




PAMS Re-Engineering

MARAMA Monitoring Meeting
September

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EPA/OAR/OAQPS



Outline

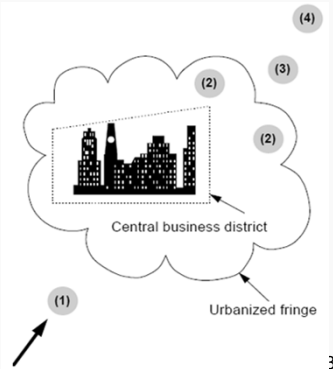
- Network Design
- Target compound list
- VOC Measurements
- Nitrogen Measurements
- Meteorological Measurements
- Data Access and Analysis

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Network Design

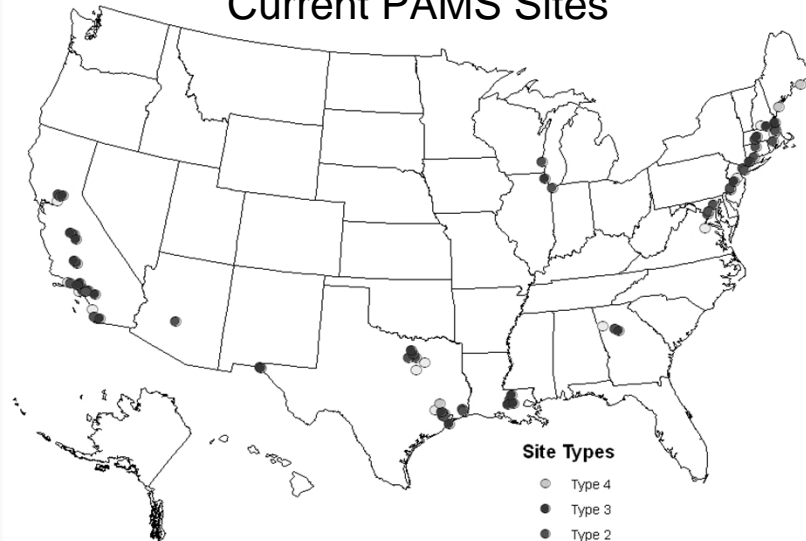
- Current design calls for up to 5 sites in each serious and above ozone non-attainment area
 - Type 1 Upwind
 - Type 2 Max emissions
 - Type 3 Max ozone
 - Type 4 Extreme Downwind
- PAMS Season June-August
- 75 current PAMS sites
 - Not counting met sites



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Current PAMS Sites



- Site Types**
- Type 4
 - Type 3
 - Type 2
 - Type 1

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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

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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



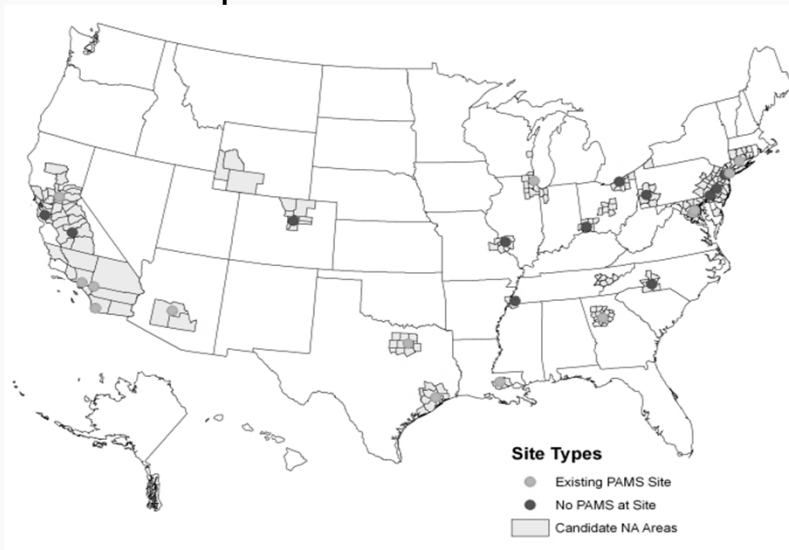
Impact on Number of Required Sites

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

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Proposed PAMS Network



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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

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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

