

# **PAMS Re-Engineering**

MARAMA Monitoring Meeting  
September

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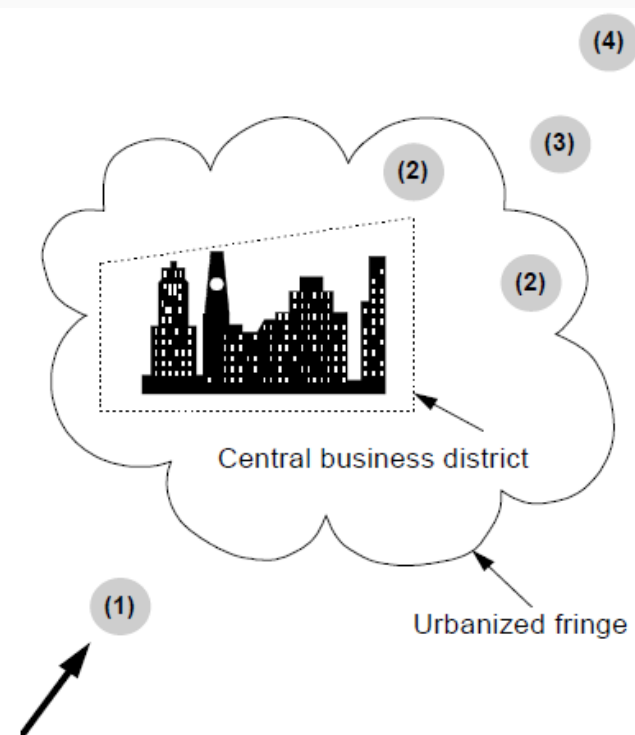
# Outline

- Network Design
- Target compound list
- VOC Measurements
- Nitrogen Measurements
- Meteorological Measurements
- Data Access and Analysis



