TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

Some challenges to sampling and reporting low level VOC's in Ambient Air related to inhalation risk exposure.

Presented by
Will Elcoate
Air Product Manager

National Environmental Monitoring Conference

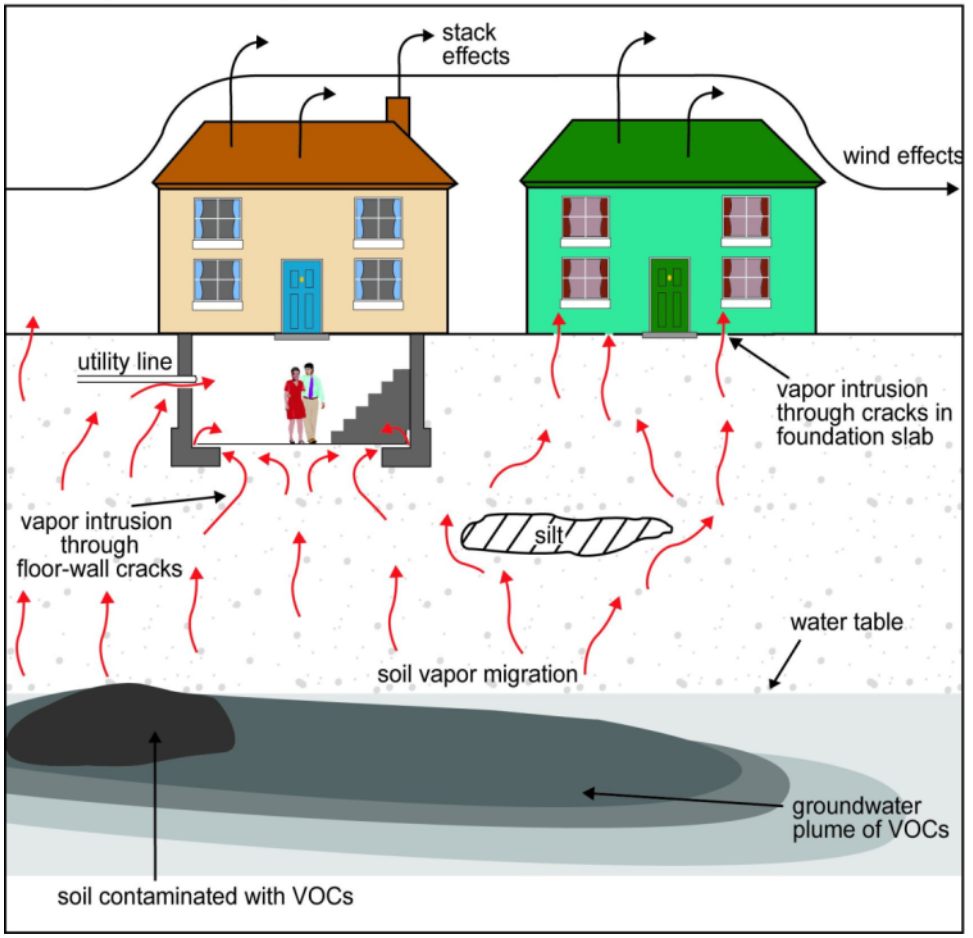
August 18th. 2011

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Vapor Intrusion

Vapor Intrusion is the migration of volatile chemicals from the subsurface into overlying or adjacent buildings

