



# Analysis of Low Level Volatile Organic Compounds in Air by EPA Method TO 17 and/or Passive Monitors

**Prepared by Will Elcoate**

Alpha Analytical Laboratories, 8 Walkup Drive,  
Westborough, MA, 01581



# Introduction

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Some considerations when expanding Air Analysis Offering



# Air Analysis Methods

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- **Industrial Hygiene (IH) Air**
  - IH = Work place exposure  
*typically involves chemicals in use at facilities*  
*OSHA & NIOSH Methods*
- **Ambient Air Quality/Indoor Air Quality**
  - *CAA Air Toxics Emissions Regulated*
  - *Indoor Air quality...Department of Health*
  - *Vapor Intrusion / Sub-slab soil Gas*



# Air Analysis Methods

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## Industrial Hygiene

OSHA & NIOSH Methods – Certification program; [www.aiha.org/](http://www.aiha.org/)

Certified Industrial Hygienist CIH to review Data usability

- Methods are targeted to specific industrial pollutants
- Sorbent media; active & passive sampling
- Generally solvent extraction, GC analysis

*AIHA - American Industrial Hygiene Association*

*Evolution of Passive Technology, (Particularly in Europe)*

Products that have gone through a validation process  
at ppbv & sub-ppbv levels

Radiello, Badges, SKC Passive/TO17 Modification



# Air Analysis Methods

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EPA Compendium Methods developed for Ambient Air Analysis. Published in 1999  
Ambient/Indoor Air Methods

Few Updates:

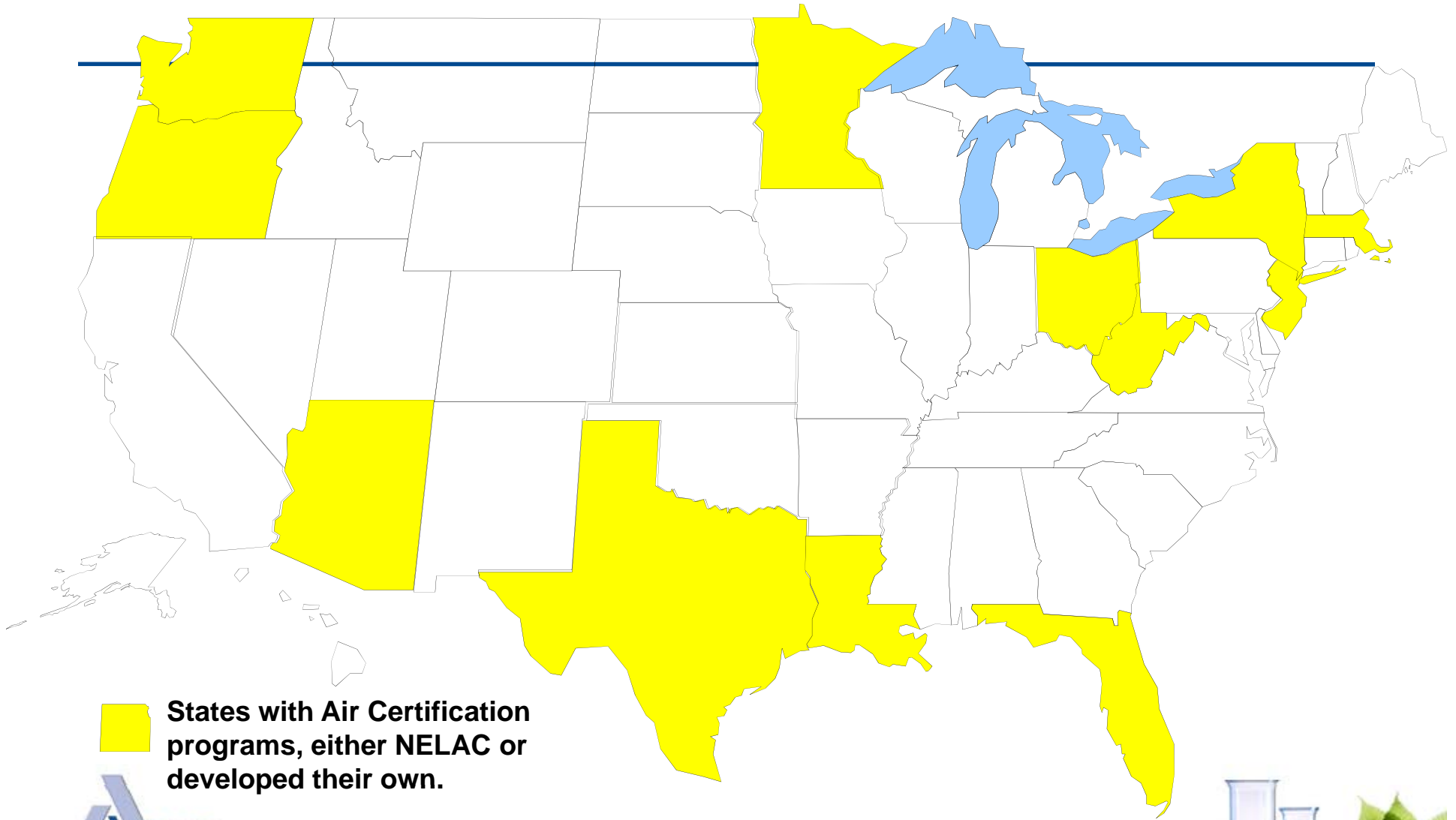
TO15 in 2009 dropping RL's from 0.5ppbv to 0.2ppbv