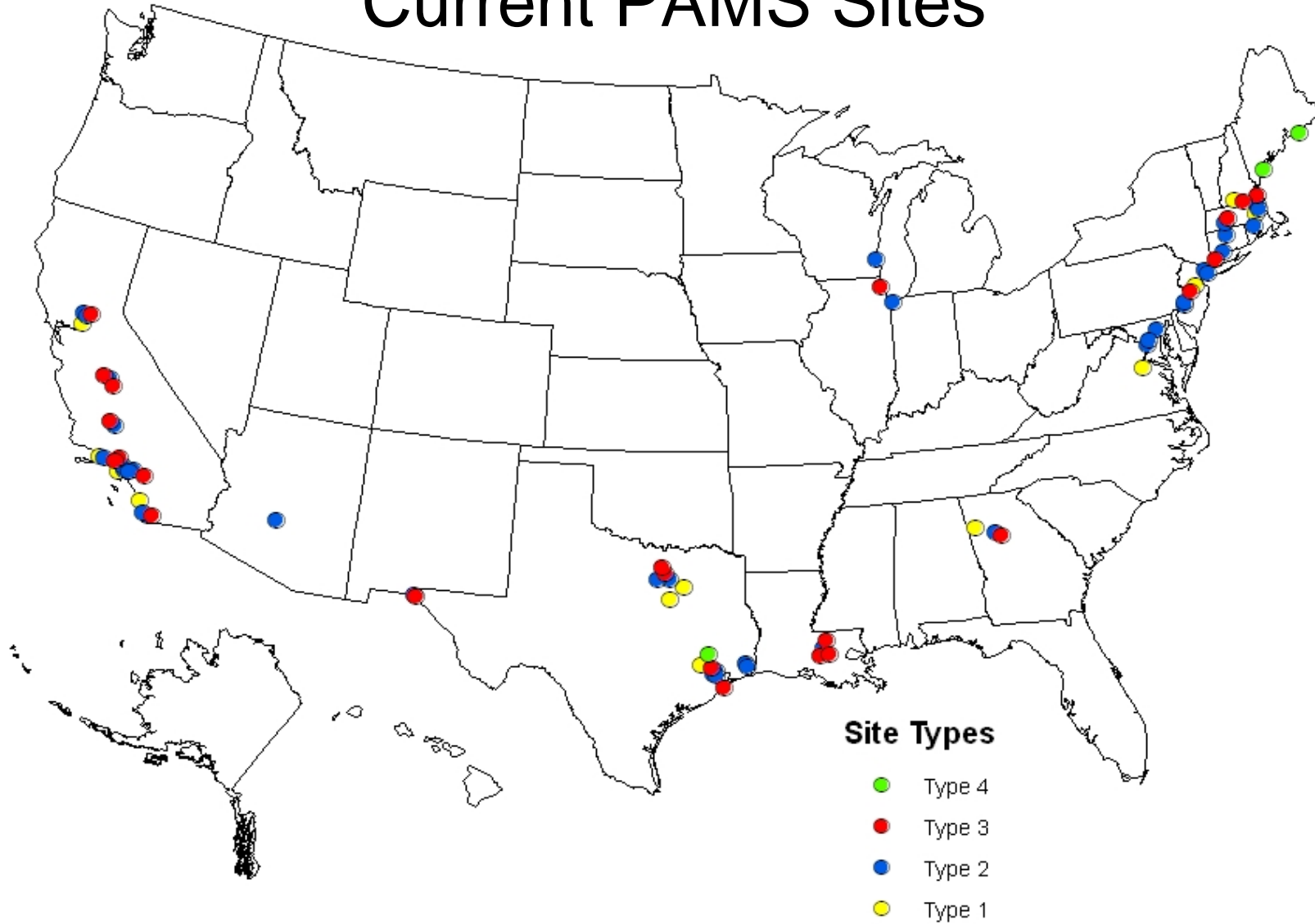
# Network Design

- Current design calls for up to 5 sites in each serious and above ozone non-attainment area
  - Type 1 Upwind
  - Type 2 Max emissions
  - Type 3 Max ozone
  - Type 4 Extreme Downwind
- PAMS Season June-August
- 75 current PAMS sites
  - Not counting met sites





# Current PAMS Sites





# Network Design Recommendations

- CASAC Recommendations
  - Current requirements too inflexible to meet state needs
  - Should consider areas beyond those in serious and above nonattainment areas
  - PAMS season should be extended
- ORD Model Developer/Evaluators Recommendations
  - Add more areas for better spatial coverage of the US at the expense of multiple sites per area
- Team Recommendations
  - Reduce minimum PAMS requirements to free up resources for states to implement alternative enhanced ozone measurements
  - Remove ties to 1 hour ozone designations
  - Add PAMS measurements to NCore sites in ozone non-attainment areas instead of current multi-site design
  - Extend PAMS season to coincide with ozone seasons
  - Provide remaining funds to monitoring agencies in non-attainment areas for regional and local enhanced ozone monitoring strategies



# Two Components of Proposed Design

- Required PAMS
  - Small core set of sites leveraging NCore infrastructure in ozone non-attainment areas
  - Consistent sampling schedule and methods
  - Primary objectives would be to gather data for model evaluation and development, tracking trends, and accountability
- Flexible PAMS
  - Monitoring agencies with ozone non-attainment areas would be required to develop and implement an enhanced ozone monitoring plan
  - Details of what, where, when and how to measure would generally be left up to monitoring agencies
  - Primary objectives would be to gather data to understand and solve local ozone problem

