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XRF-Based High Time Resolution Measurement of Airborne Particulate Matter Metals

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BIOSKETCH: Jay is an Associate Professor of Energy, Environmental and Chemical Engineering at Washington University in St. Louis. He holds B.S. and M.S. degrees from UCLA (1987) and a D.Sc. from Washington University (1993), all in Chemical Engineering. Jay's research primarily focuses on air quality characterization with emphasis on field measurements and data analysis to support a variety of applications in the atmospheric science, regulation and policy, and health studies arenas. Recent work has focused on: lead emissions from piston engine aircraft; fence-line measurements at a petroleum refinery; coarse particulate matter speciation; and air quality planning and management in Fairbanks AK, Hong Kong, and Ulaanbaatar, Mongolia. Jay currently serves on the Ambient Monitoring and Methods Subcommittee (AMMS) of USEPA Clean Air Scientific Advisory Committee (CASAC) and is Vice President of American Association for Aerosol Research (AAAR).

ABSTRACT: The commercialization of XRF-based monitors for stack and ambient measurements of particulate matter elemental composition is an important advancement towards meeting the need for continuous, high time resolution measurement of air quality parameters. This presentation will summarize our experience with the Cooper Environmental Services (CES) Ambient Metals Monitor (Xact 620) which is one in a series of XRF-based monitors for stack, fence-line and ambient measurements. In 2008 the Missouri Department of Natural Resources (MDNR) purchased a Xact 620 that was tuned for measurement of air toxics metals – especially arsenic and lead – in ambient air in urban and remote environments. MDNR conducted six one-month deployments throughout the St. Louis area, followed by a long-term deployment near a large primary lead smelter. The monitor is currently deployed at a highly instrumented air quality monitoring station operated by MDNR. My group has conducted performance evaluations by comparing Xact data to 24-hour integrated filter samples analyzed by XRF and ICP-MS and has conducted extensive analyses on the Xact data sets. This presentation will briefly summarize the performance evaluation and then focus on insights into the climatology of PM_{10} metals that we have obtained from the Xact data. High time resolution (e.g. hourly) measurements better align the data to the timescales for variability in surface winds and thereby dramatically improve the ability to resolve local sources. The high data density permits analyses that condition the data on time (e.g. hour of day, weekday/weekend), surface wind directions, or air mass transport patterns. The various measured species exhibit distinct patterns that reflect contributions ranging from local emissions to regional-scale transport.