


Is this the maturation Phase of Vapor Intrusion Investigations?

Presenter: Will Elcoate
June 27th, 2012



EPA Moves forward with Vapor Intrusion



[EPA plans to tear down three city businesses](#)

Columbus Telegram
COLUMBUS — The Environmental Protection Agency now plans to tear down three city businesses that ... the sooner we can get the **vapor intrusion** problem solved."



EPA reviews their 2002 VI Guidance

Vapor Intrusion

EPA's Review

"It's a lot more complicated than indicated in the 2002 Guidance"

- Tier 1 Update Screening Tables
- Tier 2 Using Groundwater for Screening appears to be valid
 - *external soil gas data is problematic*
 - Multiple lines of evidence approach appears valid
 - **Early Indoor Air testing appears valid**
- Tier 3 More flexibility on duration of indoor air sampling.

Many published guidance's follow a tiered approach based on developing a CSM Conceptual Site Model (CSM) & Multiple lines of Evidence (MLE)



<http://www.epa.gov/oswer/vaporintrusion/>



EPA's pending update

EPA has announced they will release their new Vapor Intrusion Guidance by November 30, 2012.

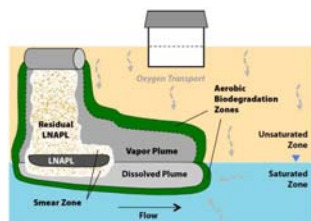
A draft final version of the guidance for comment will be released Spring 2012

- Screening Tables, Conceptual Site Model, Multiple Lines of Evidence
- Guidance on pre-emptive mitigation
- Guidance on mitigation management and closing sites
- How risk from petroleum hydrocarbons should be addressed

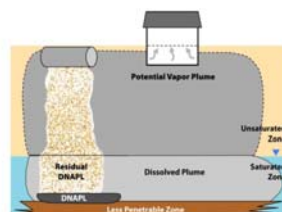


Petroleum Vapor Intrusion

Petroleum hydrocarbons (PHCs) such as gasoline, diesel, and jet fuel
Chlorinated solvents such as the dry cleaning chemical tetrachloroethylene (perchloroethylene, or PCE) and the degreasing solvents trichloroethylene (TCE), 1,1,1-trichloroethane (TCA), and PCE



Typical petroleum hydrocarbon transport conceptual scenario



Typical chlorinated solvent transport conceptual scenario



Vapor Intrusion Guidance

- States with "Final" Guidance
NY

All States with guidance

AL, AK, AZ, CA, CO, CT, DE, ID, IN, LA, MN, MD, MA, MI, MN, MC, MT, NE, NH, NJ, NY, OH, OR, PA, SD, WI.

- States without specific guidance reference EPA, ITRC and other State programs



PA Updating ACT 2, VI update Spring of 2013



Vapor Intrusion Guidance

IS there consensus on how to approach VI Pathway Investigations?

- Tiered approach to VI Investigations
Use of Conceptual site model, Multiple lines of evidence
- Risk Screening Levels and Compounds of Concern
- Data collection, sampling and analysis: including SOP's
- Addressing background: both Ambient & Indoor
- Preferential pathways
- When to stop investigating and go to mitigation



Updates to VI Guidance

Highlights of VI Changes

- VI Screening Level Updates **pending**
- VI Requirements in N.J.A.C. 7:26E – TRSR
 - Establishment of VI IEC; and,
 - Vapor Concern (VC)
- VI Reporting Forms
- <http://www.nj.gov/dep/srp/srra/forms/#draft>
- Gasoline Exclusion
- Modifications to VI triggers for diesel and No. 2 fuel oil
- Regulatory and mandatory timeframes
- Data Usability assessment



Data Usability

Why is Representative & Relevant data important?

