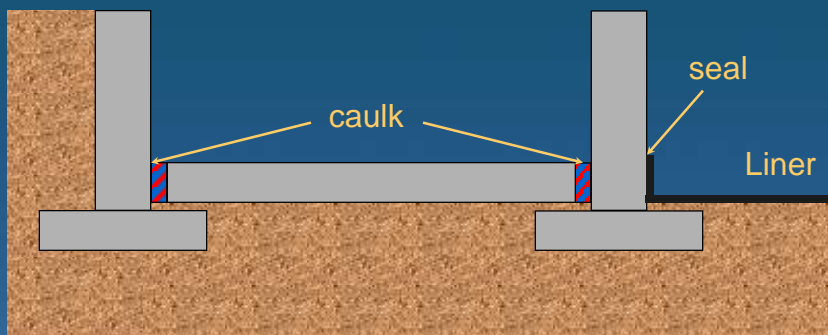
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Barriers – Existing Buildings



- Seal cracks and penetrations
- Crawl space liners (e.g. LDPE)



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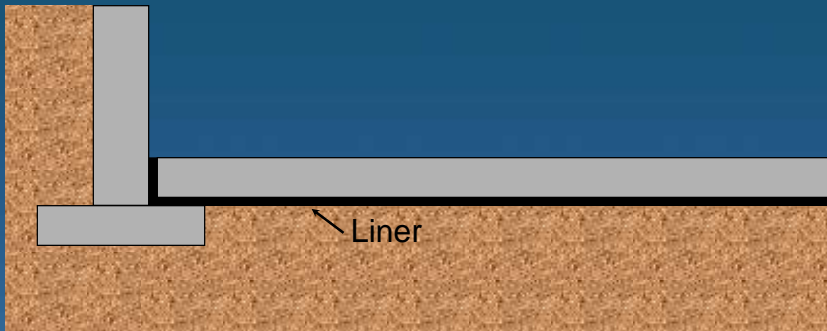
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Barriers – New Buildings



- Liner below slab
 - Spray-on rubberized asphalt membrane
 - Geomembrane (e.g., HDPE)



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Spray-On Barriers



GeoSeal

Courtesy of Land Sciences Technologies



Liquid Boot

Courtesy of GETCO Liquid Boot Company

No product endorsements intended by this presentation

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Spray-On Barrier & Vent



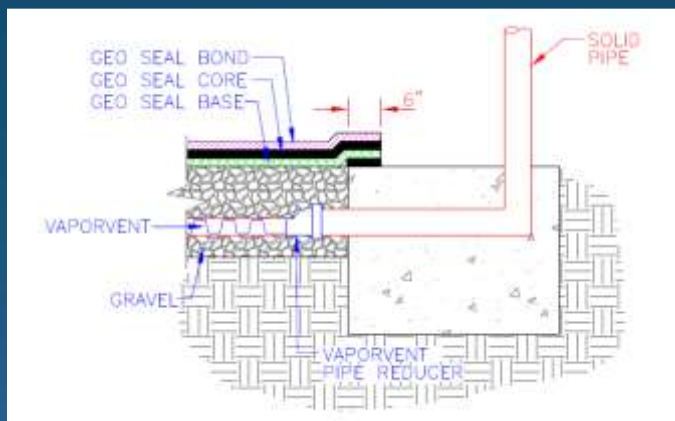
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Spray-On Barrier & Vent



Courtesy of Land Sciences Technologies

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Spray-On Barriers



- QA/QC Measures
 - Certified applicators
 - Certified inspections
 - Thickness verification testing
 - Smoke testing
 - Visual inspections

Spray-On Barriers



Courtesy of Land Sciences Technologies

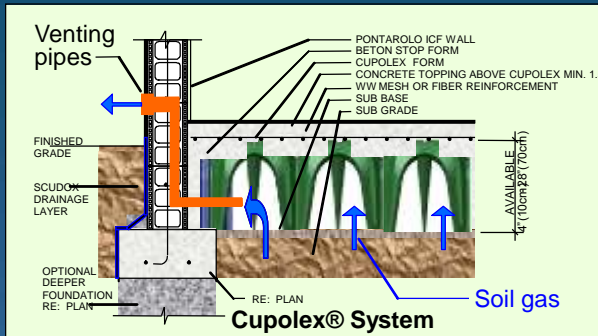
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Aerated Floor System