Figure 1. Migration of Soil Vapors to Indoor Air

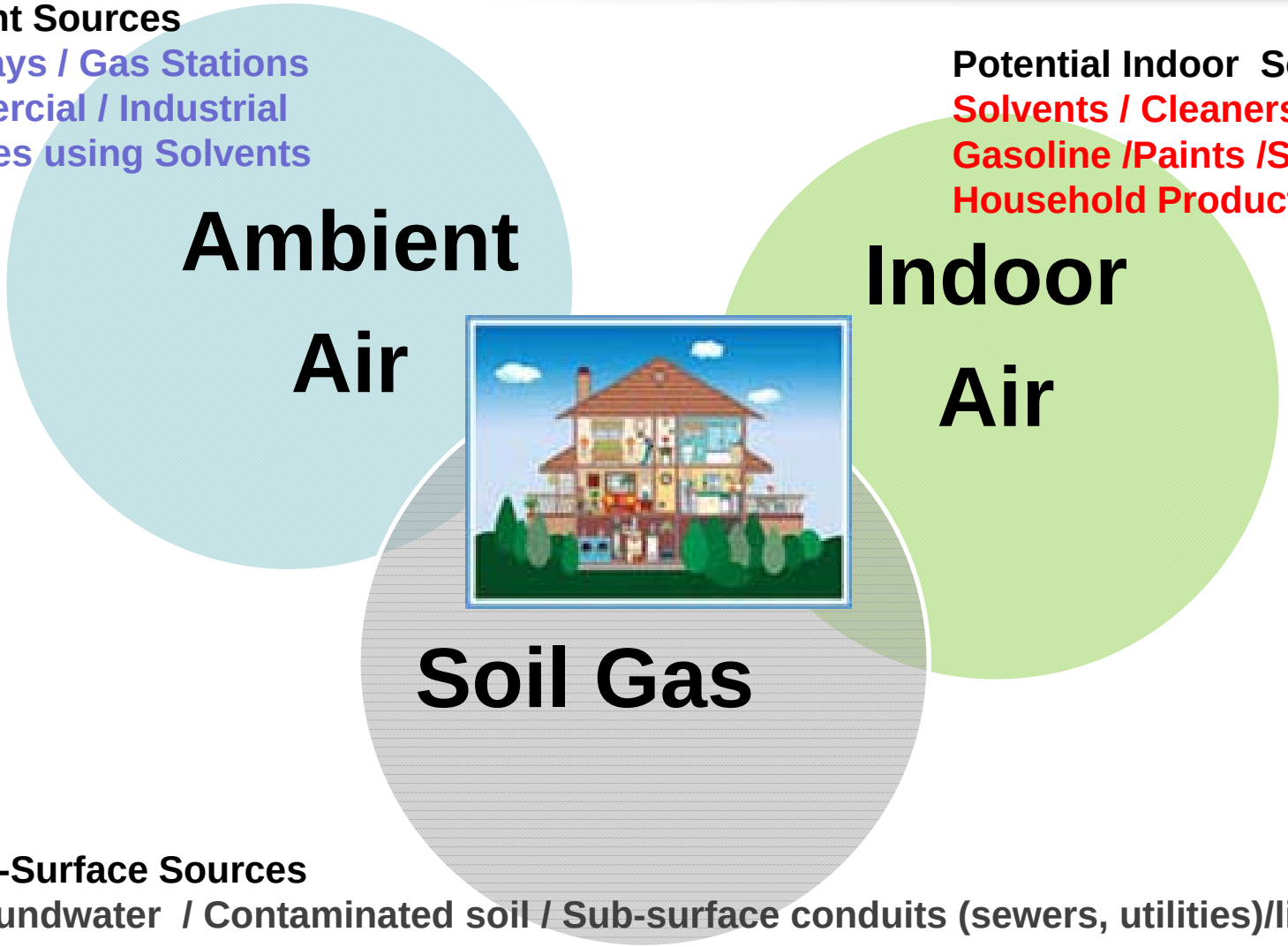


http://www.epa.gov/oswer/vaporintrusion/basic.html

Indoor Air: Point of exposure where sources intersect

Ambient Sources
Highways / Gas Stations
Commercial / Industrial
Facilities using Solvents

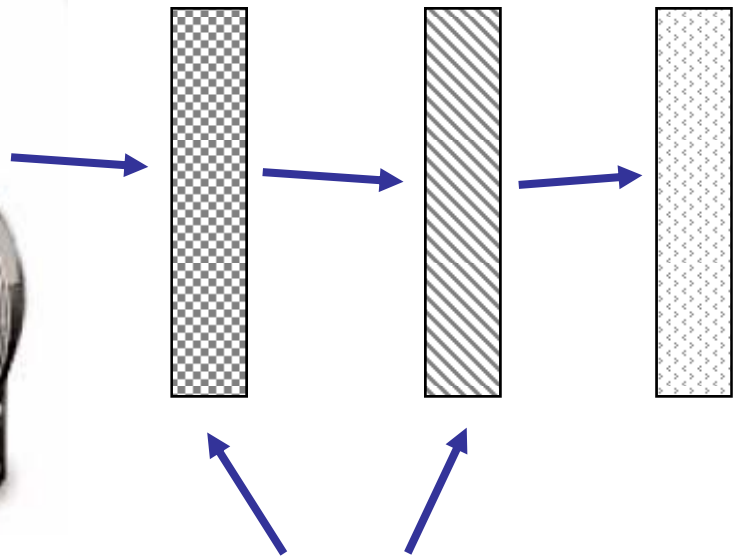
Potential Indoor Sources
Solvents / Cleaners
Gasoline /Paints /Smoking
Household Products



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

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

EPA TO15 Overview



Whole Gas Sample **Sorbent Traps** **Cold Trap** **GC/MS System**

www.epa.gov/ttnamti1/files/ambient/airtox/to-15r.pdf

Media Certification

Cleaning and Certification to a
Important: Media, Flow Controllers & SUMMA Canisters are cleaned to meet the intended use

For Method TO 15 :

- **Typical list(s) offered 48 - 64 compounds**
- **Site specific target lists develop due project pre-planning**

