



# VOC Investigations What's in the Air?

Advances in Green Building  
PO 137

Alice Delia, Ph.D.  
Prism Analytical Technologies, Inc.  
[a.delia@pati-air.com](mailto:a.delia@pati-air.com)

Celebrating 75 Years of  
*Protecting Worker Health®*

#aihce

AIHce2014+STEWARDSHIP

*Evolution & Journey to a Safer Tomorrow*

# Why Perform Air Quality Investigations?

---

- Increasing concern
  - Time indoors
  - Increased sensitivity
  - Understanding how environment influences health
- Increasing complexity
  - Biological
  - Particulate
  - Chemical

# What Is An Air Quality Investigation?

---

- Purpose
  - Problem
  - Baseline evaluation
- On site evaluation
- Testing
- Determine and implement course of action
- Follow up

# On-Site Evaluation

---

- History
  - Nature of problem
  - Recent changes (renovation, new products, new activities)
- Structural layout
  - Number of floors, open vs closed
  - Basement, attached garage
- Ventilation system
- Sources and activities
- Occupant population
  - Type: children, elderly, pregnant women, healthy adults
  - Health concerns: chronic, respiratory

# Testing

---

- Mold
  - Spores, cultures, mold VOCs
- Particulate
  - Microscopy
    - Skin cells, fibers, pollen, dust mites, building shedding
  - Gravimetric
- Chemical
  - Permanent gases (CO, CO<sub>2</sub>, NO<sub>x</sub>, methane)
  - Volatile Organic Compounds (VOCs)

# Volatile Organic Compounds (VOCs)

---

- Organic compounds that evaporate readily at room temperature
- Majority of chemical problems
  - Odors
  - Health
  - Active Mold (MVOCs)
  - Fire and Smoke

# Application of VOCs

- Chemical information limited usefulness by itself
  - Too complex to put into appropriate framework

Compound	CAS	ng/L	ppb	ng/L	RI	Additional Information
Benzene	71-43-2	3.1	0.9	0.2	698	
Bromobenzene	108-86-1	< 0.2	< 0.03	0.2	998	
Bromochloromethane	74-97-5	< 0.2	< 0.04	0.2	668	
Bromodichloromethane	75-27-4	< 0.2	< 0.03	0.2	764	
Bromoform	75-25-2	< 0.2	< 0.02	0.2	962	
tert-Butylbenzene	98-06-6	< 0.2	< 0.04	0.2	1043	
sec-Butylbenzene	135-98-8	< 0.2	< 0.04	0.2	1061	
n-Butylbenzene	104-51-8	< 0.2	< 0.04	0.2	1107	
Carbon Tetrachloride	56-23-5	< 0.2	< 0.03	0.2	684	
Chlorobenzene	108-90-7	< 0.2	< 0.04	0.2	899	

# Application of VOCs

---

## Additional information

- History and structural layout pertinent to VOCs
- Odor information
- Health information
- VOC Source prediction



# History and Structural Layout

---

- Type
  - Residential, office, commercial, manufacturing
- Age
  - Newer buildings often have different design and materials
- Construction or renovation
  - Material off gas
- Environmental conditions
  - Temperature, humidity

# Odor Information

---

- Description
  - Pleasant or unpleasant
  - Sweet, acrid, fruity, earthy, ethereal, 'chemical'
- Intensity
  - No odor to intolerable
- Threshold
  - Concentration at which 50% of panel detect odor
  - Variable for different individuals

