



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

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, CO₂, NO_x, 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

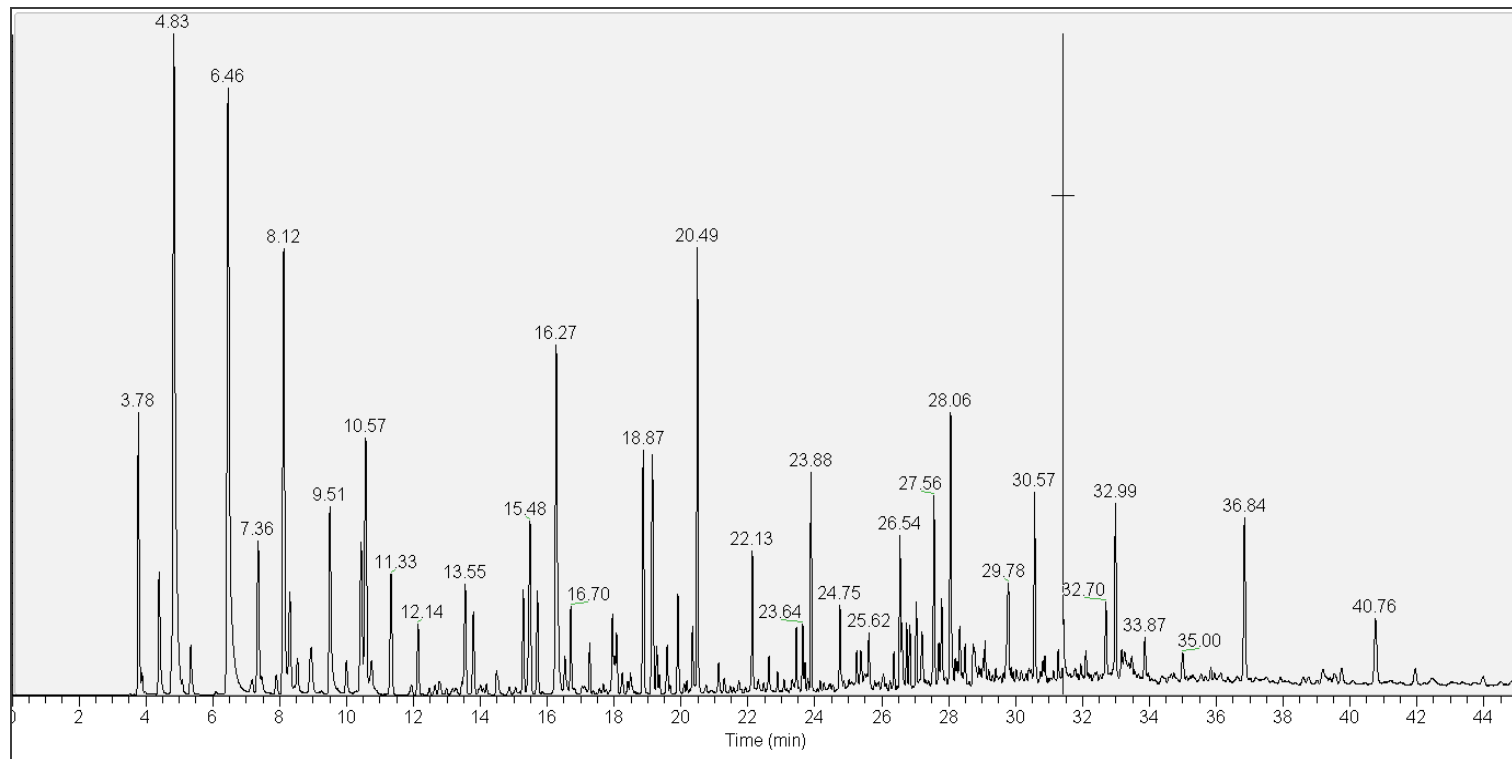
- Description
 - Pleasant or unpleasant
 - Sweet, acrid, fruity, earthy, ethereal, ‘chemical’
- Intensity
 - No odor to intolerable
- Threshold
 - Concentration at which 50% of panel detect odor
 - Variable for different individuals

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

989-772-5088

Co-sponsored by
AIHA® & ACGIH®

#aihce

AIHce2014+STEWARDSHIP

Evolution & Journey to a Safer Tomorrow