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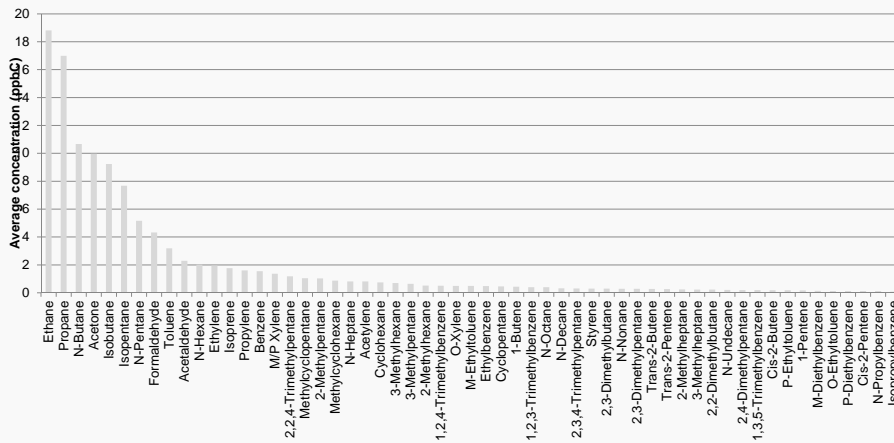


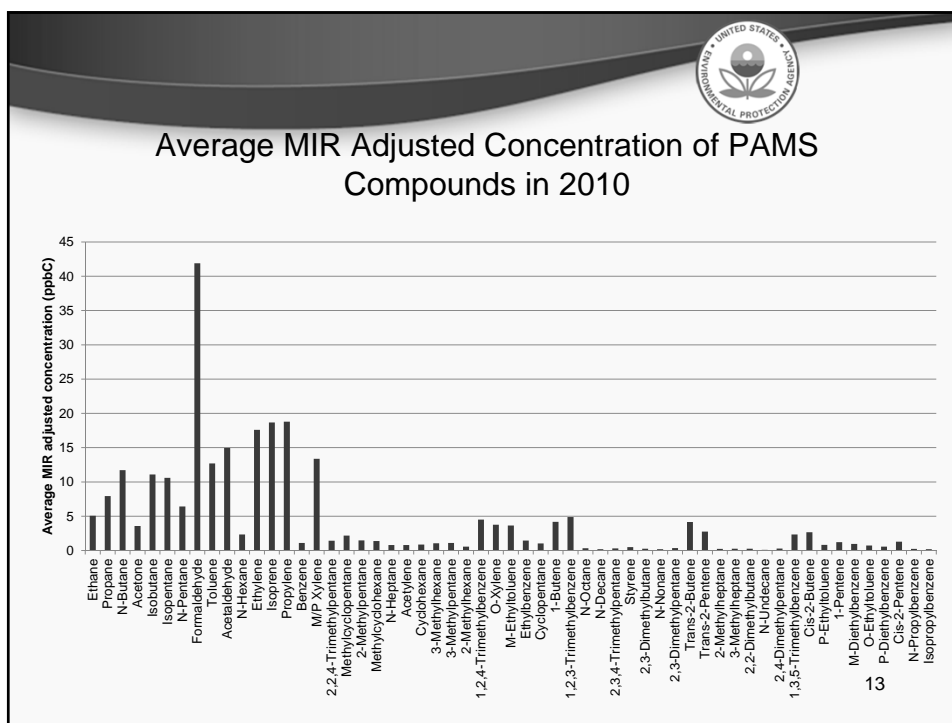
Factors for Consideration In Evaluating List

- 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





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

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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

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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

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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

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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

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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

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Nitrogen Measurements

- Current requirements
 - One NO/NO₂/NO_x site per area (at Type 2 Sites)
 - One NO/NO_y site per area (at either Type 1 or Type 3 site)
- Issues
 - NO₂ plays a major role in ozone formation
 - Standard NO_x measurement technology is known to have positive interferences from other non-NO_x species (HNO₃, PAN, mPAN, etc.)
 - NO₂ measurement = NO_{what}
 - NO_y measurements don't give a NO₂ reading at all!
 - New technologies are coming out that will provide a “true NO₂” measurement
 - Direct NO₂ measurements (e.g., cavity ringdown)
 - Photolytic converters
 - Existing NO₂ NAAQS network provides useful data for O₃ modeling.

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Nitrogen Measurements

- CASAC Recommendations
 - New NO₂ technologies should be investigated for inclusion in the PAMS network
- Team Recommendations
 - Add a “true NO₂” measurement at required PAMS NCore sites
 - NCore sites currently monitor NO/NO_y
 - Could add just an NO₂ instrument or a photolytic NO_x box

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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



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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

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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

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