NARSTO EPA_SS_BALTIMORE Metal Conc and Cytokines Induced by SEAS PM2.5 Samples

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1. Data Set Description:

The University of Maryland Semicontinuous Elements in Aerosol Sampler (SEAS) II employed at the Baltimore Supersite was a tremendous success. Thirty minute samples were collected at the 3 Baltimore monitoring locations for elemental analyses and samples were co-collected for cytokine assays. Only a small fraction of the samples collected were analyzed. Data files of SEAS elemental results for Ponca Street (July to November 2002) and for Clifton Park (August to September 2001) and one data file of cytokine assay results for Ponca Street are archived.

University of Maryland Semicontinuous Elements in Aerosol Sampler (SEAS) II

Simultaneous multielement graphite furnace atomic absorption spectrometry was used to determine Al, As, Cd, Cr, Cu, Fe, Mn, Ni, Pb, Sb, Se, and Zn in ambient air sampled at 90 L/min for 30 min and collected as a slurry after dynamic preconcentration.

Air was sampled at a flow rate of 90 L/min and particles grown by condensation of water vapor in a condenser maintained at 0.5 degrees C after saturation by direct injection of steam. The resulting droplets were concentrated 13.6 fold using a single-nozzle virtual impactor and collected in a liquid slurry with a real impactor in an all glass and plastic system. The system delivered an aerosol slurry at a rate of 0.2 mL/min, i.e., suitable for analysis by multielement graphite-furnace atomic absorption spectrometry, with system blanks adequate to permit quantitative analysis of Al, As, Cd, Cr, Cu, Fe, Mn, Ni, Pb, Sb, Se, and Zn in ambient aerosol samples.

In a typical study (Kidwell and Ondov, 2001), plumes of major point sources were readily identified in the time series plots of key marker elements. Trends in the concentrations of elemental source markers were clearly correlated with wind direction and other meteorological factors to identify the influences of local industrial emissions, including motor vehicle traffic, coal- and oil-fired power plants, and municipal incinerators. Factor analysis was applied to the 88-sample data set to extract 7 factors: urban dust, meteorological factors, incinerators, coal-fired power plants, Tour Bus emission, unknown As source, and oil-fired power plants. Factor analysis was also applied to an 18-sample data set representing 2.5 h averages of the 30 min data to simulate the effect of longer sample collection times. Only 6 factors were extracted from this data set, which shows that increased temporal resolution enhances the power of factor analysis to resolve sources. These results indicate that a wealth of detailed information is revealed at this level of temporal resolution.

Bioassay for Testing the Biological Activity of Highly Time Resolved PM2.5 in Vitro

A bioassay for testing highly time resolved PM2.5 samples for their ability to stimulate the release of immune mediators of the inflammation was successfully developed through this project. The release of cytokines and chemokines by cultured alveolar epithelial cells and monocytes stimulated by PM2.5 samples collected over time periods as short as 30 minutes was detectable and responsive to PM2.5 samples of different chemical compositions. Results obtained from the bioassay system in both cell types were reproducible and of sufficient precision to allow detection of differences between PM2.5 samples collected over short time intervals.

The health impact of the combined action of multiple metals and endotoxin present in PM2.5 needs to be studied in greater detail. Regression analysis of the biological activity of the highly time resolved PM2.5 fractions with known metal and endotoxin concentrations indicate theat Zn, Cd, Al, Se and endotoxin all play a role in the net effect of Baltimore PM2.5.

The **Baltimore Supersite** collected high-quality ambient air quality measurements with unprecedented temporal resolution at industrially influenced urban sites from August of 2001 to November of 2002 with two intensive measurement campaigns. A data set of project results was constructed to take advantage of advanced multivariate statistical techniques. Data were collected on the sources and nature of organic aerosol for the region, and large quantities of urban particulate matter (PM) were collected for retrospective chemical, physical, and biological analyses and for toxicological testing. These data provided important information on the potential health effects of particles to support

exposure and epidemiologic studies for enhanced evaluation of health outcome, pollutant, and source relationships. More information can be found at Baltimore PM Supersite.

The U.S. EPA Particulate Matter (PM) Supersites Program was an ambient air monitoring research program from 1999-2004 designed to provide information of value to the atmospheric sciences, and human health and exposure research communities. Eight geographically diverse projects were chosen to specifically address these EPA research priorities: (1) to characterize PM, its constituents, precursors, co-pollutants, atmospheric transport, and its source categories that affect the PM in any region; (2) to address the research questions and scientific uncertainties about PM source-receptor and exposure-health effects relationships; and (3) to compare and evaluate different methods of characterizing PM including testing new and emerging measurement methods. Data collected by these projects are publicly available at the NARSTO Permanent Data Archive, NASA Langley DAAC. Data users should acknowledge the U.S. EPA Particulate Matter (PM) Supersites Program and the project investigator(s) listed below.