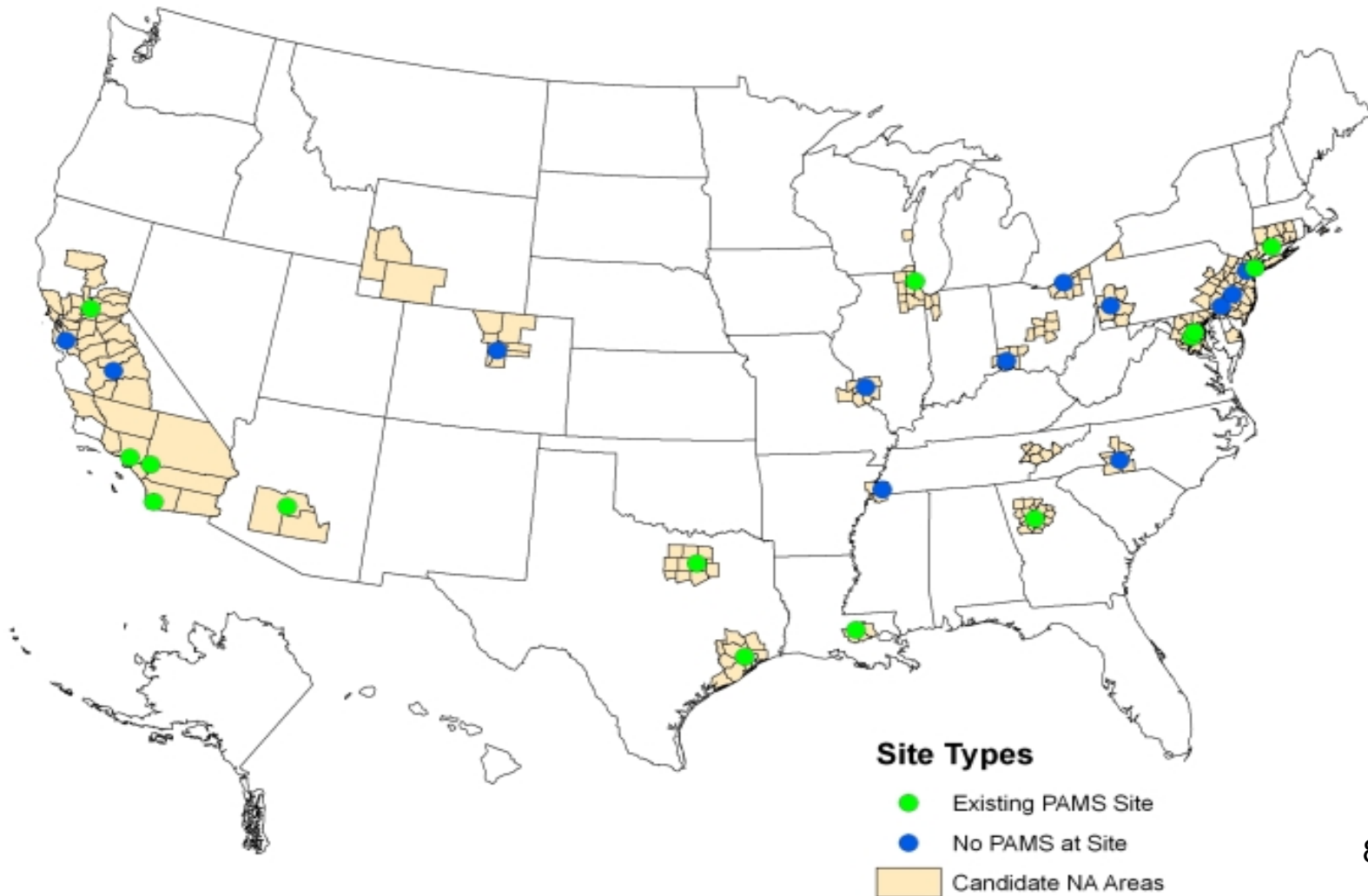


# Impact on Number of Required Sites

	<b>Currently Required</b>	<b>PAMS at NA NCore</b>	<b>Change</b>
Number of Sites	52	26	- 26
- Existing		14	
- New		12	



# Proposed PAMS Network







## VOC Target List

- Currently 54 VOC compounds (plus 3 carbonyls) are identified through guidance for measurement at PAMS
  - Complete list can be found at:
    - <http://www.epa.gov/ttn/amtic/files/ambient/pams/pams54.pdf>
- Minor modifications have been made to the list over the years