Method TO 17 is a update of TO1 & TO2 using sorbent media for sample collection and thermal desorption, analytical approach same as TO15.

Benefits: light weight and easy to deploy samplers  
Media options to target a wide range of VOC's, including higher MW compounds.  
Commercially available TD Units.



# Air Analysis by State



<http://www.nelac-institute.org/accred-bodies.php>



# VI - Indoor Air is the point of exposure

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## Ambient Sources

Highways / Gas Stations  
Commercial / Industrial  
Facilities using Solvents

**Ambient Air**

**Indoor Air**

**Potential Indoor Sources**  
Solvents / Cleaners  
Gasoline / Paints / Smoking  
Household Products



**Soil Gas**

## Sub-Surface Sources

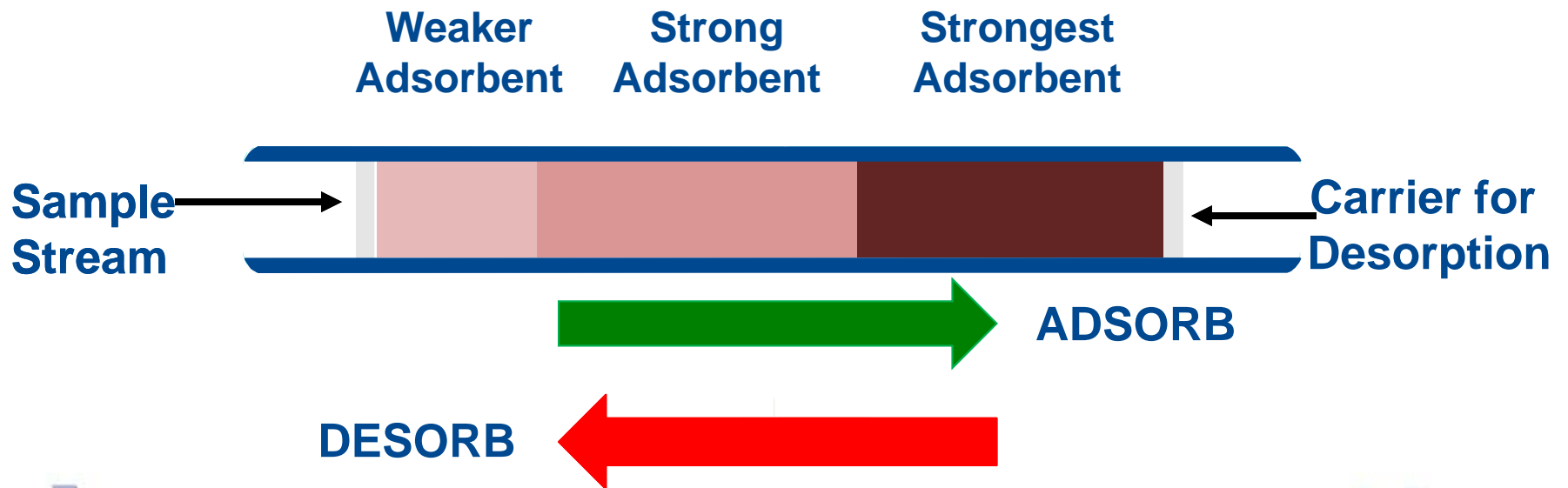
Groundwater / Contaminated  
soil / Sub-surface conduits  
(sewers, utilities)/ lithology