- Forms create continuous cavity below slab
- Passive or mechanical venting

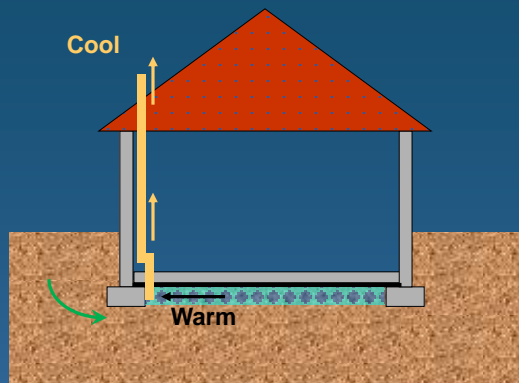


* Provided courtesy of Pontarolo Engineering, Inc.
No product endorsement intended by this presentation

Passive Venting Mechanisms



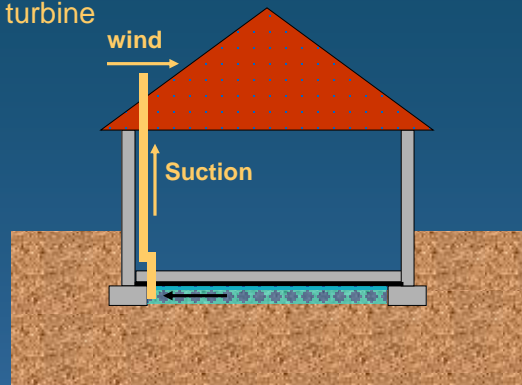
- Passive venting layers rely on diffusion and natural pressure gradients
 - Thermal-induced pressure gradient



Passive Venting Mechanisms



- Passive venting layers rely on diffusion and natural pressure gradients
 - Wind-induced pressure gradient
 - Augment with wind turbine



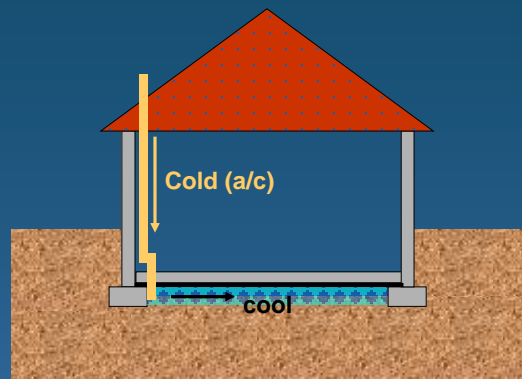
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Passive Venting Mechanisms



- Passive venting may not occur naturally at all times
 - Potential reverse stack effect
 - 10-50% as effective as active venting



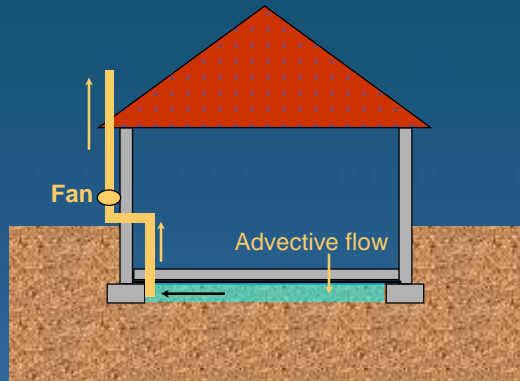
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Active Venting (Sub-slab Depressurization)