# VOC Target List Recommendations

- CASAC Recommendations
  - Provided guidance on how to prioritize current list
  - Recommended more biogenic species (such as terpenes), tracers for biofuels (such as ethanol)
  - Recommended additional carbonyl compounds
- Team Recommendations
  - Evaluate list to determine if some compounds can be removed due to low concentration/importance in all PAMS areas
  - Add important biogenics, air toxics, “tracers”, and SOA precursors that can be measured with “standard” equipment
  - Allow states to further reduce list based on their concentrations
    - Maybe provide core list of compounds that can not be removed by states
  - TNMOC should be reported based on sum of all peaks

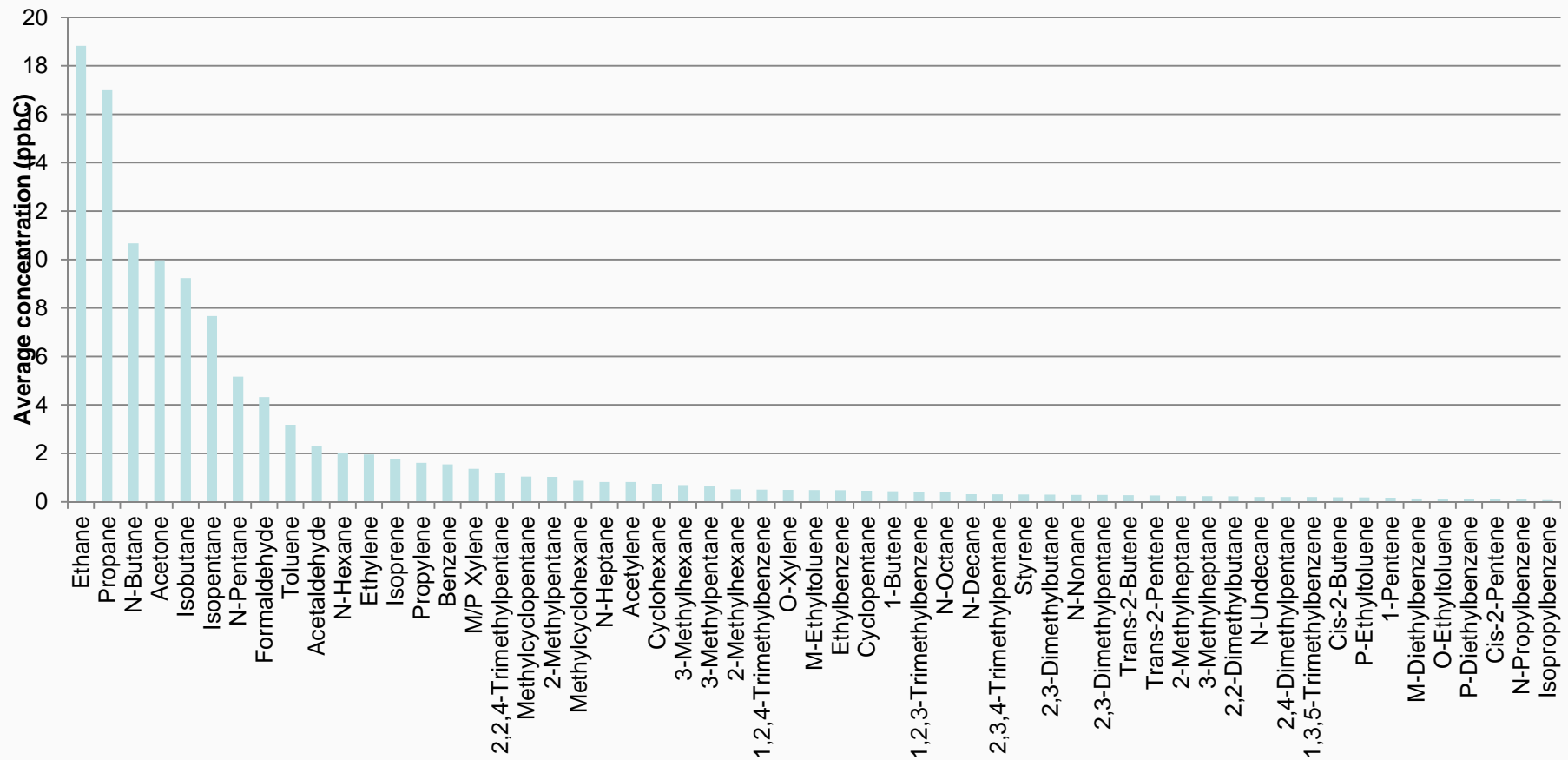


## Factors for Consideration In Evaluating List

- Average concentration
  - Average MIR adjusted concentration
  - Average MIR adjusted concentration at 9 am on high ozone days
  - Average concentration geographically (NE, SE, MW, SW, W)
- Is it a Hazardous Air Pollutant?
- Is it a Secondary Organic Aerosol precursor?
- Is it a tracer?