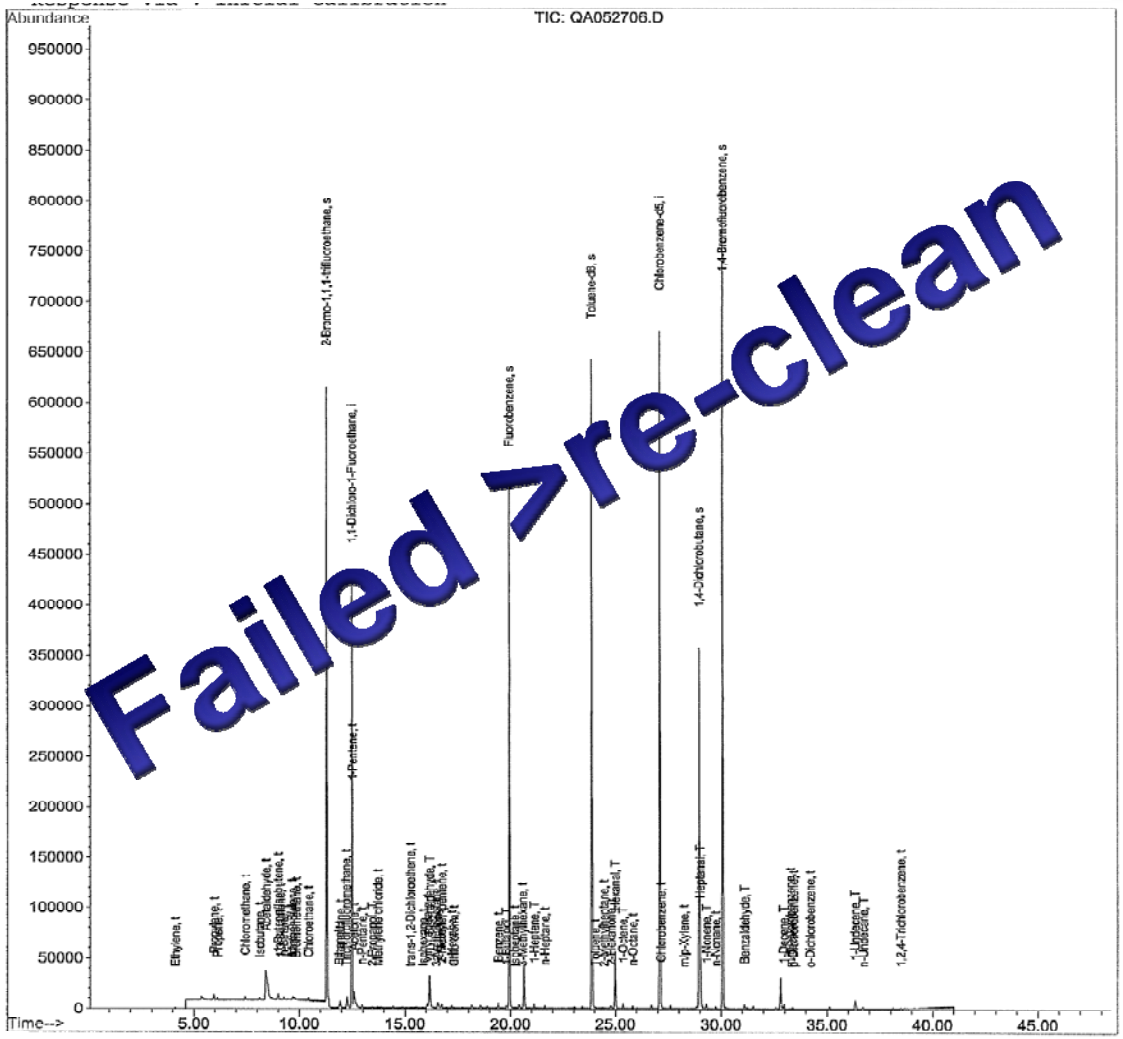
Low Level: **Indoor & Ambient Air**
Source Level: **Soil Gas, Sub-slab**

0.02ppbv
0.2ppbv
20 ppbv

Define up front, sample type: "source or low level" and/or Site specific reporting limits RL's.

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

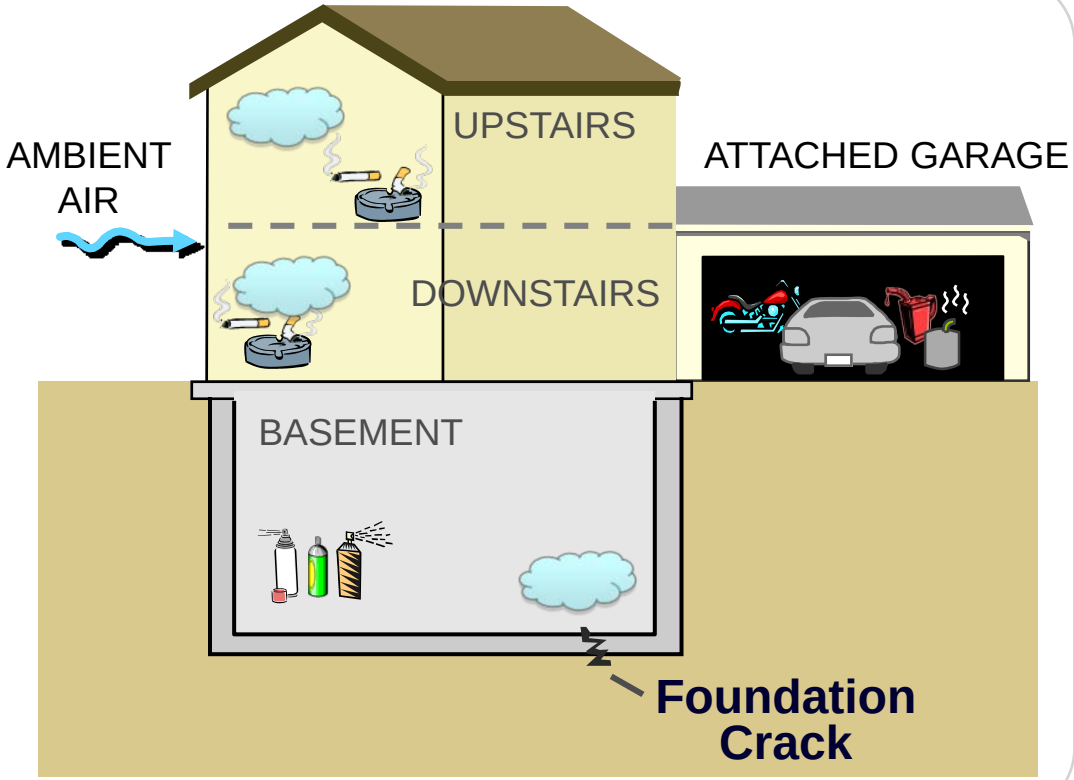
Media Certification



TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Problem:
Indoor Air Sources of VPHs?

