Lessons Learned from the PAMS Program

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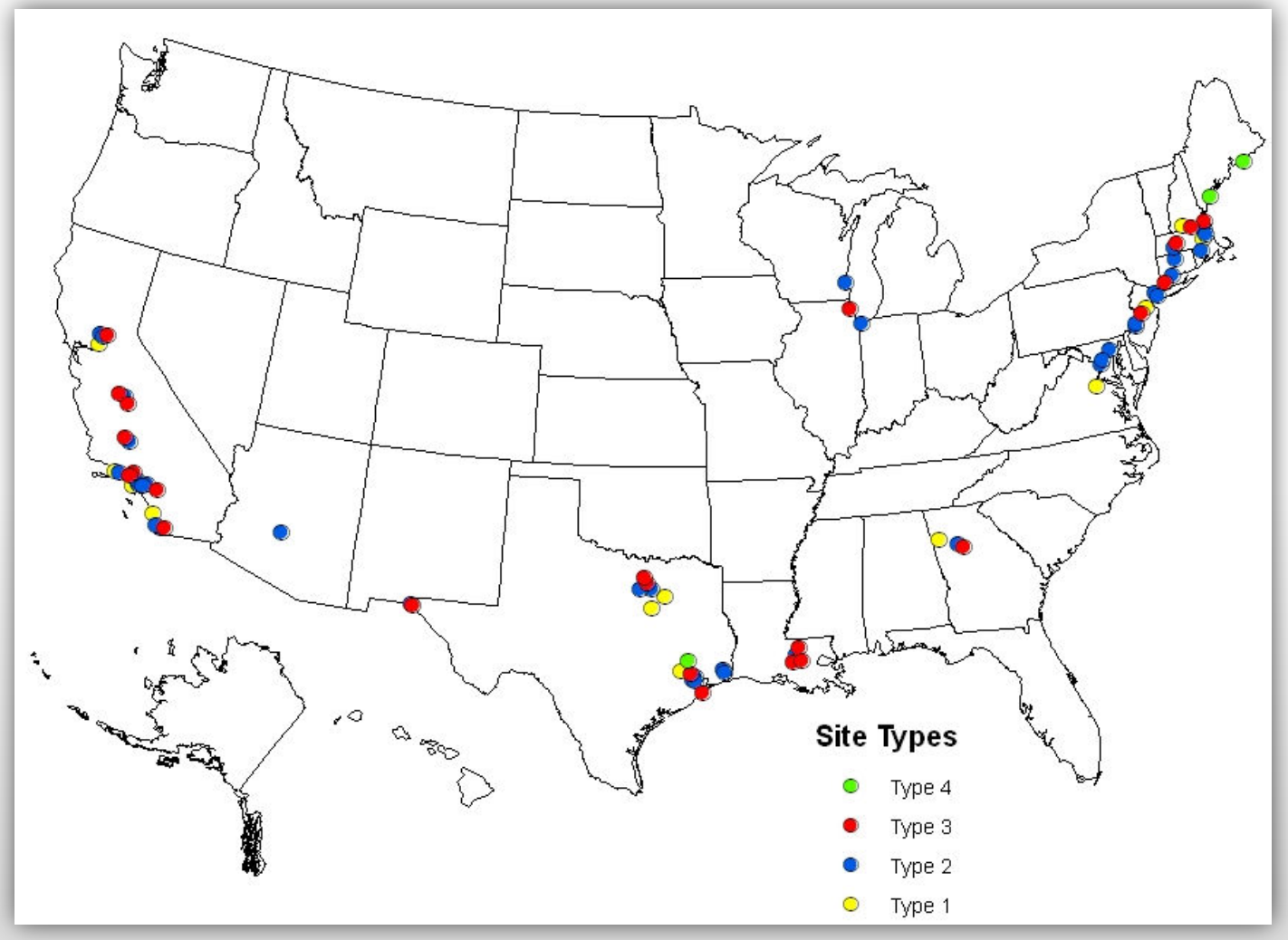
Outline

- 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 (2)

Goals

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

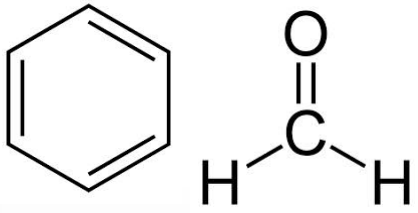
NAAQS = National Ambient Air Quality Standards

The PAMS Program (3)

