Lessons Learned from the PAMS Program

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Outline

• Background
• Understanding
  – Ozone precursors
  – Control effectiveness
• Supporting other programs/science
• PAMS data used less often for...
• What’s next?
The PAMS Program (1)
The PAMS Program

Goals

• Support NAAQS attainment
• Develop and evaluate control strategies
• Track emissions
• Assess trends
• Assess exposure

NAAQS = National Ambient Air Quality Standards
The PAMS Program (3)

Reengineering in progress

VOC Measurements

Target Compounds

Program Flexibility

Upper-Air Measurements

Nitrogen Measurements

NO

NO₂
Understanding Ozone Precursors

• VOC/NO\textsubscript{x}  
  – Which pollutant do we control to reduce ozone?

• Source apportionment

• Emissions inventory (EI) evaluation  
  – How well is EI representing ambient conditions?

• Comparisons  
  – How do concentrations in my city measure up?
At high VOC/NO\textsubscript{x} ratios, ozone formation is limited by NO\textsubscript{x} availability. Reducing NO\textsubscript{x} reduces ozone.

At low ratios, ozone formation is limited by VOC availability.
Source Apportionment

Apportionment of Total VOC

Apportionment of Benzene (in Total VOC)

Azusa (Los Angeles Basin), 2001-2003
Wind Direction Analysis
With winds from the Houston Ship Channel, concentrations are much higher and reactive species are a higher wt. % than with winds from the freeway.
EI Evaluation

Mobile sources at two urban sites underestimated in EI:

- Site 1 = 57% EI vs. 74% SA
- Site 2 = 52% EI vs. 77% SA

Comparison to source apportionment (SA) consistent with a ratio analysis suggesting EI underestimated acetylene, toluene, and xylenes.
Perspective

San Diego, CA, 1996
Understanding Control Effectiveness

Trends
- Fleet turnover
- Fuel composition
- Volatility

Benzene wt % - Los Angeles

Hydrocarbons:
- 1,3-Butadiene
- 2,2,4-Trimethylpentane
- Benzene
- Ethylbenzene
- Isopropylbenzene
- N-Hexane
- o-Xylene
- Styrene
- Toluene

Oxygenated VOCs:
- Acetaldehyde
- Formaldehyde
- Methyl Tert-Butyl Ether
- Propionaldehyde

Metals:
- Arsenic PM
- Lead PM
- Manganese PM
- Nickel PM

Percentage Change per Year
- Median Percentage Change per Year
- 10th Percentile
- 90th Percentile
Some hydrocarbons, measurable by the PAMS program, are important precursors of secondary organic aerosol

- Pinenes
- Benzene, toluene, xylenes, ethylbenzene, and other aromatic hydrocarbons
- Benzaldehyde
• Key air toxics species (potentially measurable) include
  – 1,3-butadiene, naphthalene, acrylonitrile, tetrachloroethylene, 1,4-dichlorobenzene
• Provides ability to explore temporal characteristics of air toxics (sources, transport)
PAMS Data Used Less Often For... (1)

Forecasting ozone
Characterizing transport

PAMS Data Used Less Often For... (2)

Road Less Traveled
PAMS Data Used Less Often For...

- Evaluating models
- Understanding population exposure
What's Next? (1)

Re-engineering

• Better tools for data validation and analysis
• Better detection limits?
• Upper-air met?
• Carbonyls?
• Understand role of unidentified VOCs?
What's Next? (2)

- Small sensors – comparisons
- Near-road program – augmentation
- Better integration into modeling
Questions?