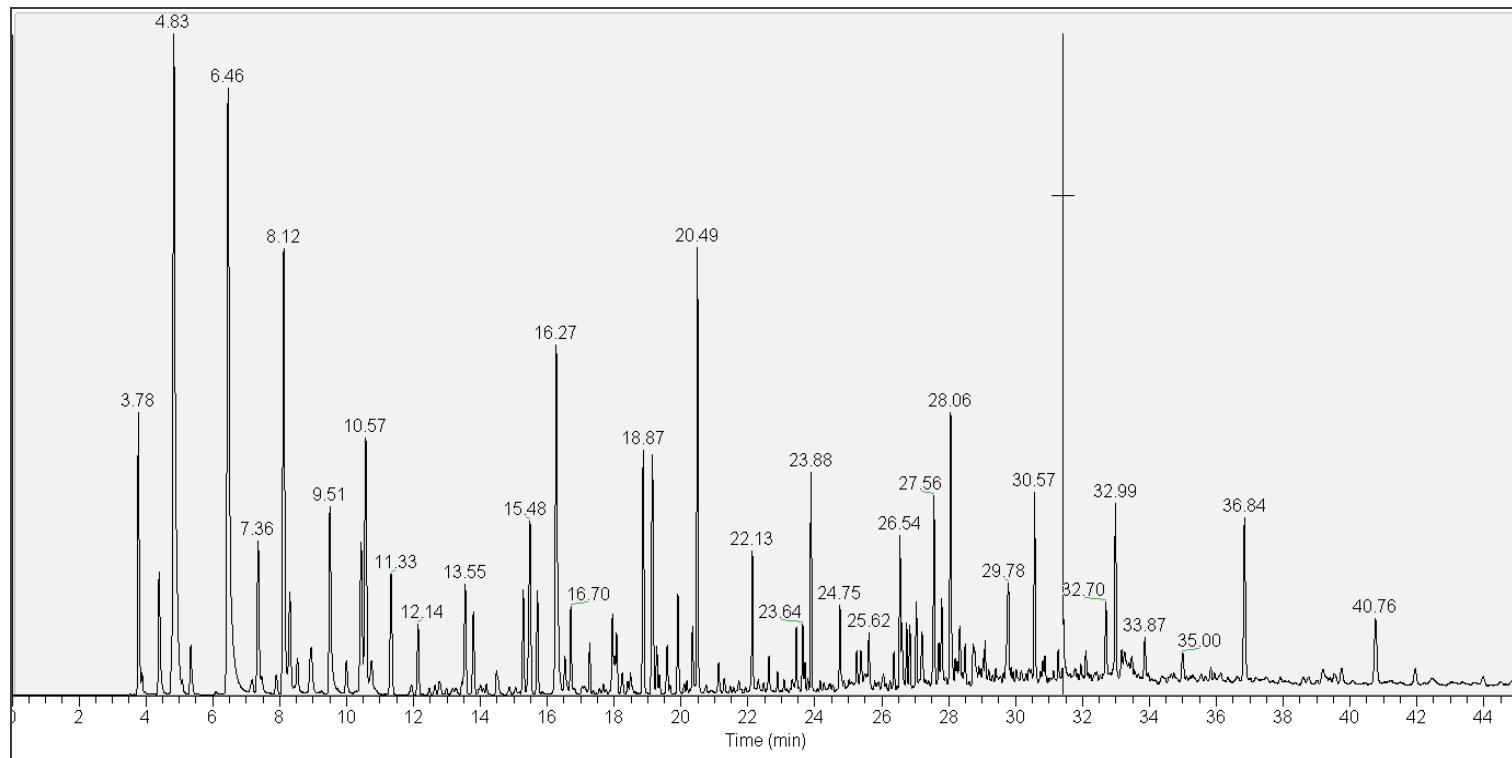
# Health Information

---

- Short term effects
  - Irritation: respiratory, eyes, nose
- Long term effects
  - Chronic conditions: asthma, cancer, organ damage
- Exacerbation of existing conditions
- Limits
  - Based on toxicology and epidemiology data
  - Workplace vs residential
  - Many chemical compounds not fully studied

# VOC Source Prediction

Chemical information → products and activities



# VOC Source Prediction

Personal Care Products	370	Moderate	Personal care products include soap, deodorant, lotions, perfumes, hair coloring supplies, nail care supplies, oral hygiene products, etc. They contain many VOCs that will dissipate if use is discontinued or reduced. Consider storing these products in a closed container when not in use, and dispose of unused products. Also, run an exhaust fan or open a window when dispensing these products.
Alcohol Products	2300	Severe	VOCs from alcohol can come from household cleaning products, antiseptic wipes, hand sanitizers, some solvents, reed diffusers, consumable alcohol, and some pharmaceuticals. These concentrations will be reduced by removing unnecessary products or proper storage of those materials in closed airtight containers. Consolidate cleaning products to the essentials. Consider switching to alternative methods of cleaning and sanitizing, e.g., baking soda, vinegar, borax, steam, etc., and ventilate the area during and after cleaning. We also recommend that you contact your service provider for further discussion and recommendations.
Odorants and Fragrances	42	Normal	VOCs in this category can come from scented candles, potpourri, air fresheners, scented cleaning products, and scented personal care products. Consider reducing use of scented products and store unused products in a tight fitting container.
Dry Cleaning Solvents	0	Normal	Typical dry-cleaning methods employ the use of carcinogenic chemicals. Dry-cleaning should be allowed to vent outside, without plastics bags, before being placed inside. Consider switching to a dry-cleaner that uses environmentally friendly methods.
Medicinals	3	Normal	Ointments and creams, topical first aid/pain relievers.

# Action

---

- Find sources
  - Remove
  - Reduce
- Ventilation
  - Number air changes
  - Air flow
- Clean
  - Air purifier/filter

# Follow Up

---

- Occupant experience
- Post response on-site evaluation
- Additional testing
- Additional action

# Where's the Ethanol

---

## Example 1

- Office building
- Employee complaints

## VOC Data

- High Total VOC
- High ethanol

## Resolution

- Hand sanitizer use



# Where's the Ethanol

---

## Example 2

- Residence
- TVOC > 25,000 ng/L
- Almost all Ethanol

## Resolution

- Cooking
  - Tomato sauce with bottle of vodka

# What's in the Paint?

---

- Types
  - Latex, oil based, low- or no-VOC, additives
- Complex mixture
  - Solid
    - Titanium dioxide, silicates, kaolin
  - Liquid
    - Hydrocarbons, Texanol™, glycols and glycol ethers

# What's in the Paint

---

- Hydrocarbons (C10-C14)
  - Solvents, sealers, diesel fuel/fuel oil, waxes
- Texanol™
  - Unique but not always present
- Glycols/Glycol Ethers
  - Cleaners (degreaser, window, soaps), automotive fluids, solvents, pesticides

# Summary

---

- Complexity of problems requires more comprehensive testing and evaluation
  - Multiple problems or sources
  - Individuals more sensitive or aware
- On-site evaluation essential
  - Sources, activities, influences, occupants
- Testing narrows down potential sources
- Action to eliminate problem
- Follow up to determine effectiveness

# Additional Resources

---

US Department of Health and Human Services  
Household Products Database

<http://householdproducts.nlm.nih.gov/>

US EPA Indoor Air Pollution: An Introduction for  
Health Professionals

<http://www.epa.gov/iaq/pubs/hpguide.html#Diag%20Quick%20Ref>



# Questions?

[a.delia@pati-air.com](mailto:a.delia@pati-air.com)

989-772-5088

Co-sponsored by  
AIHA® & ACGIH®

#aihce

AIHce2014+STEWARDSHIP

*Evolution & Journey to a Safer Tomorrow*