Reengineering in progress

VOC Measurements

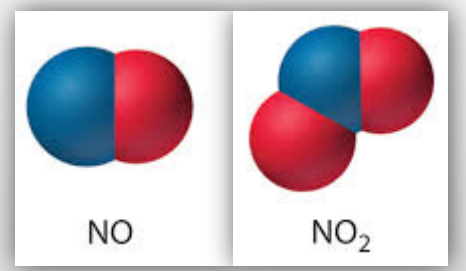
Target Compounds



Upper-Air Measurements

Program Flexibility

Nitrogen Measurements

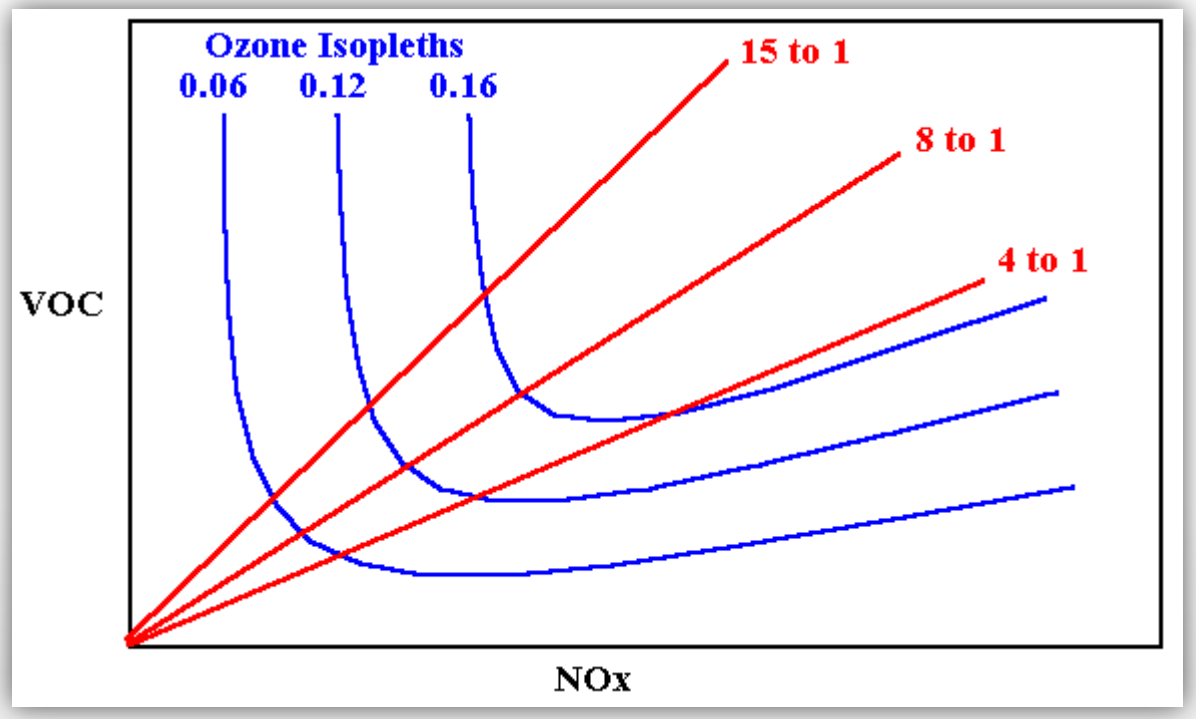


Understanding Ozone Precursors

- VOC/NO_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?

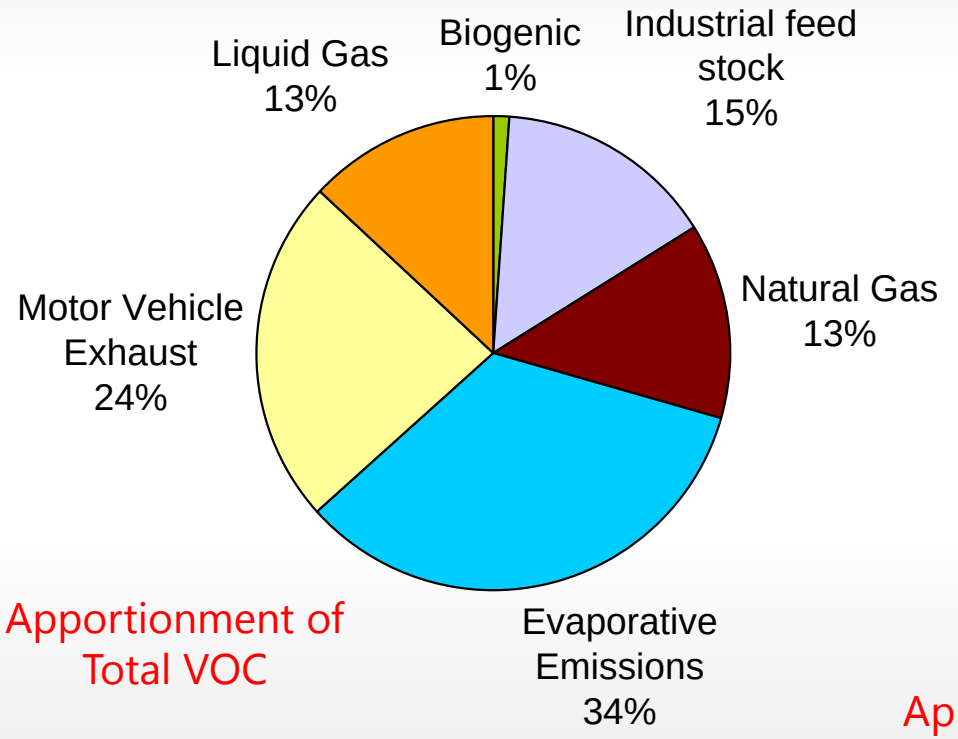
VOC vs. NO_x Controls

At high VOC/NO_x ratios, ozone formation is limited by NO_x availability. Reducing NO_x reduces ozone.