- **Sampling of indoor air is the most direct method to determine the presence or absence of vapor intrusion.**
- **Indoor sources of VPHs are ubiquitous: gasoline, cigarette smoke, natural gas.**
- **Detection of VPHs in indoor air does not necessarily indicate vapor intrusion.**



KEY POINT: **Critical need for reliable methods to distinguish between vapor intrusion and indoor sources of VPHs.**

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

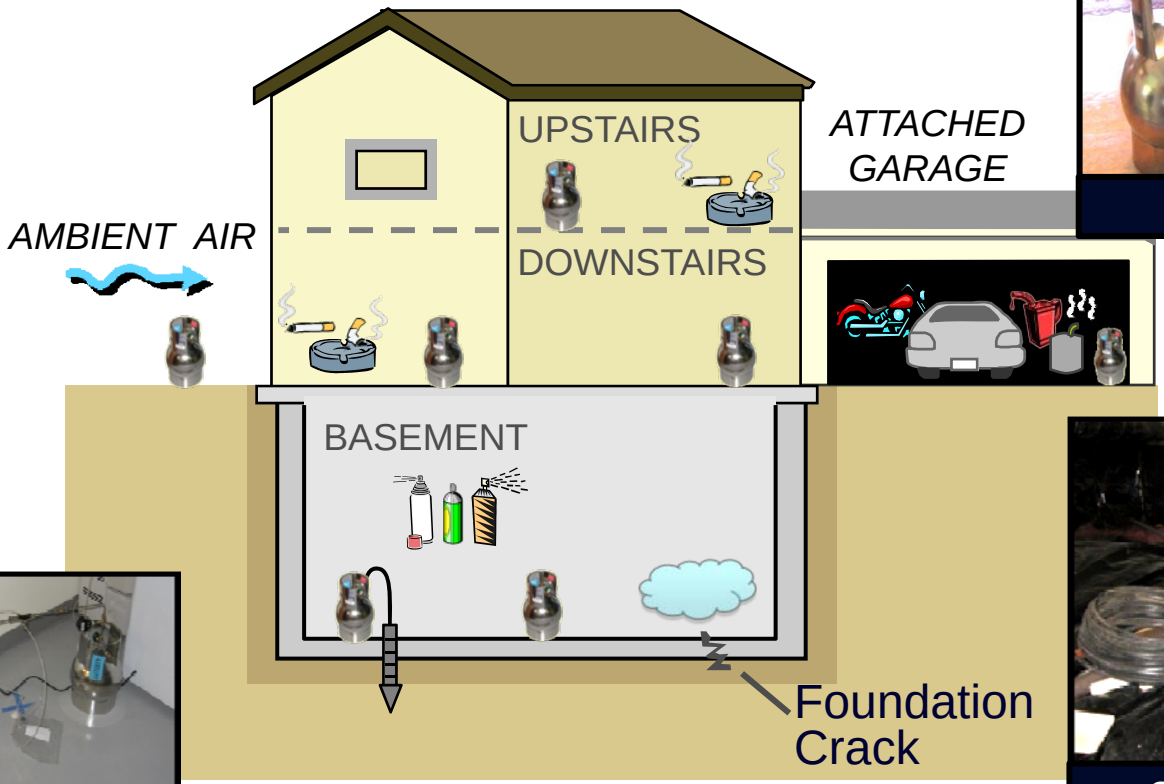
Sampling and Analytical Methods: Indoor Air Sampling

AMBIENT AIR

INDOOR AIR

SUBSLAB AIR

CRAWLSPACE / BASEMENT AIR



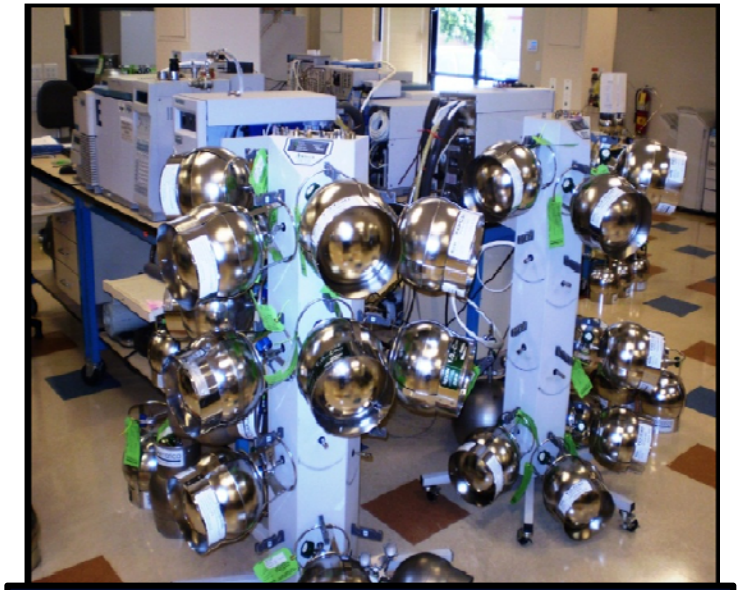
Sampling and Analytical Methods: Sample Analysis Methods

Analytical Method

- **USEPA Method TO-15: Determination of VOCs in Air by GC/MS**
- **Multi-sorbent concentrator used to increase analytical sensitivity.**

Analyte List

- **162 VOCs**
- **Includes 88 individual VPH compounds**
- **More than standard TO-15 list**



SUMMA CANISTERS AT TEST AMERICA INC.