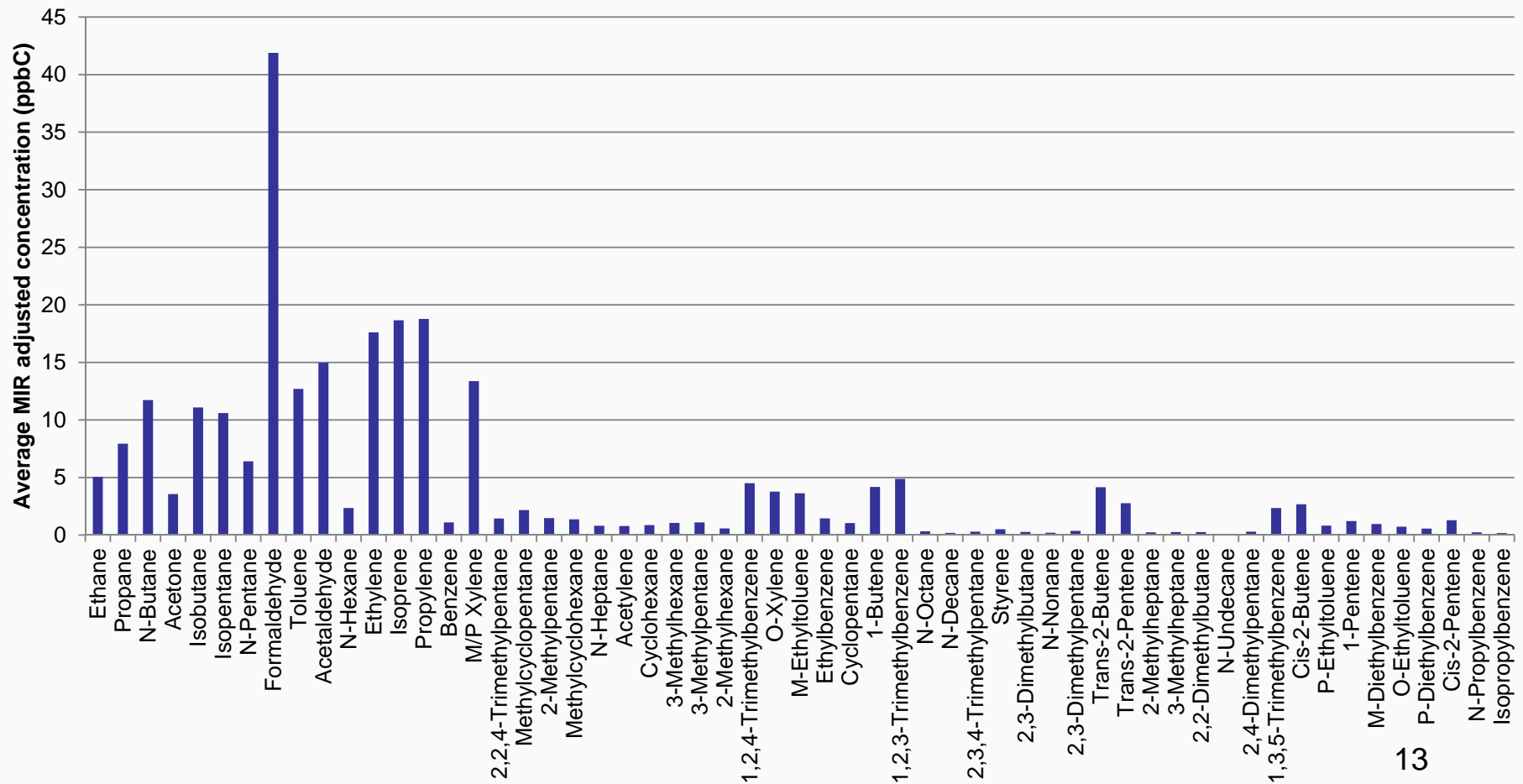


# Average Concentration of PAMS Compounds in 2010





# Average MIR Adjusted Concentration of PAMS Compounds in 2010





# Target Compounds to Consider Adding

- Secondary Organic Aerosol Precursors
  - Benzaldehyde
- Air Toxics
  - 1,3 Butadiene
  - Naphthalene
  - Benzo(a)Pyrene
  - Acrylonitrile
  - Tetrachloroethylene
  - 1,4 Dichlorobenzene
- Biogenics
  - A-pinene
  - B-pinene



# VOC Measurements

- Current requirements
  - Speciated VOC measurements at 2 sites (a Type 2 and a Type 1 or Type 3)
  - Three options allowed
    - Hourly auto GC,
    - Eight 3-hour canisters, or
    - 1 morning and 1 afternoon canister with a 3-hour or less averaging time plus continuous Total Non-methane Hydrocarbon (TNMH) measurement

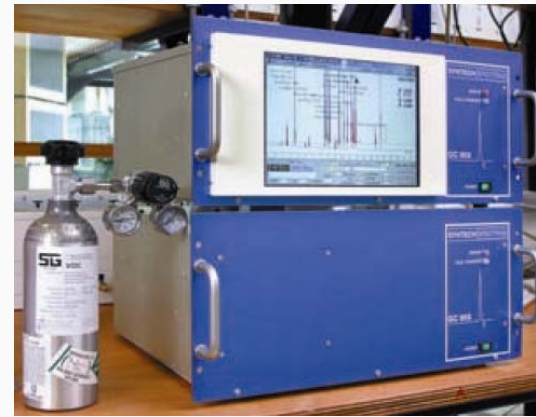


# VOC Measurement Technologies

Canisters

vs

Auto-GCs



- Data averaged over sampling period
- Low capital cost
- Continuing lab/shipping costs
- Manually intensive
- Canister “artifacts”

- Hourly data
- Higher capital cost
- Higher skill level required to run and analyze data
- Difficulty resolving some compounds





# VOC Recommendations

- CASAC Recommendations
  - No specific recommendation on autoGC vs. canister
    - CASAC did note that one objective of PAMS should be to gather data on diurnal patterns which can't be done (well) with canisters
  - Noted advantages and disadvantages of both options
  - Recommended a thorough evaluation of commercial autoGCs
- Team Recommendations
  - Require use of autoGCs at required PAMS sites
  - Allow and support canisters for flexible portion of PAMS
  - Perform a “shootout” of available autoGCs to evaluate performance, field readiness, and costs



# AutoGC Shootout

- Currently Planning Two-Phase Shootout
- Phase 1 – Open Evaluations
  - EPA would develop and setup a laboratory testing location/procedure to evaluate “best case” capabilities of autoGCs
  - Vendors would be invited to participate at own expense
- Phase 2 – Selected Evaluations
  - Select 2-3 autoGCs based on open evaluations to evaluate in more detail
  - Setup trailer with autoGCs and support equipment (calibrator, data acquisition system, etc.)
  - Test systems for 4-6 months
  - Optional: Relocate trailer and equipment to locations with higher VOC for additional testing