# EPA Method TO 17

Multiple sorbent options allows to target a wide range of Volatile compounds

Multi-Bed sorbents; allows for wide boiling point range sample analysis





# EPA Method TO-17

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## Method

- **Concurrent samples** with independent flow control
  - 16.7 ml/min to collect 1 liter of air in 1 hour
  - 66.7 ml/min to collect 4 liters of air in 1 hour
  - Maximum volume dependent on expected concentrations and sample source
- Maximum recommended volume 12 liters.
- RL's < 0.5 ppbv
- Agreement within 25% for distributed volume pairs of tubes sampled concurrently



# EPA Method TO 17

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## TO Methods are performance based

- Demonstration of capability on different media combinations
- Application to Soil Gas Vapors
  - High humidity, high concentration samples
- Samples collected in series
  - Smaller sample Volumes 60mls.
  - Targeting higher MW compounds Naphthalenes & C10 to C24 Hydrocarbon

## Transferring Passive monitor media to TD Tube



# AWMA Vapor Intrusion Conference 2009

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## Investigating Vapor Intrusion with Confidence & Efficiency (Some Observations from Indoor Air-based Radon Intrusion Studies)

Henry J. Schuver<sup>1</sup> and Ronald B. Mosley<sup>2</sup>

<sup>1</sup> USEPA (U.S. Environmental Protection Agency) however note this personal-time effort does not represent or imply USEPA policies or positions.

<sup>2</sup> USEPA (U.S. Environmental Protection Agency), Office of Research and Development

- **Indoor air is the exposure point of concern and indoor air samples are the best means of estimating long-term indoor air exposure concentrations and risks.**
- **Only indoor air samples integrate the influences of both sub-surface and above-ground factors as well as the influences of the building and its occupants.**
- **The temporal variability observed in indoor air is the cumulative variability from all sub-surface, above-ground, and building factors**
- **Lesson from the Radon program is that longer term sample collection maybe more representative of all these factors on indoor air**