- Empirical data for determination of Health Risk Exposure by inhalation
- Address public concern about exposure to toxic and/or carcinogenic volatile chemicals
- Determine if Environmental Screening Levels are exceeded
- Confidence in defining both the potential and extent
- As an environment Professional you may be required to certify the data in the reporting process

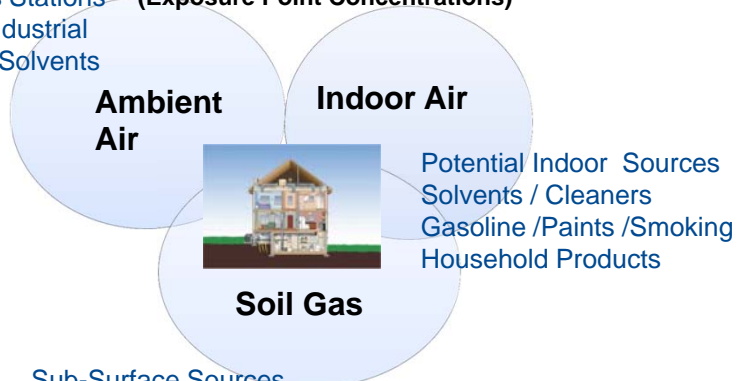


Indoor Air is the Point of Exposure

Ambient Sources

Highways / Gas Stations (Exposure Point Concentrations)

Commercial / Industrial
Facilities using Solvents



Sub-Surface Sources

Groundwater / Contaminated soil / Sub-surface conduits (sewers, utilities)/ lithology

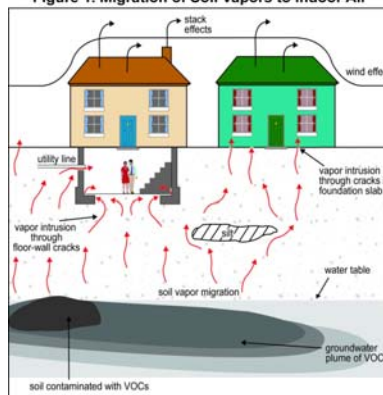


Assessment Phase

Conceptual Site Model

- Potential release sources
- Nature and extent impacts
- Potential migration pathways
- Potential sources of vapor intrusion
- Concentrations and extent of VOCs in soil gas and groundwater
- Potential indoor air receptors

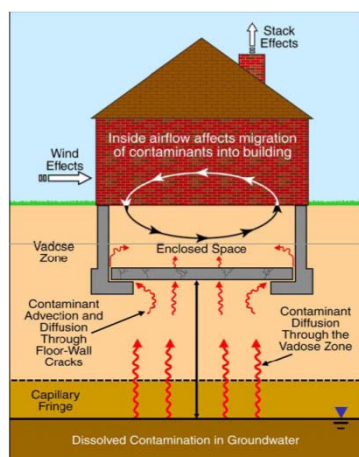
Figure 1. Migration of Soil Vapors to Indoor Air



<http://www.epa.gov/oswer/vaporintrusion/basic.html>



Assessment Phase



Multiple Lines of Evidence (MLE)

- Building construction and condition
- Sub- Surface lithology/ stratigraphy
- Presence of preferential pathways
- Groundwater spatial data
- Modeling data
- Sub slab & Soil Gas data
- Indoor Air Data
- Seasonal & temporal effects
- Constituent Ratios



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Usability of Data

Field Sampling

Define Data Quality Objectives (DQO's) for field data collection, develop a Quality Assurance Project Plan QAPP.

