



***Update of ORD Research
Activities Related to Ambient
Air Monitoring***

Integrated Air Monitoring Steering
Committee Meeting
December 9, 2004

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ORD

Overview

- Methods Development and Evaluation
 - Particulate Matter
 - Air Toxics and Ozone
- Methods and Measurements Applications
- Relevant EPA STAR Grants
- Summary and Input on Future Directions



Particulate Matter Methods: Current Activities

- Coarse FRM
 - Evaluating improvements in measurement methods since previous field studies
 - Working with vendors to address issues
 - Considering another field study in April/May of 2005 (Phoenix) to evaluate improved methods



Particulate Matter Methods: Current Activities (cont)

- EC/OC
 - STN/IMPROVE Intercomparison Study
 - 3-year study (2002-2004)
 - 6 sites (urban rural pairs in 3 locations)
 - Washington DC, Phoenix, and Seattle
 - Working with States, OAR, NPS, and UC Davis
 - Findings from first 2 years to be presented at February PM Supersites conference
 - Developing algorithms to reconcile STN/IMPROVE differences (coop agreement w/Rutgers and Carnegie Mellon)
 - Optimizing TOA protocol (IAG with NIST)
 - Addressing OC artifacts (contract with Rutgers)
 - Final products for activities above expected by 2006



Particulate Matter Methods: Current Activities (cont)

- Organic Speciation
 - Research accomplished using in-house Organic Aerosol Laboratory
 - Objectives
 - Develop and evaluate methods for measuring polar and non-polar components (2005)
 - Identify marker species for source apportionment (2006)
 - Conduct field study to evaluate markers (2007)



Particulate Matter Methods: Future Directions

- Evaluation of continuous PM_{2.5} methods for Class III equivalency
- Evaluation of semi-continuous PM speciation monitors
- Aerosol Wind Tunnel research



Air Toxics and Ozone

- Diffusive sampling methods
 - Acrolein
 - DNSH Method (improved stability and recovery)
 - Currently field testing in Detroit as part of large exposure study
 - Good results for acrolein
 - Addressing problems with formaldehyde
 - Plans for additional field tests in San Jose, Tampa, and Houston
 - 1,3 Butadiene
 - Carbopack X (improved detection limits)
 - Currently field testing in Detroit
 - Good results to date
 - Potential Future Direction
 - Research to support possible implementation of large-scale long-term sampling using diffusive monitoring for air toxics (EPA SAB recommendation)



Air Toxics and Ozone (cont)

- Mercury Dry Deposition
 - Objective
 - Develop direct measurement method and model for estimating dry deposition
 - Effort to be initiated in FY 05
 - Products expected in 2007
- Semi-continuous formaldehyde
 - Developed by Texas Tech with support of EPA
 - Deployed at some NATTS sites
- Semi-continuous NO₂ analyzer
 - Used successfully in Tampa field study (BRACE I)
 - To be used in upcoming Region 6 monitoring study
- Review of available methods for the 33 Urban Air Toxics



Methods and Measurement Applications

- PM Supersites
- Detroit Exposure and Aerosol Research Study (DEARS)
- Receptor Modeling Applications



PM Supersites

- 2005 AAAR PM Supersites International Specialty Conference
 - February 7-11, 2005 in Atlanta
- Policy Relevant Findings Document
 - Prepared with input from Supersite PIs
 - To be completed in late 2005 or early 2006



Detroit Exposure and Aerosol Research Study (DEARS)

- Describe the relationship between concentrations at a central site and residential/personal concentrations
 - PM constituents and Air Toxics
 - PM and Air Toxics from specific sources
- Emphasis placed on understanding impact of:
 - Local sources (mobile and point) on outdoor residential concentrations
 - Housing type and house operation on indoor concentrations
 - Locations and activities on personal exposure
- 3-year study initiated in July of 2004



DEARS Measurements

- Particulate matter
 - Mass
 - Sulfate
 - Metals
 - SVOCs
- EC/OC
- Particle-bound nitrate
- Gases
 - Ozone
 - Nitrogen Dioxide
 - Sulfur Dioxide
- Air Toxics
 - VOCs
 - Carbonyls
- Indoor air exchange rates