# Background Volatile Compounds

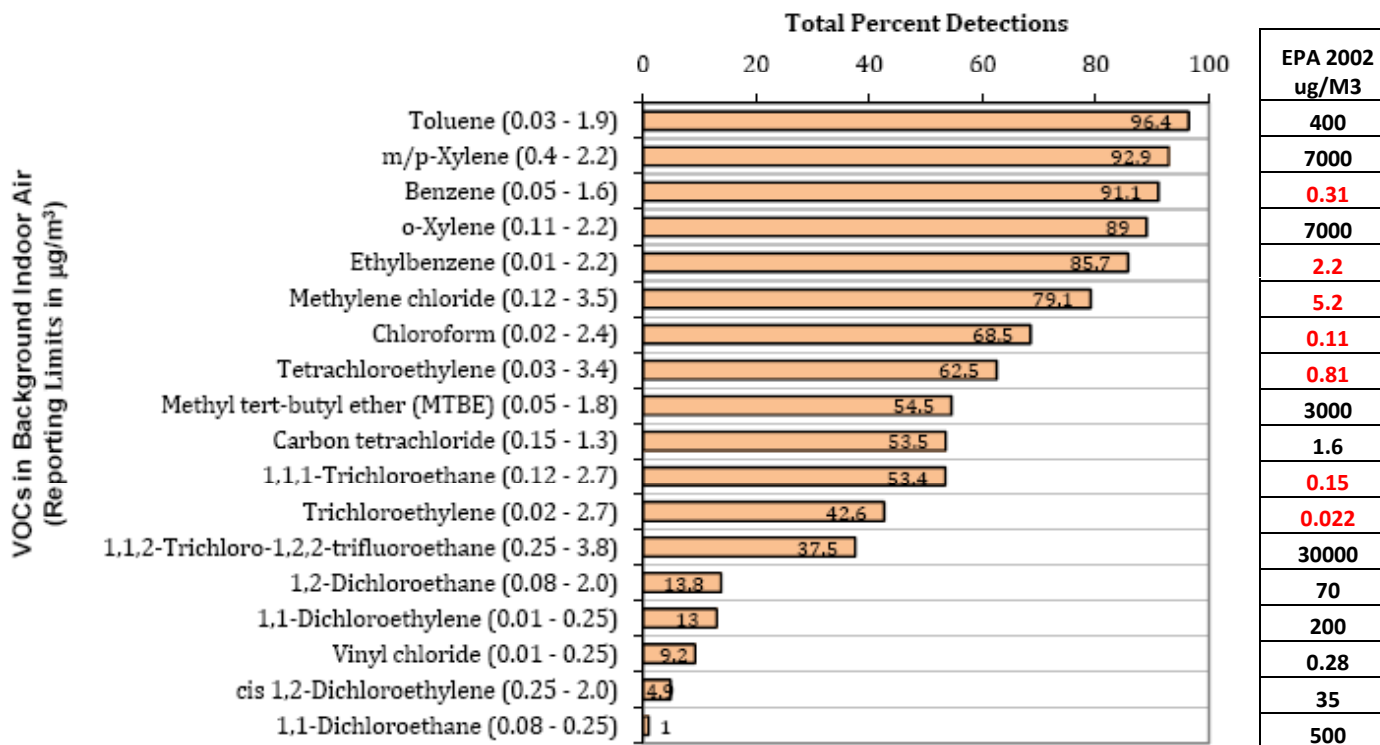


Figure 4. Total percent detections of common VOCs in background indoor air compiled from 15 studies conducted between 1990 and 2005. Range of reporting limits is shown in parentheses.



# Passive Monitors Indoor

## Apparent Benefits:

- Handling/shipping
- Easy deployment, light weight, no Pumps, un-obtrusive
- Extended sampling period time >30days
- Ability to detection ppbv levels

## Cautions

- Environmental factors, temperature, wind speed/ air movement  
Humidity & particulates
- Finite capacity
- Requires solvent extraction, adds a dilution
- TO17 Modification – Thermal desorption from tube used for sample collection  
Transfer of media requires modification and re-validation



ULTRA III – Front view



# Naphthalene example

	UG/M3	DL	LOD	LOD	RL	Res Indoor	Res Soil
TO15 FullScan	Naphthalene	0.2427	0.4875	0.97	1.05	0.072	31.9
TO15SIM	Naphthalene	0.063	0.1258	0.252	0.262	0.072	31.9

Naphthalene	Reporting Limit	EPA RSL	Volume Liters	Volume (+30%)	Flow	Total Time
Method TO17	10 NG/Tube	72 NG/M3	13.88	18	200 mls/min	1 1/2 hours
Passive Monitor	30NG	72 NG/M3	41.64	55	5mls/min	18 1/3hrs