- QAPP requirements are defined during the development of the CSM from the MLE
- Sampling collection, location selection & sampling protocols
- Laboratory Test Methods and QA/QC controls
- In field documentation and field screening data

Data Quality & Usability, is evaluated against conformance to the QAPP



When to sample

Table 2-1: Conditions for Sampling Indoor Air

Parameter	Most Conservative Conditions	Least Conservative Conditions
Season	Late winter/early spring	Summer
Temperature	Indoor 10°F > than outdoors	Indoor temp < outdoor temp.
Wind	Steady, > ~5 mph	Calm
Soil	Saturated with rain or frozen	Dry
Groundwater	High water table	Low water table
Pressure	Indoor > Outdoor	Indoor < Outdoor
Doors/Windows	Closed	Open
Heating System	Operating	Off

Multiple indoor sampling events, at least 1 under the most conservative conditions



Indoor Air Sampling

The diagram illustrates various indoor air sampling locations in a house. It shows a cross-section of a house with a basement, a crawlspace, and an attached garage. Sampling points are indicated for Ambient Air (outside), Upstairs, Downstairs, Basement, Subslab Air (under the floor slab), Indoor Air (inside the house), and Crawlspace / Basement Air (in the crawlspace). A foundation crack is also labeled. Four inset photographs show: 1) Two people outdoors with a sampling device labeled 'AMBIENT AIR'. 2) A sampling device on a floor labeled 'SUBSLAB AIR'. 3) A sampling device in a crawlspace labeled 'CRAWLSPACE / BASEMENT AIR'. 4) A sampling device in a garage labeled 'INDOOR AIR'. The Alpha Analytical logo is in the bottom left, and the number 14 is in the bottom right.

Ambient Air

UPSTAIRS

DOWNSTAIRS

ATTACHED GARAGE

INDOOR AIR

AMBIENT AIR

BASEMENT

Foundation Crack

SUBSLAB AIR

CRAWLSPACE / BASEMENT AIR

Courtesy of Thomas McHugh GSI Environmental Inc.
Battelle Bioremediation Symposium 2011 Reno, Nevada

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Soil Gas & Sub Slab Sampling

Two photographs illustrate field sampling. The left photo shows three people in a field; one is using a soil gas sampling device. The right photo shows a sub slab sampling setup with a vacuum pump, a gas cylinder, and a sampling device connected to a sub slab access point. The Alpha Analytical logo is in the bottom left, and the number 14 is in the bottom right.

Courtesy: Viridian Environmental Field Services

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Air Sampling Equipment

Sampling Canisters typically used: Sizes available to meet sampling and reporting needs



Grab Sample Filter



F.C. Soil Vapor

Flow Controller FC Configurations



Ambient air F.C.

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Soil Gas & Sub-Slab Sampling

Steps in sub-surface vapor sampling

- Before collecting sampling: Check installed sample points for flow – adjust draw for tight soils: max recommended is 200mls/min
- Field check soil vapor during setup, FID/PID
- Demonstrate sample train integrity before sampling “Shut in Check”
*“Withdraw air from the sampling apparatus until a vacuum of approximately 100” water (10 in. Hg) is Achieved. Observe the induced vacuum for at least 1 min and preferably for 5 min.
 If a change in vacuum over the observation period is equal to or less than 1700 Pa (0.5 in. Hg), the system leak rate is acceptable.”*
- If leak check is required, develop and follow standard operating procedure
- Take pictures & document



Soil Gas & Sub Slab Sampling

ASTM D7663 - 11 Standard Practice for Active Soil Gas Sampling in the Vadose Zone for Vapor Intrusion Evaluations

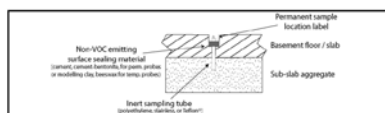
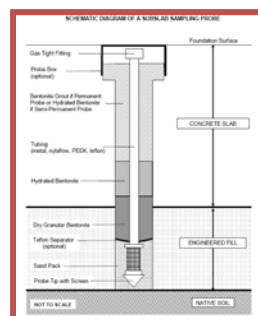
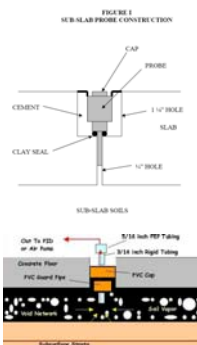
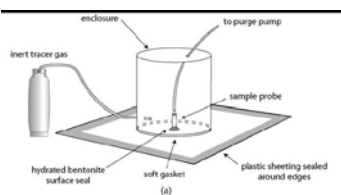