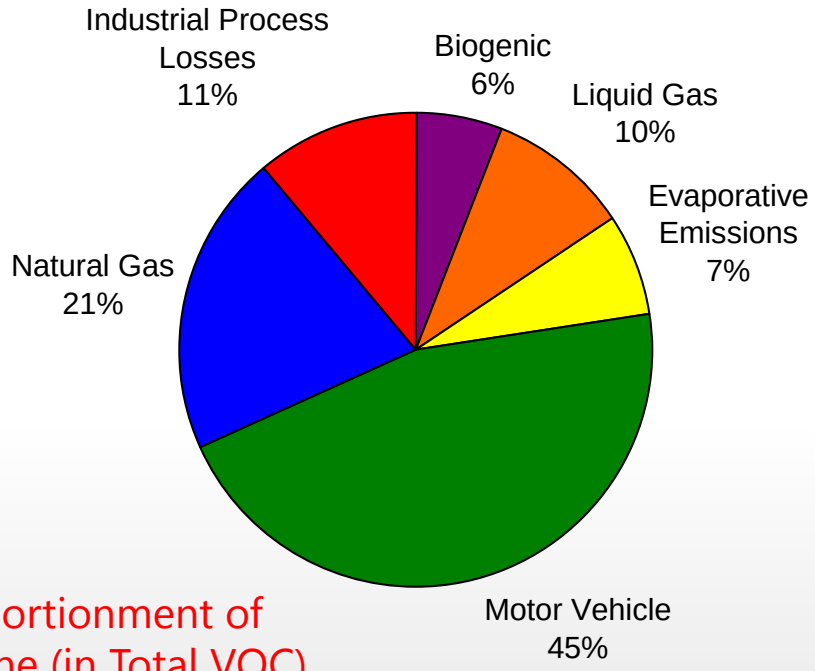


At low ratios, ozone formation is limited by VOC availability.