Typical air concentrations of naphthalene in cities are about 0.944ug/M3

EPA Technology Transfer Network Air Toxics Web Site –**Naphthalene**

<http://www.epa.gov/ttn/atw/hlthef/naphthal.html>



# Initial Evaluation of TO 17 and Passive Monitors for VI

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- Both have applicability to certain aspects of Data collection for Vapor Intrusion determinations
- EPA TO17 is an EPA validated method, performance based and requires modifications to be documented and demonstrated
- Requires upfront planning, site knowledge and experience samplers to be used effectively

## Passive Monitors

- Offers an attractive approach to longer term sampling
- Environmental conditions can effect performance
- Regulatory Acceptance and adoption problematic



# Is there Light at the end of the Tube?

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# Data Quality

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## **Introduction to SW846, Chapter 1, Data Quality...**

“It is the goal of the U.S. Environmental Protection Agency's (EPA's) quality assurance (QA) program to ensure that:

- all data be scientifically valid, defensible,
- of known precision and accuracy.

The data should be of sufficient known quality to withstand scientific and legal challenge relative to the use for which the data are obtained”.



# Is there Light at the end of the Tube?

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Increased regulatory attention on the impact of sample collection on final data quality & usability

Laboratory Data is reviewed against conformance or non-conformance to the Laboratory SOP's .....on the samples received.

Empirical Data Acquisition:

- Relevance of samples to Project Plan
- Sampling & Analytical Methods
- Integrity of sampling & sample handling
- Field QA/QC samples collected
- Documentation of field Activities



# Is there Light at the end of the Tube

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TNI/ NEFAP

National Environmental Field Activities Program (NEFAP)

The purpose of the National Environmental Field Activities Program (NEFAP) is to establish and implement an accreditation program for field sampling and measurement organizations (FSMOs).



# Is there Light at the end of the Tube?

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- US EPA - Unified Federal Policy for Quality Assurance Project Plans UFP-QAPP
- MassDEP
  - Presumptive certainty
  - Screening Data
  - Data representativeness & Usability Assessment  
<http://www.mass.gov/dep/cleanup/laws/07-350.pdf>
- NJ DEP
  - Technical Regulations, requirement for a each project.
  - Project review check list and sign off



# Data Quality & Usability

## NJ DEP

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

 <p>New Jersey Department of Environmental Protection Site Remediation Program</p> <p><b>FULL LABORATORY DATA DELIVERABLES FORM</b></p> <p><input type="checkbox"/> Non-LSRP (Existing Cases)   <input type="checkbox"/> LSRP   <input type="checkbox"/> Subsurface Evaluator</p>	<p>Date Stamp (For Department use only)</p>
<p><b>SECTION A. SITE NAME AND LOCATION</b></p>	
<p><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.</i></p>	
<p>Signature: _____ Date: _____</p>	
<p>Name/Title: _____ <b>No Changes Since Last Submittal</b> <input type="checkbox"/></p>	



# Conclusion

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Developing Data Quality / Usability reporting requirements incorporating field data evaluation will require closer scrutiny on field sampling activities.

TO17 offers some advantages, ability to target compounds of interest, report heavier MW compounds & lower reporting levels.

Selection of sorbent media, sample collection and taking additional samples with investigative sampling may limit its usefulness

Passive Monitors offer longer term sampling options. Project setup planning, data interpretation and regulatory acceptance may present some challenges.



# Questions

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**Preparers:**  
**Alpha Analytical**

**Will Elcoate**  
National Air Program Manager  
Tel: 508.330.3753  
[welcoate@alphalab.com](mailto:welcoate@alphalab.com)

**Andy Rezendes**  
Product Line Manager-Air Testing  
Tel: 508.844.4181  
[arezendes@alphalab.com](mailto:arezendes@alphalab.com)

## The end of the Tunnel