Notes:

1. ***Analyses conducted by TestAmerica Inc. in Austin, Texas.***
2. ***TestAmerica Inc. Contact: William Elcoate (William.Elcoate@testamericainc.com)***

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

TO 15 Method Details

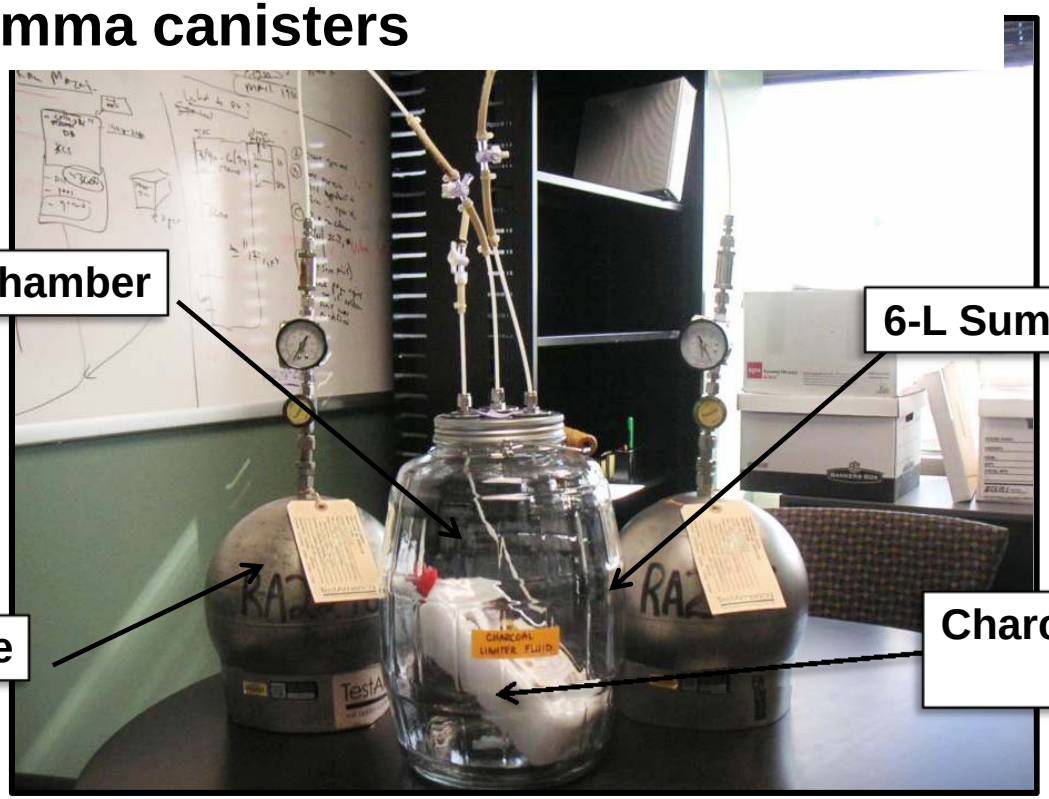
- **Extended Analytical run to improve compound resolution**
- **Non traditional capillary column used to improve compound resolution**
- **Multiple "scan ranges" on the GC/MS in order to acquire the extended compound list**
- **Non traditional conditions for the concentrator to allow for capturing the wide range of compounds**

Linde achieves Guinness World Record for record breaking multi-component gas mixture
http://hiq.linde-gas.com/international/web/lg/spg/like35lgspg.nsf/docbyalias/news_063

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

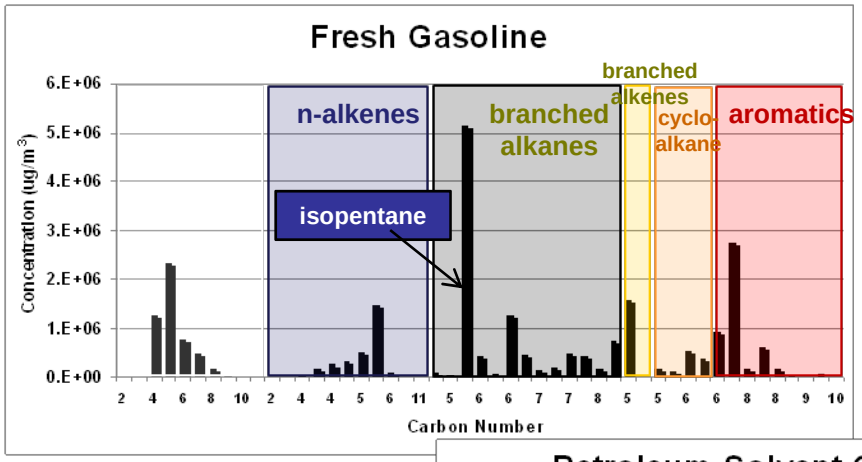
Sampling and Analytical Methods: Potential Indoor Air Sources