The data set should be cited as follows:
Ondov, John M. 2007. NARSTO EPA_SS_BALTIMORE Metal Conc of and Cytokines Induced by SEAS PM2.5 Samples. Available on-line via NARSTO Data and Informaton at the Atmospheric Sciences Data Center at NASA Langley Research Center, Hampton, Virginia, U.S.A.

More information can be found at Baltimore PM Supersite.

Related Archived Data Sets:

- NARSTO EPA_SS_BALTIMORE JHU LIDAR Backscatter and Mixing Height Data
- NARSTO EPA_SS_BALTIMORE JHU Meteorological Data
- NARSTO EPA_SS_BALTIMORE Rapid Single-Particle Mass Spectrometer Data

2. Sample Data Record/Data Format:

Data files are in the NARSTO Data Exchange Standard (DES) format that is described in detail on the NARSTO Quality Systems Science Center (QSSC) web site. The files follow a tabular layout and are stored as ASCII comma-separated values files (.csv). The DES does not rely on row position to identify specific information, but uses a tag to describe the information contained in the row. The DES is a self-documenting format with three main sections: the header contains information about the contents of the file and the data originator; the middle section contains metadata tables that describe/define sites, flags, and other codified fields; and the final section is the main data table that contains key sampling and analysis information and the data values. Descriptions of the standardized metadata fields are also available on the QSSC web site.

Data Quality Notes

- NARSTO_EPA_SS_BALTIMORE_CLIFTON_SEAS_PM25_METALS_V1.csv
  - The original version of this file was submitted 20070625 with name BALTIMORE_CIIFTON_metals_SEAS_finalv3_jmo.csv. The NARSTO QSSC made minor formatting changes and renamed it for archiving.
  - View time series plot for NARSTO_EPA_SS_BALTIMORE_CLIFTON_SEAS_PM25_METALS_V1 (PDF)

- NARSTO_EPA_SS_BALTIMORE_PONCA_SEAS_PM25_CYTOKINE_V1.csv
  - The original version of this file was submitted 20070625 with name BALTIMORE_PONCAcytokineSEAS_finalv2_CorrGB.csv. The NARSTO QSSC made minor formatting changes and renamed it for archiving.
  - View time series plot for NARSTO_EPA_SS_BALTIMORE_PONCA_SEAS_PM25_CYTOKINE_V1 (PDF)

- NARSTO_EPA_SS_BALTIMORE_PONCA_SEAS_PM25_METALS_V1.csv
  - The original version of this file was submitted 20070625 with name BALTIMORE_PONCA_PM25_SEAS_final_Corrected_Fatma.csv. The NARSTO QSSC made minor formatting changes and renamed it for archiving.
  - View time series plot for NARSTO_EPA_SS_BALTIMORE_PONCA_SEAS_PM25_METALS_V1 (PDF)

A Note about Cytokine Results

Negative cytokine values mean that the normal release of the cytokine from the bioassay cells was inhibited. The baseline media cytokine concentration from cells only exposed to normal media is subtracted from the media cytokine concentration from cells exposed to particles in their media. Thus, negative numbers are reported when less cytokine is released to the media when the cells are exposed to particles.

Time-Series Plots

Time-series plots are included for all of the numeric variables in each of the Baltimore data files. These plots are useful for screening for outliers and visualization of values less than the detection limit and values with other quality flags.

3. References:

- Kidwell, C.B., Ondov, J. M. 2001. Development and evaluation of a prototype system for collecting sub-hourly ambient aerosol for chemical analysis. AEROSOL SCIENCE AND TECHNOLOGY 35 (1): 596-601.

- Kidwell CB, Ondov JM. 2004. Elemental analysis of sub-hourly ambient aerosol collections. AEROSOL SCIENCE AND TECHNOLOGY 38 (3): 205-218.

- Pancras, J. P., Ondov, J.M., and Zeisler, R. 2005. Multi-element electrothermal AAS determination of 11 marker elements in fine ambient aerosol slurry samples collected with SEAS-II. ANALYTICA CHIMICA ACTA 538 (1-2): 303-312.

- Park, S. S., Pancras P. J., Ondov, J. M., Poor, N. (2005) A New Pseudo-deterministic Multivariate Receptor Model for Accurate Individual Source Apportionment Using Highly Time-resolved Ambient Concentrations, J. Geophys. Res., 110, No. D7,1 6 April. Citation no. D07S15, doi:10.1029/2004JD004664

- Park, S. S., Pancras, P., Ondov, J. M., C. Davidson, A. Robinson (2006) Application of the Pseudo-Deterministic Multivariate Receptor Model to resolve Power Plant Influences on Pittsburgh Air Quality. Aerosol Sci. Technol. 40:883-897.

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Data Center:

The User and Data Services Office at the NASA Langley Atmospheric Science Data Center is involved throughout the system to monitor the quality of data on ingest, to ensure prompt replies to user questions, to verify media orders prior to filling them, and to ensure that the needs of the users are being met.

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5. Acknowledgement:

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