

National PM_{2.5} Speciation Program

Overview, Objectives, Requirements, and Approach

Chemical speciation is included in the discussion of major monitoring requirements and principles set forth in 40 CFR Part 58, Ambient Air Quality Surveillance for Particulate Matter; Final Rule. A requirement of this rule is a modest chemical speciation network of fifty PM_{2.5} sites across the nation that provide a first order characterization of the metals, ions, and carbon constituents of PM_{2.5}. In addition to development of network design and implementation, it is important to establish an analytical laboratory framework to consistently support the speciation monitoring network needs.

Physical and chemical speciation data can be used to support several areas which include:

- Helping to implement the PM_{2.5} standard by using speciated data as input to air quality modeling analyses and as indicators to track progress of controls;
- Aiding the interpretation of health studies by linking effects to PM_{2.5} constituents;
- Understanding the effects of atmospheric constituents on visibility impairment; and
- Using the speciated particulate data to aid in monitoring network design and siting adjustment.

The 40 CFR Part 58 rule describes the initial speciation monitoring network as including fifty core sites within the National Air Monitoring System (NAMS). Twenty-five of the monitors are to be collocated as part of the Photochemical Air Monitoring System (PAMS) component of NAMS, with the remaining twenty-five sites to be selected in coordination among the EPA, Regional Office Administrators and the States. This required network represents a small fraction of all the chemical speciation work that EPA expects to support. Therefore, analytical support services are being planned for an additional 250 sites. Samples will be collected every six and twelve days, respectively, for the NAMS and other site monitors. The analytes of interest from these samples will be similar to those currently measured within the Interagency Monitoring of Protected Visual Environments (IMPROVE) program.

The approach to be used for chemical speciation involves both sampling and analysis components. The single channel, 47-mm polytetrafluoroethylene (PTFE) filter, Federal Reference Method Monitor is not capable of completely supporting a comprehensive set of analyses required to characterize the components of a PM_{2.5} sample. Since the 40 CFR Part 53, Revised Requirements for Designation of Reference and Equivalent Methods for PM_{2.5}, equivalency requirements provide that no designations are required for speciation monitors, their design can be flexible to include additional filter collection media best-suited for the analysis of specific components. With the prospects of ensuring data quality for several thousand filter analyses per year which utilize a range of analytical methods, it is critical to establish an analytical laboratory framework which can consistently support these needs. One key point is to establish a common set of standard operating procedures (SOPs) for all speciation analyses. The SOPs must be based on analytical methods with proven application to the analysis of ambient particulate matter filter samples.

- The chemical analysis of PM_{2.5} involves many considerations including the:
- target analytes of interest;
 - sample handling;
 - analytical SOPs;
 - quality assurance; and
 - data reduction, reporting, validation, and ensuring adequate laboratory capacity to support the analysis of several thousand samples annually.

The PM_{2.5} target analytes are similar to those within the IMPROVE program and consist of an array of cations, anions, carbon species, trace elements, and semi-volatile organic particles. Each series of analytes requires sample collection on the appropriate filter medium to allow chemical analysis with methods of adequate sensitivity.

The methods used for analyses of these filter media include gravimetry (electro-microbalance) for mass; X-ray fluorescence (XRF) and particle induced X-ray emission (PIXE) for trace elements; ion chromatography (IC) for anions and selected cations; controlled-combustion for carbon; and gas chromatography/mass spectroscopy (GC/MS) for semi-volatile organic particles. In addition to chemical analyses, special measurement needs may include determining particle size and morphology through optical and/or electron microscopy.

Although the speciation monitor designs will vary, all will involve the collection of multiple filter sample sets. Guidance and procedures will be provided to site operators on pre- and post-sampling filter use, handling, transport and storage.

In addition to guidance on sampling and handling, the EPA will also develop guidance and documentation for SOPs on the measurement of the target analytes which will include laboratory quality assurance guidelines specific to the methods of analysis; and guidelines on standardized data reduction, validation, and reporting formats. The EPA plans for the speciation data to be submitted to the Aerometric Information Retrieval System (AIRS) data base.

The EPA's approach to providing the speciation laboratory support services will begin with developing the laboratory specifications, analytical standard operating procedures, and associated quality assurance requirements. These guidelines will be utilized through a national laboratory services support program consisting of contracted services with qualified laboratories. Speciation site operators will be able to access analytical support from these laboratories through EPA Regional Project Officers who will service site needs in those states residing in their Regions.

The operational schedule for providing the speciation laboratory support services begins with development of a program team of EMAD and EPA regional office personnel. The Office of Air Quality Planning and Standards (OAQPS) will lead the development of the required guidance information and the SOPs with input from the Office of Research and Development (ORD), EPA Regional Offices, and the PM_{2.5} monitoring technical community. Initial deployment of the speciation monitors is projected for the fourth quarter of calendar

1998. Allowing for time by site operators to be trained in the use of the monitors, we project that the laboratory portion of the National PM_{2.5} Speciation Program will be in place by February of 1999.

For further information on the National PM_{2.5} Speciation Laboratory Program or to provide comments on your anticipated services needs, please contact:

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