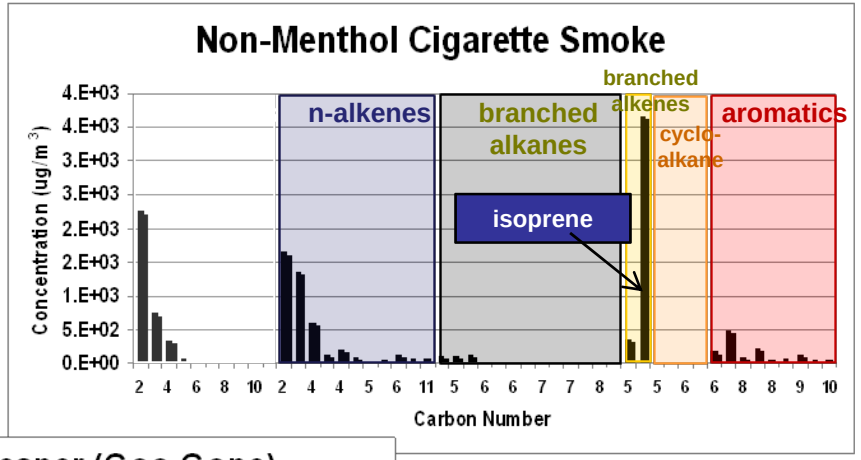
Collect vapor headspace samples using 6-L Summa canisters

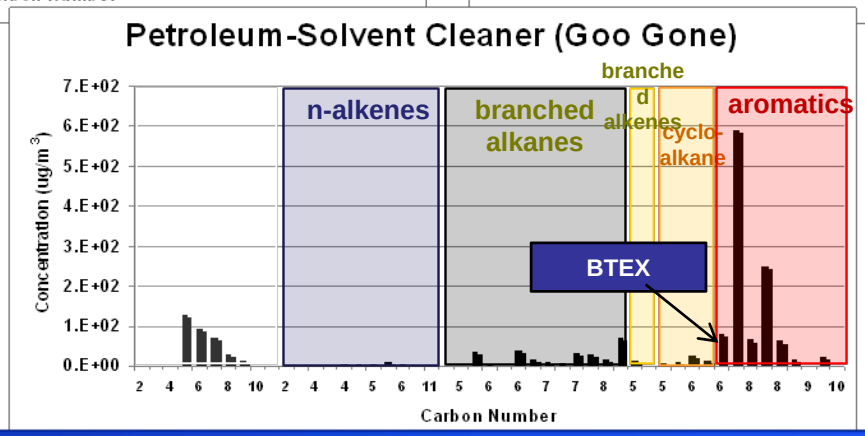


TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Consumer Products: Sources with Complex Hydrocarbon Mixtures



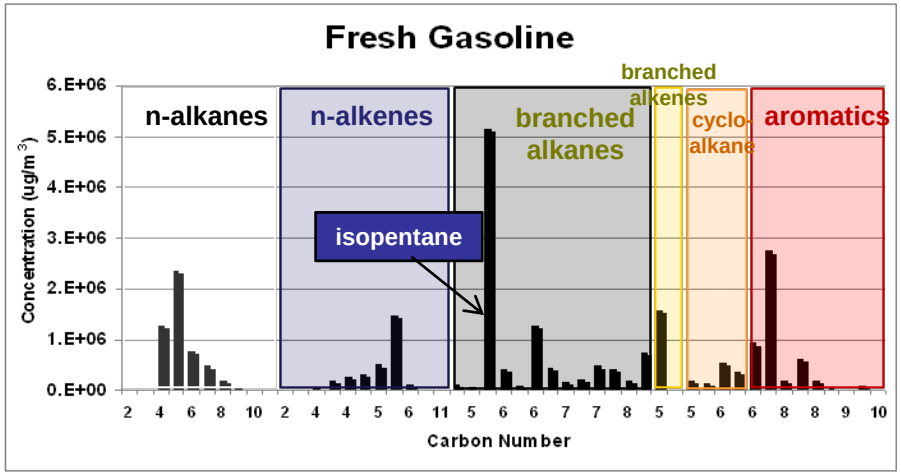


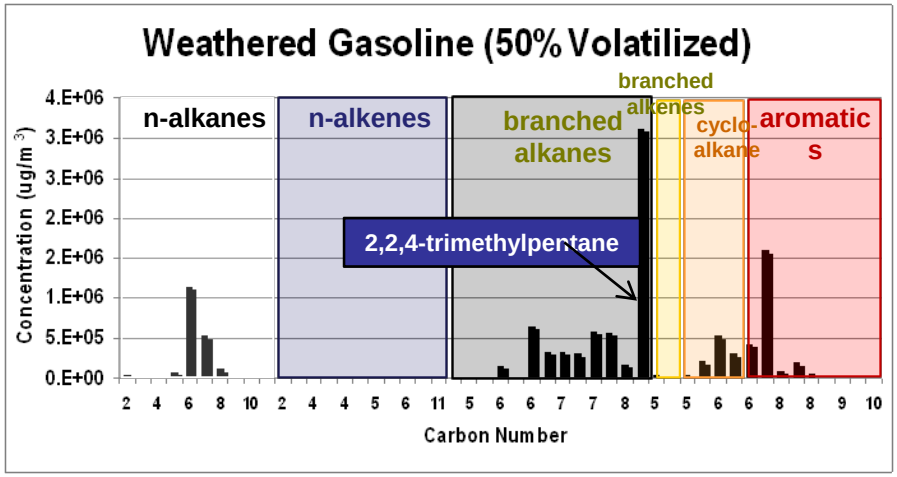


KEY POINT: ***Each complex hydrocarbon mixture has an unique component.***

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Consumer Products: *Fresh vs. Weathered Gasoline*