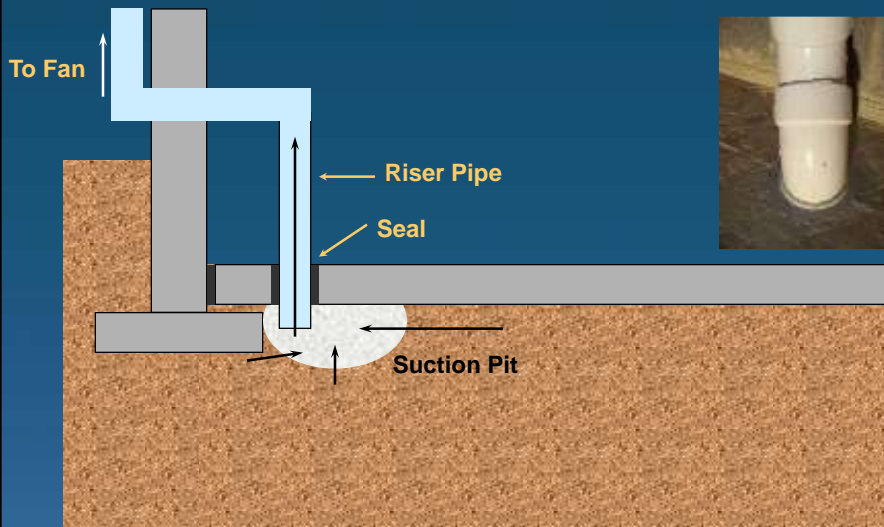
- Active venting relies on fans to create suction (i.e., depressurize venting layer)