Source Apportionment

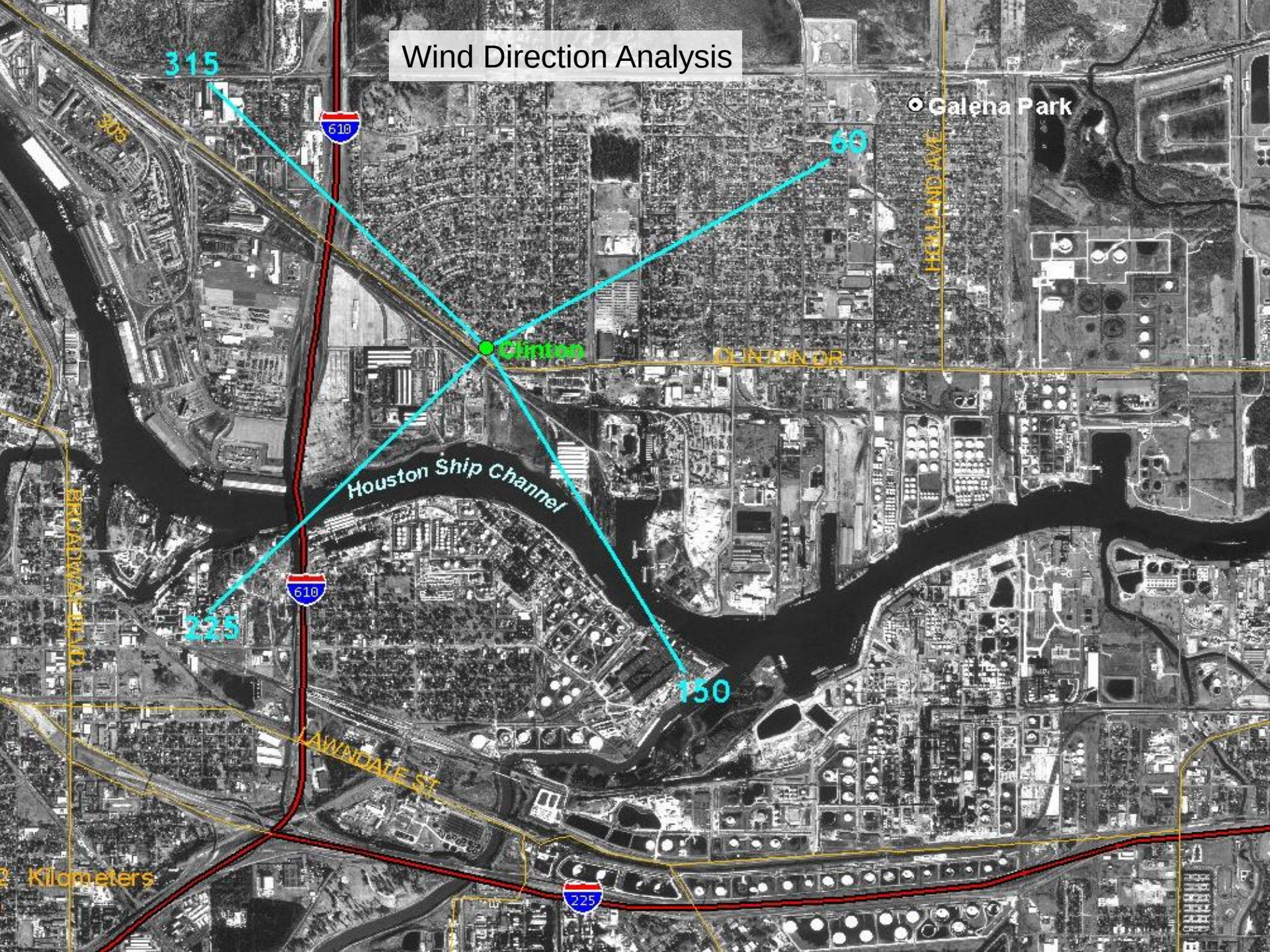


Apportionment of Total VOC

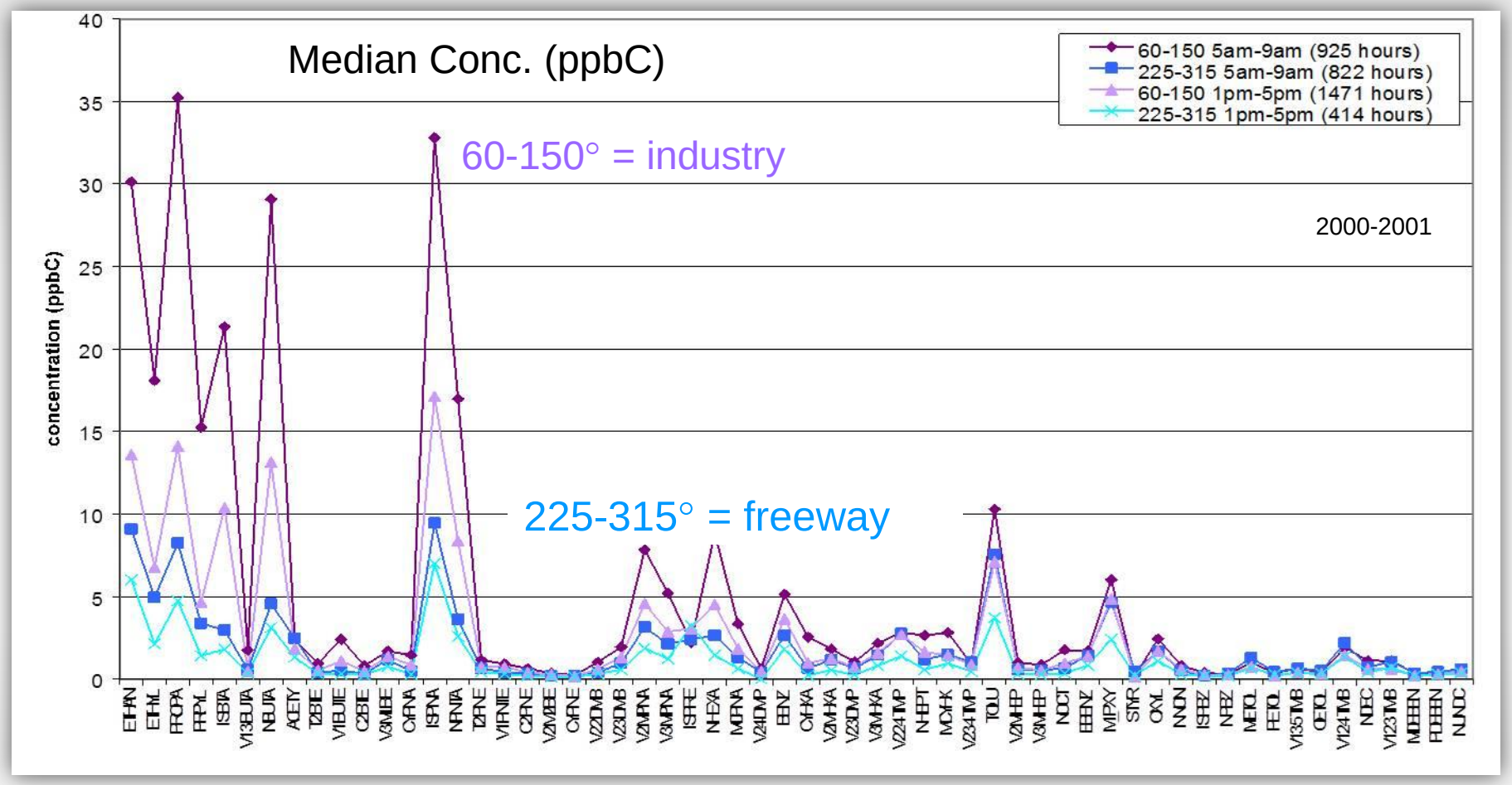


Apportionment of Benzene (in Total VOC)

Azusa (Los Angeles Basin), 2001-2003


Wind Direction Analysis
315
60
225
150
Clinton
Galena Park
Houston Ship Channel
610
610
225
HOLLAND AVE
CLINTON DR
BROADWAY BLVD
LAWNDALE ST
Kilometers