Figure 2.3 Schematic of a sub-slab vapor probe



Sub-Slab Sampling



Sub-Slab probe installation
Purging
In field leak check



Courtesy: EST Associates, Mt Laurel NJ



Indoor Air Sampling

The challenges of indoor air sampling are:

Separating the Vapor Intrusion pathway impact from Ambient background and Indoor air sources

Conduct a Pre-sampling survey



New Jersey Department of Environmental Protection

INDOOR AIR BUILDING SURVEY and SAMPLING FORM

Preparer's name: _____ Date: _____
 Preparer's affiliation: _____ Phone #: _____
 Site Name: _____ Case #: _____

Part I - Occupants

Building Address: _____
 Building Block: _____ Lot: _____
 Property Contact: _____ Owner / Renter / other: _____
 Contact's Phone: home () _____ work () _____ cell () _____
 # of Building occupants: Children under age 13 _____ Children age 13-18 _____ Adults _____



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Background Volatile Compounds

Table G-4
Summary of Ambient Indoor Levels and New Jersey Median Background Concentrations of Volatile Contaminants in Homes ($\mu\text{g}/\text{m}^3$)^a

Chemical	CAS No.	Range of median values	Representative median indoor air concentrations	Range of 90th percentile values
Acetone (2-Propanone)	67-64-1	6-34	34	62-110
Benzene	71-43-2	<1.6-3.1	2	5.2-15
Bromodichloromethane (Dichlorobromomethane)	75-27-4	<RL		<RL
Bromoethene (Vinyl bromide)	593-60-2	<RL		<RL
Bromoform	75-25-2	<RL		<RL
Bromomethane (Methyl bromide)	74-83-9	<RL		0.6 ^b
1,3-Butadiene	106-99-0	<RL		1.6 ^b
2-Butanone (Methyl ethyl ketone) (MEK)	78-93-3	1.5 ^b 2.7-3.5 ^b	4	6.7 ^b 9.5-16 ^b
Carbon disulfide	75-15-0	0.13 ^b		0.86 ^b
Carbon tetrachloride	56-23-5	<0.25-0.6	0.6 ^c	0.8-0.9
Chlorobenzene	108-90-7	<RL		<RL
Chlorodibromomethane (Dibromochloromethane)	124-48-1	<RL		<RL
Chloroethane	75-00-3	<RL		<RL
Chloroform	67-66-3	<0.25-2.4	1	1.4-3.4 ^d 4 ^b
Chloromethane (Methyl chloride)	74-87-3	0.5-1.4	1	1.8-3.3
3-Chloropropene (Allyl chloride)	107-05-1	<RL		<RL
2-Chlorotoluene (o-Chlorotoluene)	95-29-8	<RL		<RL
Cyclohexane	110-82-7	0.7-0.8 ^d 4.5 ^b	0.7	2.8-8.1 ^d 15 ^b
1,2-Dibromoethane	106-93-4	<RL		<RL
1,2-Dichlorobenzene (o-Dichlorobenzene)	95-50-1	<RL		0.7 ^b
1,3-Dichlorobenzene (m-Dichlorobenzene)	541-73-1	0.15 ^b		0.5-1
1,4-Dichlorobenzene (p-Dichlorobenzene)	106-46-7	0.2-2		1.3-3.8
Dichlorodifluoromethane (Freon 12)	75-71-8	<0.25-3.3	3	5-15
1,1-Dichloroethane	75-34-3	<RL		<RL

Median concentration



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Background Volatile Compounds

U.S. Department of Health & Human Services www.hhs.gov

Household Products Database
Health & Safety Information on Household Products

Home Products Manufacturers Ingredients Health Effects

Quick Search

What's under your kitchen sink, in your garage, in your bathroom, and on the shelves in your laundry room? Learn more about what's in these products, about potential health effects, and about safety and handling.