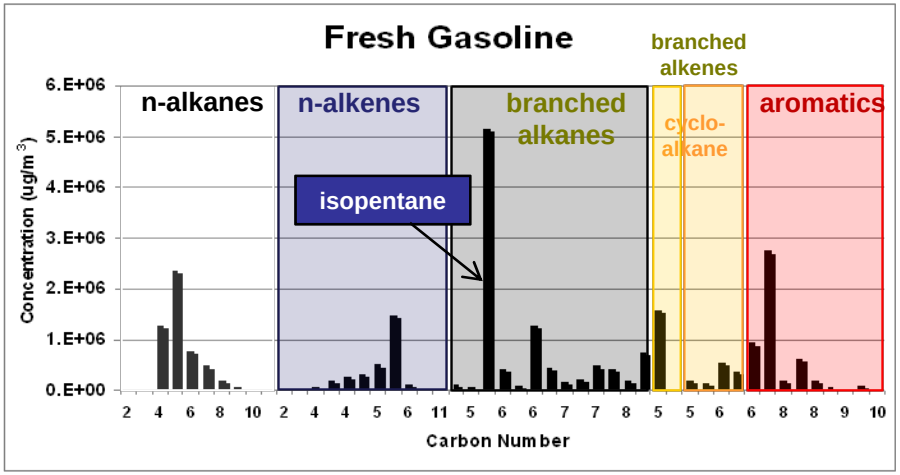


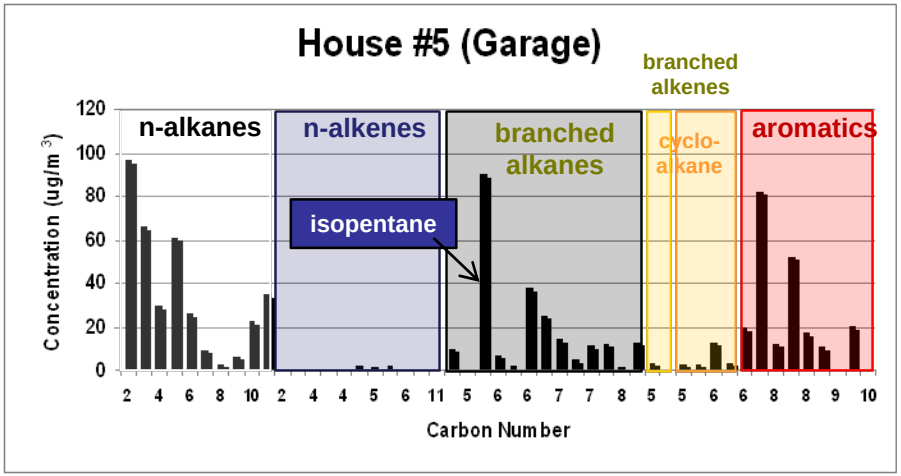
- **Fresh Gasoline – Isopentane spike**
- **Weathered Gasoline – Missing many of the lighter VPH compounds (especially n-alkenes); 2,2,4-Trimethylpentane spike**
- **Similar fingerprints of cycloalkanes and aromatics**

KEY POINT: **Analyzing for extended VPH list allows you to distinguish between fresh and weathered gasoline.**

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Hydrocarbons in Indoor Air:
House #5 Garage vs. Fresh Gasoline