Ozone Precursors

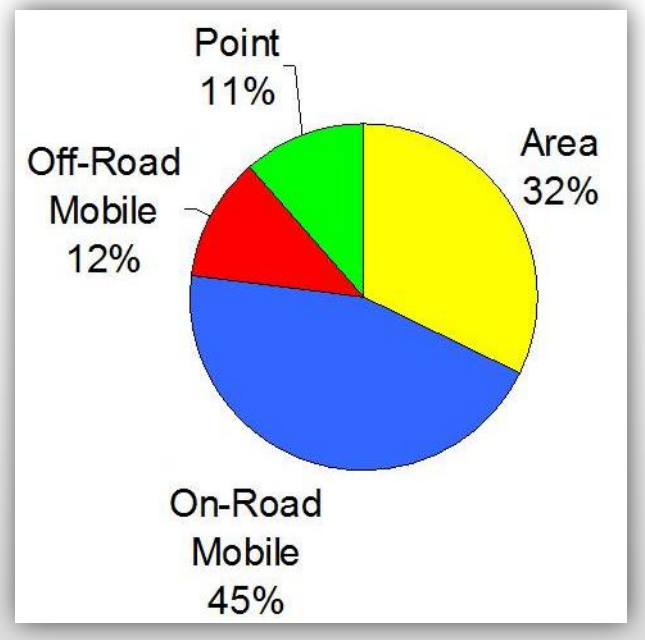


With winds from the Houston **Ship Channel**, concentrations are much higher and reactive species are a higher wt. % than with winds from the **freeway**.

EI Evaluation

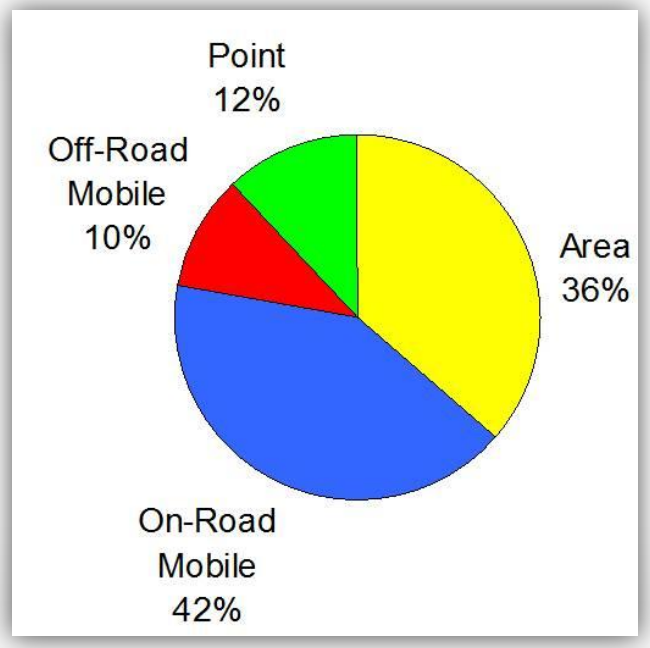
Mobile sources at two urban sites underestimated in EI:

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



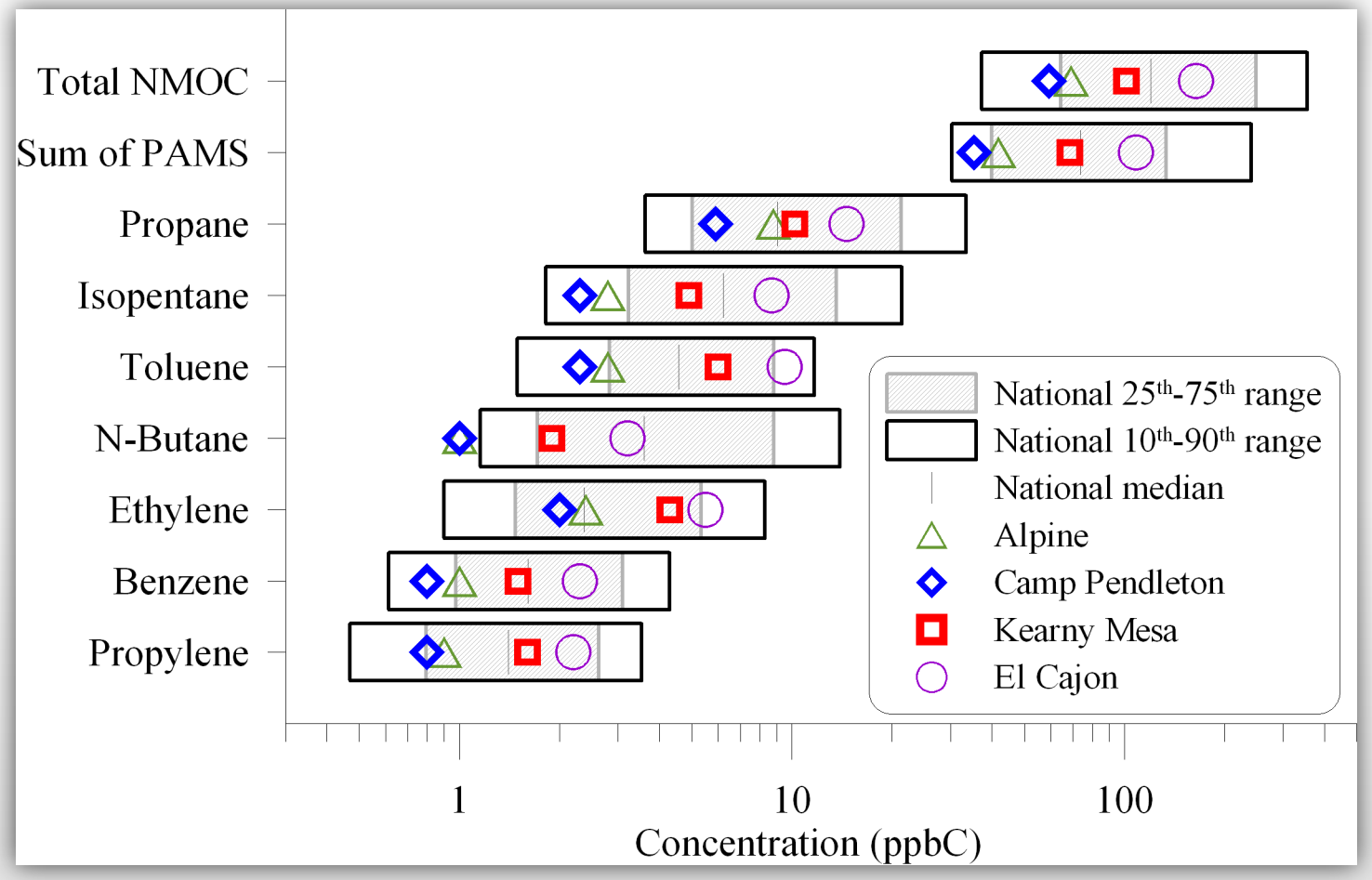
Site 1

Site 2



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

Perspective



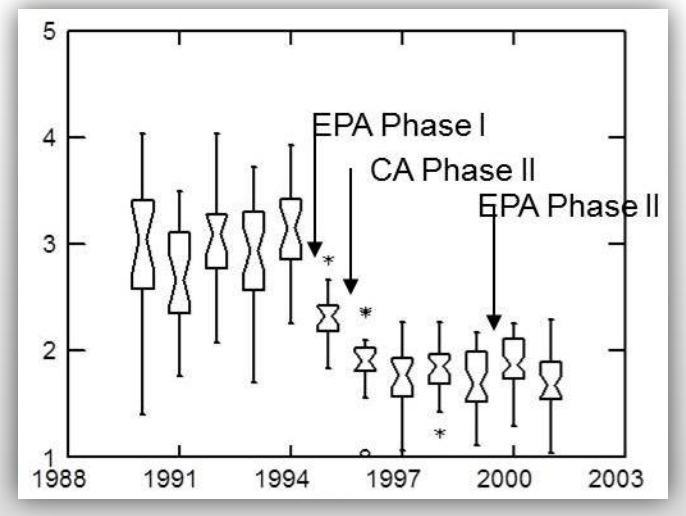
San Diego, CA, 1996

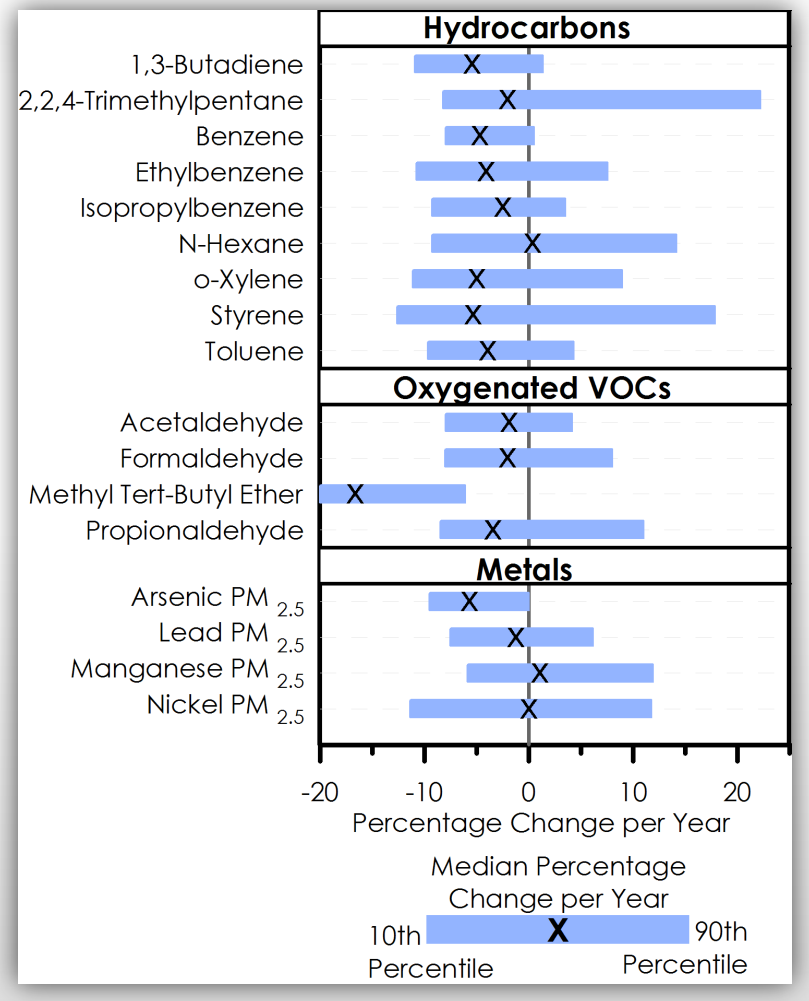
Understanding Control Effectiveness

Trends

- Fleet turnover
- Fuel composition
- Volatility

Benzene wt % - Los Angeles





Supporting Other Programs/Science: $PM_{2.5}$

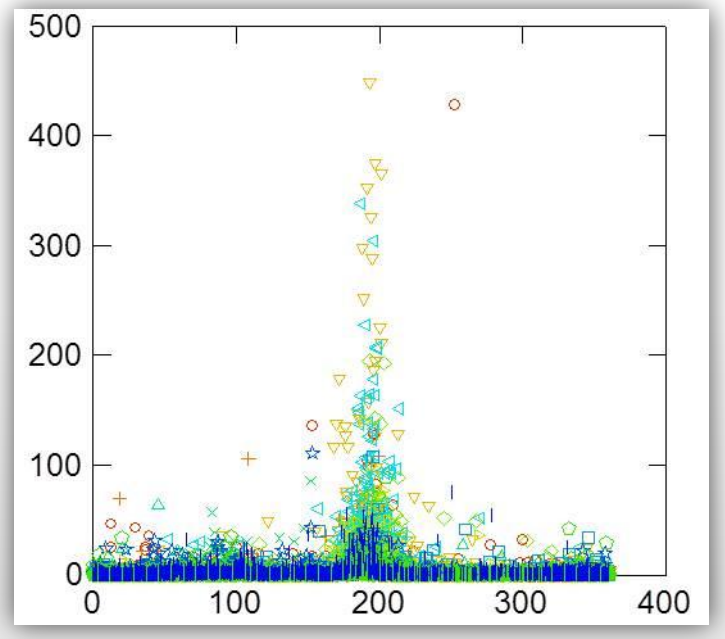
