

Intraurban Variability of Ambient Particulate Matter Arsenic and Other Air Toxics Metals: St. Louis Case Study*

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This presentation includes three components. First, we will briefly compare and contrast commercially-available methods to collect ambient particulate matter metals data (especially trace elements) at high time resolution. Second, as detailed below we will summarize our recent field campaign to characterize air toxics metals in St. Louis, USA. Third, we will provide a perspective on the opportunities and challenges when incorporating high time resolution metals measurements into air quality studies.

A detailed study of arsenic and other air toxics metals has been conducted under a USEPA-funded Community Air Toxics grant. 24-hour integrated PM₁₀ HiVol samples were collected at four sites in St. Louis every third day for the 2008 calendar year. Filters were extracted by hot acid digestion and analyzed by ICP-MS for arsenic and certain other air toxic metals. A Cooper Environmental Services (CES) Ambient Metals Monitor (Xact 620) was deployed to identify temporal patterns in PM₁₀ arsenic and other elements by siting the instrument at six locations each for a one month period. This instrument features ambient particulate matter collection onto a filter tape for a user-defined sampling period. The filter tape is subsequently advanced to transfer the deposit into an analysis chamber where the elemental mass loadings are quantified by x-ray fluorescence. Simultaneous collection of a new deposit while the previous deposit is being analyzed provides a continuous stream of elemental data at the user-defined sampling time base (two-hour resolution in this study).

An arsenic emission inventory implicates coal-fired power plants as the largest arsenic emitters in the St. Louis area. However, spatial gradients across the four-site network demonstrate there are other significant, local sources of arsenic. The daily minimum concentration value observed across the network was used to apportion the site-specific concentrations values into an area-wide baseline contribution and a local excess. Surface winds analysis of the excess arsenic concentration distributions identified bearings where local emission sources are likely located. The high time resolution measurements further refined our understanding of the location and nature of local arsenic sources, in one case implicating a hazardous waste incinerator and in another case an operation with emissions only during weekday, daytime hours. We will also present a performance evaluation of the Xact including sensitivity metrics, collocated precision, and comparisons to data collected using filter-based sampling and offline analysis.

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