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Semi-continuous monitoring techniques for particulate matter and its components: A summary of EPA's PM Supersites Program and Related Studies results

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The US Environmental Protection Agency's (EPA) Particulate Matter Supersites Program was established to provide key stakeholders (government and private sector) with significantly improved information needed to develop effective and efficient strategies for reducing PM on urban and regional scales. The primary goals of the program were: to provide unprecedented physico-chemical characterization of ambient particulate matter that contributes to a better understanding of PM sources and formation mechanisms; to develop and evaluate routine and novel state-of-the-art sampling methods of PM mass, chemical components, and related properties; and to support health effects and exposure research. All Supersites Projects developed and evaluated new methods and instruments and significant advances have been made and applied within the current programs yielding new insights to our understanding of PM accumulation in air and improved source-receptor relationships. Looking to the future, this paper reviews results from these research studies conducted over the last 5 years or so to help the science and policy communities identify measurement methods and instrumentation that should be considered for use in routine monitoring networks so improved information regarding ambient PM may be available within a few years.

The tested methods include a variety of semi-continuous methods measuring PM2.5 mass concentrations with reduced or eliminated positive or negative artifacts, which are potentially encountered in current monitoring networks that employ filter-based methods for PM mass, such as the EPA's Federal Reference Method (FRM) network. In addition, semi-continuous coarse and ultrafine mass measurement methods were developed and evaluated. Other semi-continuous monitors tested measured the major

components of PM such as nitrate, sulfate, ammonium, organic and elemental carbon, trace elements, and, water content of the aerosol as well as methods for physical properties of PM, such as number concentration, size distribution, particle density. Particle mass spectrometers, while unlikely to be used in national routine monitoring networks in the foreseeable future because of the robust technical requirements are mentioned here because of the wealth of new information they provide on the size-resolved chemical composition of atmospheric particles on a near continuous basis. Particle mass spectrometers likely represent the greatest advancement in PM measurement technology during the last decade. The improvements in time resolution achieved by the reported semi-continuous methods has proven to be especially useful in characterizing ambient PM, and is becoming essential in allowing scientists to investigate particle sources and to probe into the dynamics of aerosol formation in the atmosphere.

Although this work was reviewed by EPA and approved for publication, it may not necessarily reflect official Agency policy.