How Can We Measure Ambient Concentrations of Speciated Fine and Coarse PM Mass to Support Improvements in the Ambient Air Quality Standards?

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research and development

Science Question

How can we measure ambient concentrations of the chemical and physical characteristics of fine and coarse PM mass and its precursor species to support improvements in developing, implementing, and tracking progress for attaining the National Ambient Air Quality Standards for Particulate Matter?

Research Goals

To provide key stakeholders – state, local, tribal, and Federal agencies, regional planning organizations, the private sector, and the general scientific community – with sampling and analysis methods to measure the chemical and physical characteristics of PM and important precursor species. The specific goal is to provide methods with reduced uncertainty and improved selectivity, sensitivity, and reliability to support improvements in developing, implementing, and tracking progress for attaining the NAAQS for PM.

ORD's PM Methods Program includes both in-house and extramural research efforts, the latter primarily through NCER STAR Grants and EPA's PM Supersites Program. Smaller cooperative agreements and contracts with universities and other research organizations provide additional support.

Methods/Approach

Develop and Evaluate Advanced PM Research Methods

Laboratory Testing

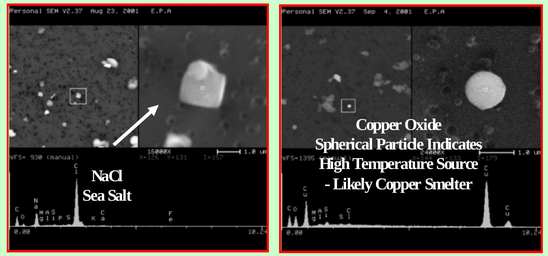
Texas Tech University (Dasgupta) Continuous Gas-Particle System Testing In ORD/NERL

Field Evaluations, Baltimore Supersites Project

Photo Courtesy of S. Pandis, Pittsburgh Supersites Project

ORD Works with OAQPS, PM Supersites, and Others to Evaluate Methods in the Field

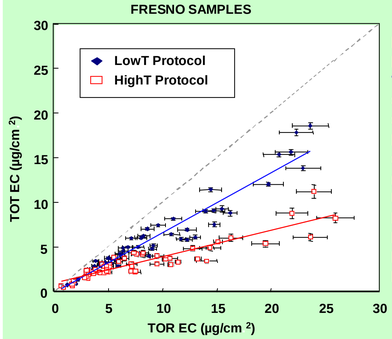
Computer Controlled Scanning Electron Microscopy (CCSEM) In ORD/NERL



Single Particle Chemical Analysis by CCSEM Provides Additional Information for Source-Apportionment Modeling

Results

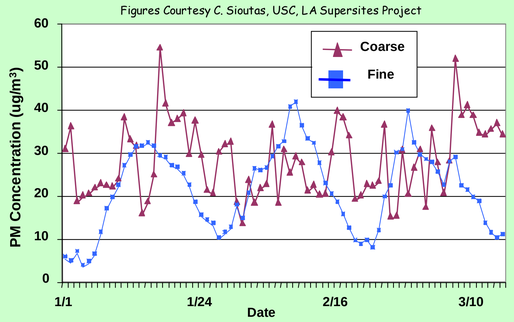
Methods Comparison: OC TOA Carbon Method STN vs IMPROVE



Methods Evaluation Through EPA's ORD STAR Grant Program – DRI Thermal - Optical Method (TOA) To Understand Differences in National Network Methods

Continuous Coarse Particle Sampler USC-EPA Patent

Figures Courtesy C. Sioutas, USC, LA Supersites Project



First Time Ever Continuous Coarse Particle (PM10-PM2.5) Measurements; Fine and Coarse Particles Follow Separate Tends, Since Generated by Different Mechanism and Sources

Conclusions

ORD=s PM Methods Program is investigating methods to measure a wide range of PM sizes (ultrafine to PM10 coarse) and compositions (inorganic and organic species). The methods and subsequent measurements employing these methods provide the basis for our understanding of the fate of PM in air. Methods presented in this poster represent a very small subset of the methods being developed and supported by ORD.

Future Directions

ORD will continue to develop, evaluate, and support species-specific PM and related methods both in-house and through external collaborations. In-house research will continue to focus on continuous methods, sampling and analysis methods for organic chemical species and for bulk organic and elemental carbon, and bulk and single particle elemental analyses. Extramural research will continue to complement and augment the in-house research efforts.

Impact and Outcomes

PM chemical speciation methods research directly impacts both EPA's national PM monitoring program and state programs in their needs to monitor more efficiently with reduced uncertainty. These methods support SIP development and setting of NAAQS for PM. The methods development and evaluation has provided significant input to states and vendors for developing and improving integrated and continuous species-specific methods for fine particles, precursor species, and related properties, such as size and composition of ultrafine PM. The PM Methods Program, with support from emissions- and receptor-based modeling, improves our understanding of the origins and fate of PM on urban and regional scales. These methods can be extended to human exposure assessments.

Air Quality