Some hydrocarbons, measurable by the PAMS program, are important precursors of secondary organic aerosol

- Pinenes
- Benzene, toluene, xylenes, ethylbenzene, and other aromatic hydrocarbons
- Benzaldehyde

Supporting Other Programs/Science: Air Toxics

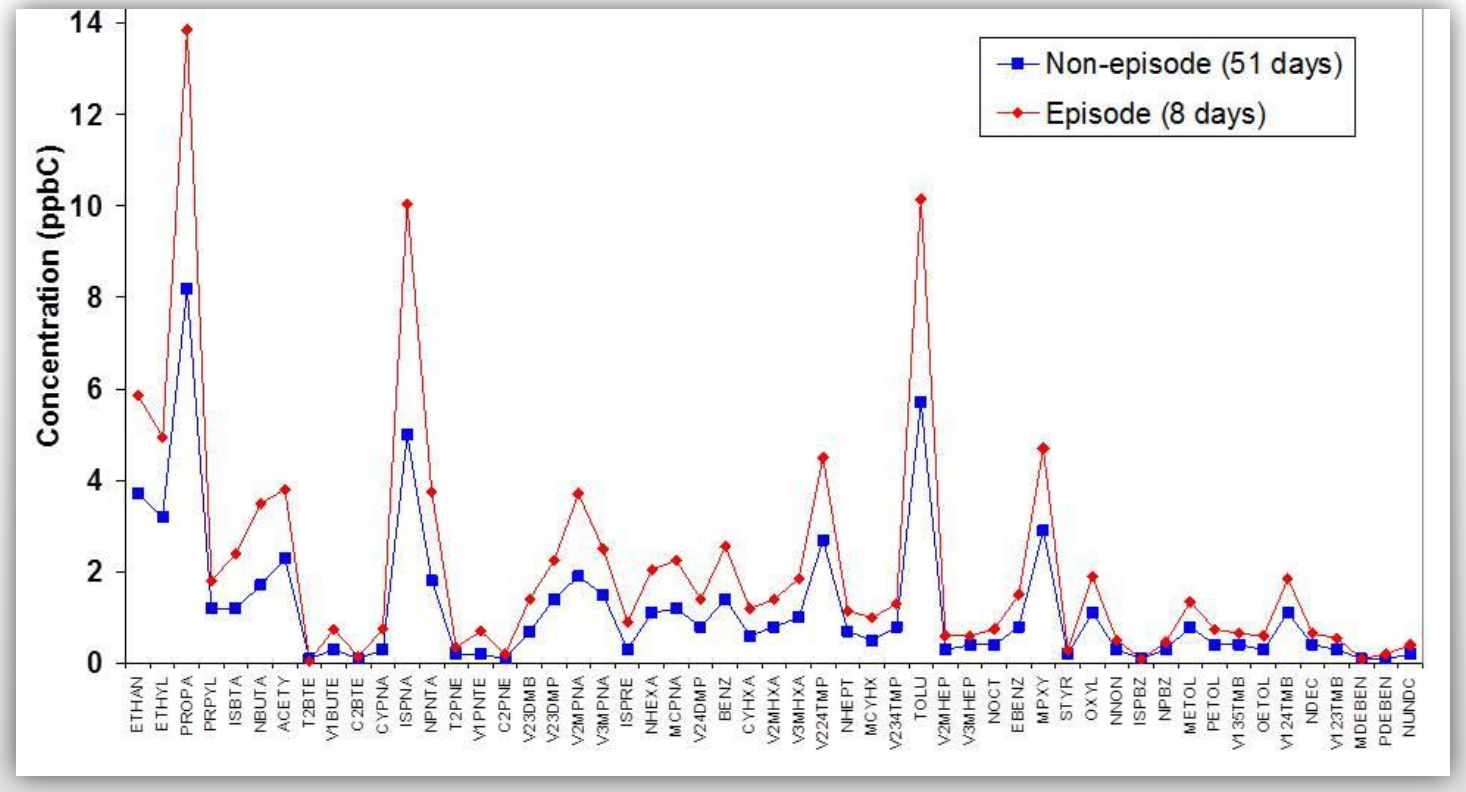
- Key air toxics species (potentially measurable) include
  - 1,3-butadiene, naphthalene, acrylonitrile, tetrachloroethylene, 1,4-dichlorobenzene
- Provides ability to explore temporal characteristics of air toxics (sources, transport)