DEARS – Related Research Efforts

- Source Apportionment
- Air Quality and Human Exposure Modeling
- Near Roadway Exposure Study
- Mobile Source Characterization
- Field testing for acrolein and 1,3-butadiene measurement methods
- Health Studies
 - EPA/NHEERL Toxicity Studies of PM from major sources
 - EPA/NHEERL Detroit Children's Health Study
 - EPRI Health Studies (with University of Michigan and Michigan State University)



Receptor Modeling Applications

- Apply EPA PMF and UNMIX models to Supersites and STN data sets
 - Provide examples of the use of these models for SIP preparation
 - Involve state and local air pollution organizations



ORD STAR Grants

- Two recent Science to Achieve Results (STAR) grant solicitations are relevant to PM measurement
 - Carbonaceous PM (\$6.8M)
 - Awards in early 2004
 - Early results expected in late 2005
 - Final products expected by 2008
 - Source Apportionment of PM (\$4.5M)
 - Awards in early 2005



Carbonaceous PM STAR Grants

Grant Title	PI	Institution
Evaluation and Minimization of Organic Aerosol Sampling Artifacts Using Impactors and Quartz Fiber Filter Denuders	Fitz	UC-Riverside
Application of Thermal Desorption GC-MS for the Analysis of Polar and Non-Polar Semi-Volatile and Particle-Phase Molecular Markers	Schauer	UW-Madison
Advancing ATOFMS to a Quantitative Tool for Source Apportionment	Prather	UC-San Diego
Integrating the Thermal Behavior and Optical Properties of Carbonaceous Particles: Theory, Laboratory Studies, and Application to field Data	Bond	Univ of Illinois
Atmospheric Processing of Organic Particulate Matter: Formation, Properties, Long Range Transport, and Removal	Donahue	Carnegie Mellon
Secondary and Regional Contributions to Organic PM: A Mechanistic Investigation of Organic PM in the Eastern and Southern United States	Turpin	Rutgers
Source-Oriented Chemical Transport Model for Primary and Secondary Organic Aerosol	Kleeman	UC-Davis
Development of Advanced Factor Analysis Methods for Carbonaceous PM Source Identification and Apportionment	Hopke	Clarkson
Secondary Aerosol Formation from Gas and Particle Phase Reactions of Aromatic Hydrocarbons	Kamens	UNC-Chapel Hill
Fundamental Experimental and Modeling Studies of Secondary Organic Aerosol	Seinfeld	Caltech
Emissions Inventory and Process Reconciliation Using Molecular Markers and Hybrid/Inverse Photochemical Modeling with Direct Sensitivity Analysis	Russell	Georgia Tech
Understanding Thermal and Optical Carbon Analysis Methods	Chow	DRI
Particle Sampler for On-Line Chemical and Physical Characterization of Particulate Organics	Smith	MIT
Atmospheric Aersols from Biogenic Hydrocarbon Oxidation	Milford	Univ of Colorado
Development and Application of A Mass Spectra-Volatility Database of Combustion and Secondary Organic Aerosol Sources for the Aerodyne Aerosol Mass Spectrometer	Ziemann	UC- Riverside
Aetahlometric Liquid Chromatographic Mass Spectrometric Instrument for Characterization of Carbonacceous Ambient Particulate Matter. Laboratory and Field Studies	Dasgupta	Texas Tech



RESEARCH & DEVELOPMENT

Building a scientific foundation for sound environmental decisions

Summary

- ORD is conducting research to support air monitoring activities
 - Methods development and evaluation
 - Coarse FRM, EC/OC, organic speciation, diffusive air toxics methods, semi-continuous methods for formaldehyde and NO₂
 - Application of methods and measurements
 - PM Supersites, DEARS, and Receptor Modeling Applications
- Several products expected in 2006 to 2008 timeframe
- Future Directions include:
 - Evaluations of continuous PM mass and semi-continuous PM speciation methods
 - Application of methods and models to demonstrate impact of research and to support customer needs
 - Research => Application => Impact
- Are we on the right track?
 - Seeking input from customers