Browse by Category

- Auto Products
- Inside the Home
- Pesticides
- Landscape/Yard
- Personal Care
- Home Maintenance
- Arts & Crafts
- Pet Care
- Home Office

Browse A-Z

- Product Names
- Types of Products

Auto Products
Brake Fluid, De-icer, Lubricant, Sealant, and more...

Inside the Home
Air Freshener, Bleach, Cleaners, Toilet Bowl Cleaner, and more...

Pesticides
Animal Repellent, Fungicide, Herbicide, Insecticide, and more...

Landscape/Yard
Fertilizer, Lawn Care, Swimming Pool Products, and more...

Personal Care
Antiperspirant, Hair Spray, Makeup, Shampoo, Soap and more...

Home Maintenance
Caulk, Grout, Insulation, Paint, Putty, Stain, and more...

ALPHA
ANALYTICAL
World-Class Chemistry

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Typical Air/Vapor Analytic Methods

Laboratory Methods used for Vapor Intrusion Investigations

USEPA Method TO-15

(NJDEP-LL TO-15 -3/2-2007?)

MassDEP APH Carbon Ranges & Target Analytes

USEPA Method TO-17 "Sampling with Automatic Thermal Desorption tubes"

USEPA Method 3C Fixed Gases & Methane

Gasoline exclusion ...active Natural attenuation

Other Methods

Mercury NIOSH 6009



NJ DEP TO15 Low Level Method

Status of USEPA Method TO-15 **verses** NJDEP-SRP Low Level TO15

- Tech Rules and Laboratory certification
- Documentation requirements
- Deliverables NJDEP data report format



New Jersey Department of Environmental Protection
Division of Remediation Management Response

NJDEP-SRP LOW LEVEL USEPA
METHOD TO-15
(NJDEP-LLTO-15-3/2007) FOR
AMBIENT AIR
NJDEP REGULATORY DATA REPORT
FORMAT-APPENDIX 1
MARCH 2007
(March 2006 Update)



Office of Data Quality
Division of Remediation Management
and Response
PO Box 413
6th Floor
Trenton, New Jersey 08625-0413



NJDEP TO15-LL Method

What's so different?

- Specific target analyte list: additional analytes
- Additional QC is required
 - Reporting limit recovery check
 - Closing calibration check
- Only use a 6 L can for ambient/indoor air collection
- Specific Data deliverables: additional forms & documentation
- Tentatively Identified Compounds (TICs)

Technical Regulation incorporates EPA TO15 & NJDEP TO15LL



Method Comparison TO15 v TO17

EPA /NJ Method TO15 Whole Gas sample



Method TO 15
Broad Range of VOC's
Meets current ESL's
Multiple analysis &
methods
from one canister

Investigation Phase



EPA Method TO17

Samples collected on sorbent
media: Active or Passive?



Method TO 17

Knowledge of concentrations
& VOC's present
Soil Gas: easy to exceed tube
capacity
14 day hold time/4 degrees C
*Passive mode; has protocol been
validated?*

Monitoring Phase & specific compounds

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Setting up to Sample

Contact the Laboratory in advance:

Information to provide the Laboratory


- Compound List & Reporting Limits
Does the requested VOC's cover CSM / MLE?
- Type of sample: Soil Gas or Indoor /Ambient
- Sample time: 200mls/min, 8hrs, 24hrs?
- How many samples and when?

Field Sampling

- Is leak check being performed?