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SSD in Existing Building

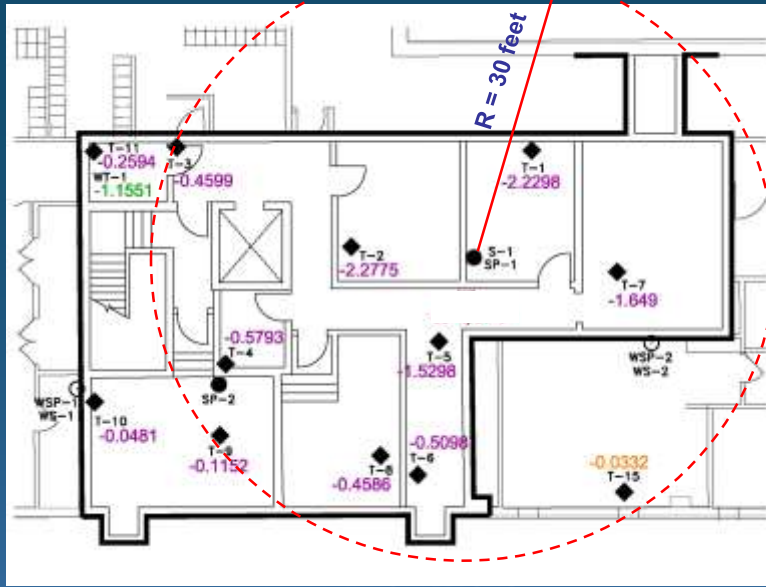


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Radius of Influence



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Communication Test Devices



Hot Wire Anemometer



Manometer and MicroManometer

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Venting Fans



Passive Solar Vent



GP 501,
high
vacuum, low
flow
fan



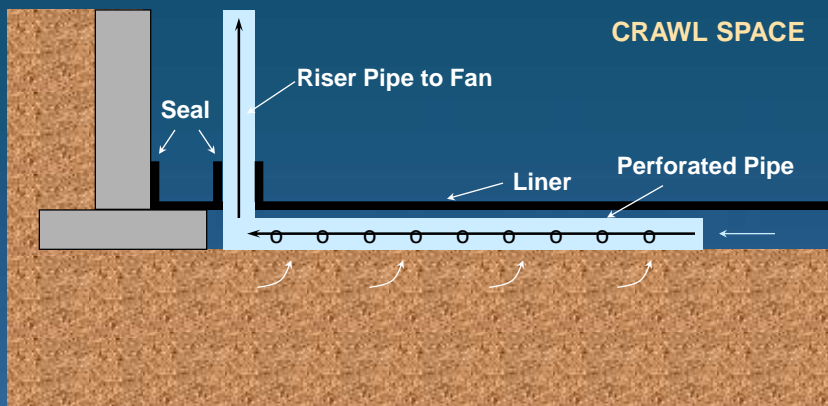
RP 145, Low vacuum, High flow fan



SSD Variations



Sub-Membrane Depressurization

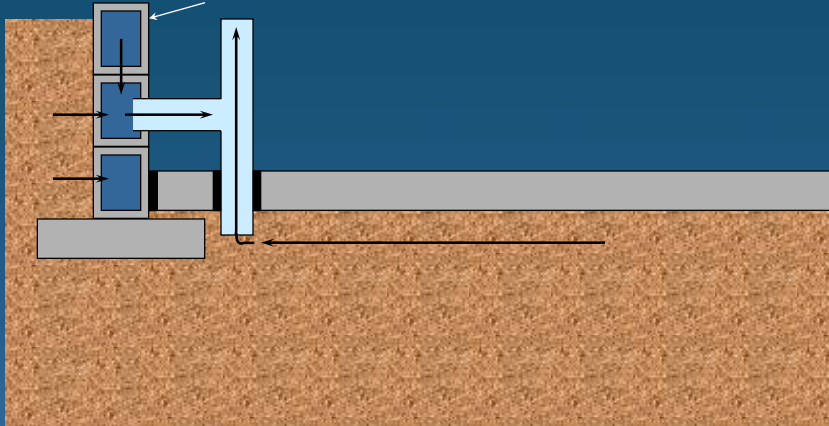


SSD Variations



Block Wall Depressurization

Cinder block foundation wall



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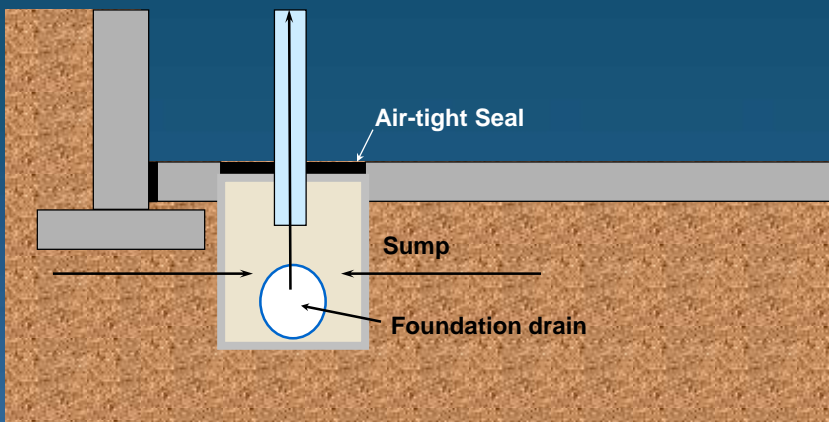
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SSD Variations



Foundation drain depressurization



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Passive vs. Active



Passive Controls	Active Controls
<ul style="list-style-type: none">▪ Favored by many developers▪ No active components or costs▪ Less stigma perceived▪ Barriers must be robust▪ Venting must be provided▪ Integrity should be tested (more difficult to test than active)▪ Only works for new buildings▪ Passive venting less effective	<ul style="list-style-type: none">▪ Less favored by developers▪ Operation and maintenance needed▪ Perceived stigma▪ Highly effective (99% reduction)▪ Easily tested (pressures)▪ New or existing buildings▪ Easily modified▪ Can initially be passive (convert to active system if necessary)

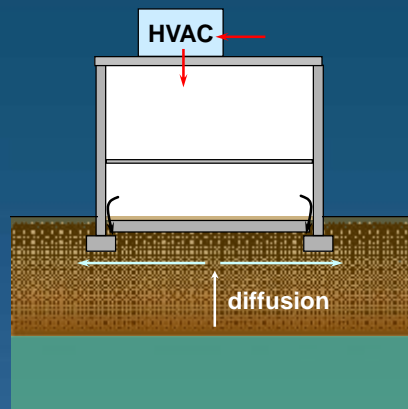
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Building Pressurization



- Positive building pressures
 - Requires increase intake air flow
 - Creates downward pressure gradient through slab
 - Increases energy costs



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Indoor Air Treatment



Source: www.austinair.com

- Typical residential unit
 - Size of shop vac
 - Standard 120 v outlet
 - 15 lbs of carbon
 - Effective up to 1500 ft²
 - 3 speed fan
 - 250 cfm
 - 125 cfm
 - 47 cfm

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Mitigation Summary



- Site remediation
- Institutional controls
- Building controls
 - Sub-slab depressurization most common
 - Short term measures - TCE
 - Building pressurization
 - Indoor air treatment

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QUESTIONS

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