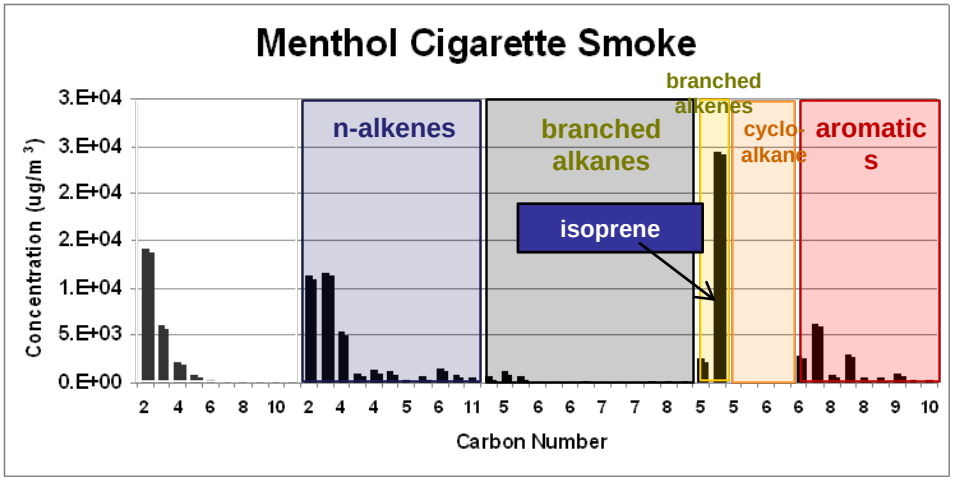


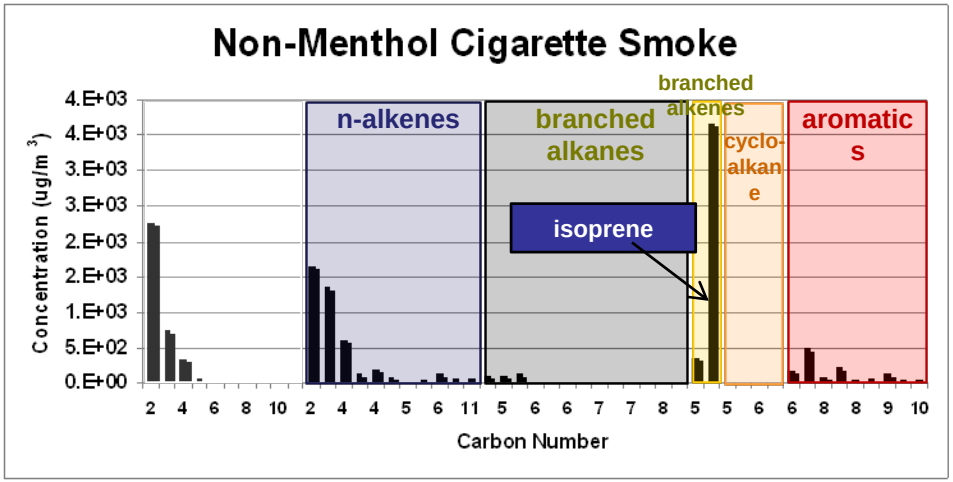
- <u>Good visual match</u>:
  - ✓ Similar fingerprints of branched alkanes, cycloalkanes and aromatics
  - ✓ Isopentane spike
- Other hydrocarbon source for n-alkanes

KEY POINT: **Mixed hydrocarbon sources with significant contribution from fresh gasoline.**

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Hydrocarbons in Consumer Products: *Menthol vs Non-Menthol Cigarettes*





KEY POINT: **Menthol and Non-Menthol Cigarette Smoke have very similar fingerprints.**

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Key Findings: Sources of VPHs in Indoor Air

Air Quality	■ **Hydrocarbons are ubiquitous in indoor and ambient air. Concentrations often exceed USEPA risk limits.**
Hydrocarbon Sources	■ **Common consumer products contribute a wide range of VPH compounds to indoor air.**
Fingerprinting	■ **Fingerprinting analysis can provide an improved understanding of the key sources of hydrocarbons detected in indoor air.**

NEXT STEPS:

- **Analysis of additional source and indoor air samples.**
- **Advanced statistical methods (i.e., cluster analysis) to quantify impact of specific sources.**

Reference

Use of Hydrocarbon Fingerprinting to Characterize the Source of Volatile Petroleum Hydrocarbon (VPH) Compounds in Indoor Air

Danielle Bailey, Thomas McHugh, Shawn Paquette, and Lila Beckley, GSI Environmental Inc.
William Elcoate, TestAmerica Inc.
Stephanie Fiorenza, BP America

Battelle Bioremediation Symposium 2011 Reno, Nevada

Work Funded By: BP America

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Questions

Products used at home or work can release VOCs into the air when used and stored.


Examples of Household Products	Possible VOC Ingredients
Fuel containers or devices using gasoline, kerosene, fuel oil and products with petroleum distillates: paint thinner, oil-based stains and paint, aerosol or liquid insect pest products, mineral spirits, furniture polishes	BTEX (benzene, toluene, ethylbenzene, xylene), hexane, cyclohexane, 1,2,4-trimethylbenzene
Personal care products: nail polish, nail polish remover, colognes, perfumes, rubbing alcohol, hair spray	Acetone, ethyl alcohol, isopropyl alcohol, methacrylates (methyl or ethyl), ethyl acetate
Dry cleaned clothes, spot removers, fabric/ leather cleaners	Tetrachloroethene (perchloroethene (PERC), trichloroethene (TCE))
Citrus (orange) oil or pine oil cleaners, solvents and some odor masking products	d-limonene (citrus odor), a-pinene (pine odor), isoprene
PVC cement and primer, various adhesives, contact cement, model cement	Tetrahydrofuran, cyclohexane, methyl ethyl ketone (MEK), toluene, acetone, hexane, 1,1,1-trichloroethane, methyl-iso-butyl ketone (MIBK)
Paint stripper, adhesive (glue) removers	Methylene chloride, toluene, older products may contain carbon tetrachloride
Degreasers, aerosol penetrating oils, brake cleaner, carburetor cleaner, commercial solvents, electronics cleaners, spray lubricants	Methylene chloride, PERC, TCE, toluene, xylenes, methyl ethyl ketone, 1,1,1-trichloroethane
Moth balls, moth flakes, deodorizers, air fresheners	1,4-dichlorobenzene, naphthalene
Refrigerant from air conditioners, freezers, refrigerators, dehumidifiers	Freons (trichlorofluoromethane, dichlorodifluoromethane)
Aerosol spray products for some paints, cosmetics, automotive products, leather treatments, pesticides	Heptane, butane, pentane
Upholstered furniture, carpets, plywood, pressed wood products	Formaldehyde

Will Elcoate
Air Product Manager
Mobile: 708-261-8355
William.elcoate@testamericainc.com