1,3-butadiene (ppbC)



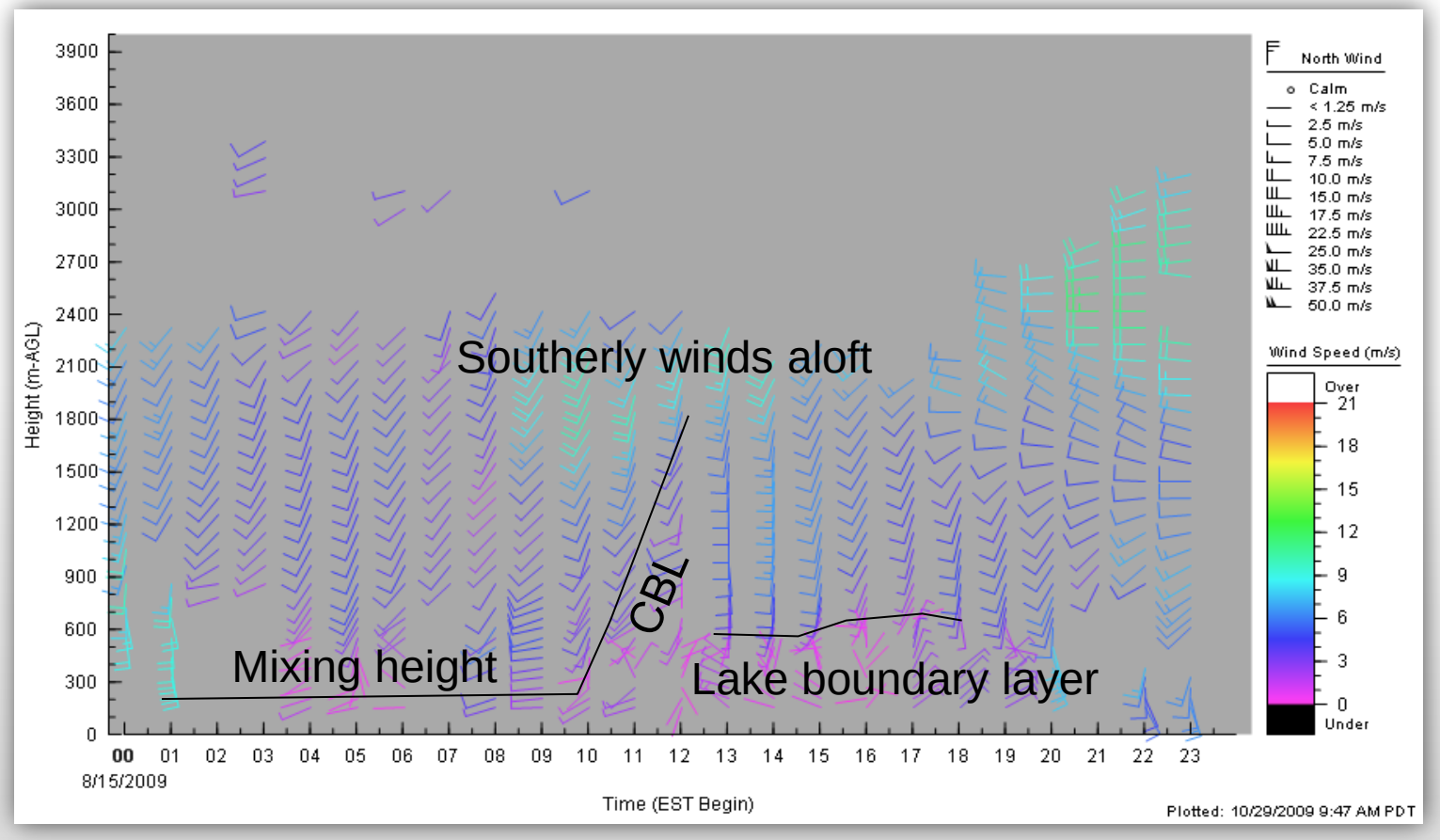
PAMS Data Used Less Often For… (1)

Forecasting ozone



PAMS Data Used Less Often For… (2)

Characterizing transport



PAMS Data Used Less Often For… (3)

- 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?