Review data on receipt:
Alpha ADEX Data Checker





Alpha Analytical
320 Forbes Blvd
Mansfield, MA 02048-1806
Tel: 508-822-9300
Fax: 508-822-3288

AIR Chain-of-Custody - NJ

Date Rec'd in Lab: _____

ALPHA Job# _____

Client Contact Information		Project Information		NJ DEP Information		of		CDG	
Company: _____		Project Name: _____		Bureau: _____ Division: _____ Contract No: _____		Analysis		Matrix	
Address: _____		Project No: _____		Report Information - Data Deliverables:					
City/State/Zip: _____		Site/Location: _____		<input type="checkbox"/> FAX: _____ <input type="checkbox"/> ADEx _____ <input type="checkbox"/> Criteria Checker: _____ <input type="checkbox"/> EMail (standard pdf report) _____					
Phone: _____		Project Manager: _____		Billing Information					
FAX: _____		Analysis Turn-Around Time		<input type="checkbox"/> Same as Client info PO #: _____ <input type="checkbox"/> Rush (Specify): _____					
Email: _____		Standard (Specify): _____							
Site Contact: _____		Rush (Specify): _____							
Site Contact Phone: _____									

ALPHA LAB ID (Lab Use Only)	Sample Identification	Sample Details	Time Start (24 hr clock)	Time Stop (24 hr clock)	Canister Pressure (at field) (Psi)	Canister Pressure (in lab) (Psi)	Inlet Temp. (F)	Inlet Temp. (C)	Outgoing Canister Pressure (Psi)	Incoming Canister Pressure (Psi)	Flow Bag ID	Can ID	Can Size (L)	Flow Controller Readout (m/min) (Note 1)	Set Pt Can ID (Note 1)	TO-15	BPA/C	Notes/Remarks	Signature

Custody Seal: _____

Outgoing Seal No: _____ (Refer to case file)

Incoming Seal No: _____ (if available)

Special Instructions/Remarks/Requirements & Comments: _____

Canisters Shipped by: _____ Date/Time: _____

Canisters Relinquished by: _____ Date/Time: _____

Relinquished by: _____ Date/Time: _____

Canister Received by: _____ Date/Time: _____

Received by: _____ Date/Time: _____

Received by: _____ Date/Time: _____


Please print clearly, legibly and completely. Samples can not be logged in and turnaround time clock will not start until all ambiguities are resolved. All samples submitted are subject to Alpha's Payment Terms. See reverse side.

Form: 101-06 September 16, 2011 Note: Combined External Chain of Custody and NJDEP Field Test Data Sheet

Usability of Data

NJ DEP

- **FULL LABORATORY DATA DELIVERABLES FORM**
- Section F. Data Quality Assurance/Quality Control**



New Jersey Department of Environmental Protection
Site Remediation Program

FULL LABORATORY DATA DELIVERABLES FORM

Non-LSRP (Existing Cases)
 LSRP
 Subsurface Evaluator

Date Stamp
(For Department use only)

SECTION A. SITE NAME AND LOCATION

I am committing a crime of the fourth degree if I make a written false statement which I do not believe to be true. I am also aware that if I knowingly direct or authorize the violation of any statute, I am personally liable for the penalties.



Signature: _____ Date: _____

Name/Title: _____ No Changes Since Last Submittal

Full Laboratory Data Deliverables Form
Version 1.3 5/25/11
Page 3 of 4

MassDEP: MCP REPRESENTATIVENESS EVALUATIONS AND DATA USABILITY ASSESSMENTS Policy #WSC-07-350

<http://www.mass.gov/dep/cleanup/laws/07-350.pdf>

Data Usability

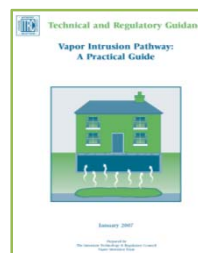
Were the data reported relevant and representative?

- Appropriate and documented sampling strategies
- Followed best practices for sample collection
- Sample & equipment integrity?
- Were data reviewed?
- Was background considered?
- Were issues that may effect usability addressed?



Is the Market Maturing for Vapor Intrusion ?

- EPA Update will address Policy
- ITRC Guidance is being adopted by many states as “best practices”
- Complex pathway to evaluate: States, environmental professionals, Stakeholders & responsible parties are still on the learning curve
- The Best Practices have been established, States will be catching up over time



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Questions

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