

SEARCH: The PM_{2.5} NAAQS and Particulate Matter Composition

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Summary

The Southeastern Aerosol Research and Characterization project (SEARCH) is a multi-year study begun in August 1998 and scheduled to operate through 2005. SEARCH leveraged off of and expanded upon the three-station ozone-related network begun in mid-1992 as part of the Southern Oxidants Study. SEARCH consists of eight monitoring stations in four urban-rural pairs: in Alabama (North Birmingham [BHM] and Centreville [CTR]); in Florida (Pensacola [PNS] and suburban Pensacola [OLF]); in Georgia (Atlanta [JST] and Yorkville [YRK]), and in Mississippi (Gulfport [GFP] and Oak Grove [OAK]). Each site measures a wide complement of gases (O₃, NO, NO₂, NO_y, HNO₃, SO₂, CO, CO₂), particle mass (PM_{2.5}, PM_{coarse}, and PM₁₀), particle composition (elemental carbon, organic carbon, sulfate, nitrate, ammonium, and trace metals), and meteorology (wind speed, wind direction, temperature, relative humidity, barometric pressure, solar radiation, and rainfall). A unique feature of SEARCH is the deployment of continuous particle speciation monitors for: PM_{2.5} mass, elemental carbon, organic carbon, total carbon, sulfate, nitrate, and ammonium, as well as dry scattering and absorption measurements.

The objectives of SEARCH include:

- develop a climatology of PM_{2.5} composition and related air quality for 8 Sites;
- develop an understanding of the spatial and temporal variability of PM_{2.5} composition;
- estimate source contributions and formation processes;
- provide data to constrain model performance;
- test, improve, and deploy routinely new continuous speciation methods; and
- collaborate with the States and others.

Conclusions to date include:

- Based on three years of PM_{2.5} FRM data:
 - Three of the 8 sites (BHM, JST & YRK) exceed annual standard, however, YRK would not if blank correction were allowed as part of the FRM.
 - No site exceeds the daily PM_{2.5} standard (but occasional readings > 65 ug/m³, more often at rural sites in winter).
- Organic matter (i.e., organic carbon x 1.4) exceeds sulfate in urban areas but the two are equivalent in rural areas. However, total carbon (organic matter plus elemental carbon) exceeds sulfate at all sites.
- Urban areas have higher PM_{2.5} concentrations than their rural counterparts. Most of the urban-rural differences in PM_{2.5} concentration is explained by differences in elemental and organic carbon.
- Elemental and organic carbon are important components of PM_{coarse}.
- There is substantial diurnal and day-to-day variability in PM_{2.5} composition as demonstrated by the continuous PM_{2.5} speciation methods.
- The continuous methods provide important information:
 - for understanding sources,
 - for understanding processes leading to PM_{2.5} formation, and
 - for constraining the performance of atmospheric models (i.e., the models must reproduce the observed variability to have confidence in their use).
- Initial EPA PEP results in SE suggest important differences between FRM manufacturer. These differences have important implications in assessing spatial patterns across collecting agency.
- Primary organic carbon appears to dominate over secondary organic carbon in the Southeast.
 - Diesel, gasoline, meat cooking, and wood smoke dominate organic carbon in the Southeast.