# Carbonyl Measurement Requirements

- Carbonyl measurements are required at Type 2 sites in areas classified as serious or above for the 8-hour ozone standard
  - Formaldehyde,
  - Acetaldehyde, and
  - Acetone
- Carbonyl requirements were dramatically scaled back in 2006 monitoring revisions due to method concerns
  - EPA's Office of Research and Development (ORD) has plans to develop improved carbonyl methods



# Carbonyl Recommendations

- CASAC Recommendations
  - Noted that carbonyls are very important in ozone formation
  - Voiced continued concerns regarding method and need for improved QA protocols for field and laboratory analysis
- Team Recommendations
  - Follow ORD evaluation of carbonyl sampling methods
  - Require carbonyl sampling at required PAMS sites, but only after ORD has finalized a new and improved method



# Nitrogen Measurements

- Current requirements
  - One NO/NO<sub>2</sub>/NO<sub>x</sub> site per area (at Type 2 Sites)
  - One NO/NO<sub>y</sub> site per area (at either Type 1 or Type 3 site)
- Issues
  - NO<sub>2</sub> plays a major role in ozone formation
  - Standard NO<sub>x</sub> measurement technology is known to have positive interferences from other non-NO<sub>x</sub> species (HNO<sub>3</sub>, PAN, mPAN, etc.)
    - NO<sub>2</sub> measurement = NO<sub>what</sub>
  - NO<sub>y</sub> measurements don't give a NO<sub>2</sub> reading at all!
  - New technologies are coming out that will provide a “true NO<sub>2</sub>” measurement
    - Direct NO<sub>2</sub> measurements (e.g., cavity ringdown)
    - Photolytic converters
  - Existing NO<sub>2</sub> NAAQS network provides useful data for O<sub>3</sub> modeling.



# Nitrogen Measurements

- CASAC Recommendations
  - New NO<sub>2</sub> technologies should be investigated for inclusion in the PAMS network
- Team Recommendations
  - Add a “true NO<sub>2</sub>” measurement at required PAMS NCore sites
    - NCore sites currently monitor NO/NO<sub>y</sub>
    - Could add just an NO<sub>2</sub> instrument or a photolytic NO<sub>x</sub> box



# Upper Air Meteorology Measurements

- Currently one representative upper air site is required in each PAMS area
  - Details on what upper air data is to be collected is not defined!
    - Mixing height
    - Wind direction and speed?
- Most upper air systems used in PAMS are radar profilers with RASS temperature profilers
  - The systems at PAMS sites are old and VERY expensive
- Inexpensive ceilometers can provide continuous mixing height data
  - NOAA has recently installed over 1000 ceilometers across the US but are not currently collecting mixing height data







# Upper Air Meteorology

- **CASAC Recommendations**
  - Upper air wind speed and wind direction data should not be required at all PAMS areas
    - Upper air wind speed and direction data are useful but expensive
    - Utility of upper air wind speed and wind direction data depends on local or regional needs
  - EPA should explore other sources of upper air data (e.g., NOAA's Aircraft Meteorological Data Relay program)
- **Team Recommendations**
  - Remove requirement to collect upper air data at PAMS sites
  - Work with NOAA to make NOAA upper air data available
    - Alternatively, require mixing height measurement at required PAMS sites
  - Continue to support use of profilers as part of flexible portion of PAMS





# Data Access and Analysis

- PAMS data is stored in AQS
  - Data can be downloaded from <http://www.epa.gov/ttn/airs/airsaqs/detaildata/downloadaqdata.htm>
  - OAQPS is also working on a Google Earth based system for identifying and downloading PAMS data
- It can be difficult to analyze PAMS data due to the large amount of data collected and reported
  - The 2011 data file for PAMS data is approximately 700 MB with over 5 million individual measurements
- EPA has been holding \$150,000/yr off the top to pay for data analysis at the National level
  - Note, we have not yet spent this money as we are trying to determine how best to use the money