

Monitoring and Modeling of Mercury Transport and Deposition in the Ohio River Valley

K. Crist¹, Reddy Yataavelli L.N.¹, J. Fahmi¹, S. Winter², R. Khosah³, C. Seigneur⁴ and R. Kotamarthi⁵

¹Ohio University, ²Consol R&D, ³Advanced Technology Systems, ⁴Atmospheric and Environmental Research Inc., ⁵Argonne National Laboratory

PROJECT DESCRIPTION

Over the past several years, the U. S. Department of Energy's National Energy Technology Laboratory (NETL) has funded a number of research projects targeted towards the characterization of fine particulate matter (PM2.5) present along the Upper Ohio River Valley corridor with the intent of guiding the strategy of emission control programs. The proposed project complements NETL's overall goal of ensuring that the best science and technology are available for emission control strategies and regulatory decision making related to the health and environmental impacts of PM2.5, regional haze, and air toxics. Ohio University, in collaboration with Consol Energy R&D, Advanced Technology Systems, Atmospheric Environmental Research and Argonne National Laboratory is evaluating individual and regional coal-based power plant emissions and transport issues related to mercury associated PM2.5 in the Ohio River Valley Region.

PROJECT OBJECTIVES

Quantitatively evaluate the emission, transport and deposition of mercury, arsenic and fine particulate matter in the Ohio River Valley region. This will include:

- Ambient Monitoring
- Regional-Scale Modeling Analysis
- Develop a web based decision support tool

Anticipated Benefits

Provide critical information for the development of relevant and cost effective control strategies

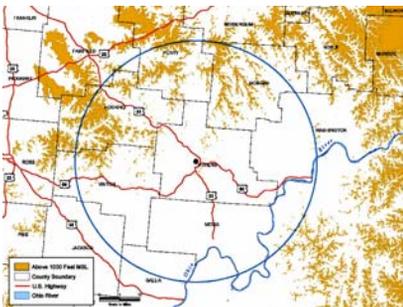
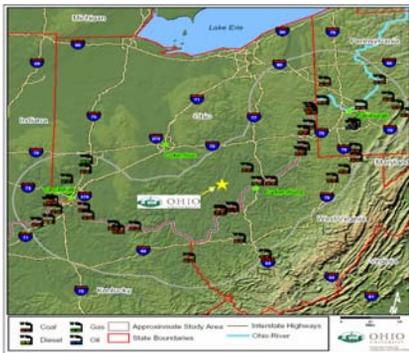
PROJECT TASKS

AMBIENT MONITORING

Objectives

- Measure and evaluate ambient and deposited concentrations of mercury and fine PM
- Validate model simulations
- Provide pre-regulatory data that can be used by the Ohio Valley industries to assess performance on multi-pollutant control systems

Site Location (rural): Ohio University, Athens, Ohio – Center of the Ohio River Valley Coal Fired Power Production



At an elevation of 1000ft the Athens site will capture transport events across the Ohio River Valley

Sampling Program

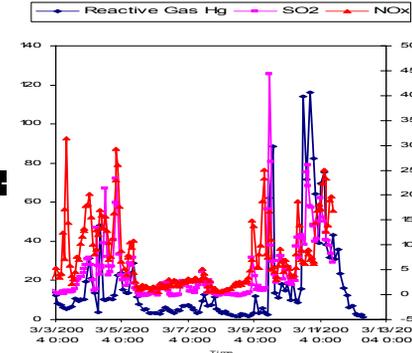
- Continuous sampler for gas and particulate phase Hg
- Filter based measurements: PM2.5
- Wet mercury deposition
- Continuous Samplers for PM2.5, PM10, SO2, CO, NOx and O3

Sampling schedule

- Gases, Tekran, TEOM, and weather to sample continuously or semi-continuously
- Deposition sampling to be conducted on a weekly and event schedule
- 1 in 3 schedule for filter based samplers



RGM, SO2, and NOx..Plume Hit?



Data yet to be validated and quality assured by the team.

CONTINENTAL/REGIONAL SCALE SIMULATIONS

Objectives

- Perform annual, seasonal, episodic simulations for 2004
- Model Evaluation – Comparison of simulated and measured values
- Evaluate the impacts of long range transport from regions outside the Ohio River Valley as well as biospheric recycling
- Series of simulations (matrix analysis) to evaluate the impact of various emissions reduction strategies for the coal-fired power plants in the Ohio River Valley Region



Simulations: Specifics

- Chemical Transport Model: Community Multi-scale Air Quality (CMAQ) model
- Meteorological Fields: MM5
- Emissions processor: SMOKE
- Domain: North America
Grid System Nested (36/12/4 km)
- Emission Inventories
Mercury: AER (Seigneur et al., 2001) Includes power plant emissions from ICR

DEVELOPMENT OF A DECISION SUPPORT TOOL

Series of model runs will be conducted to evaluate the sensitivity of point sources (coal fired power plants) to deposition patterns, for mercury in the region.

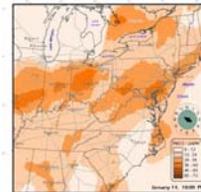
These simulations will be coupled with a GIS/web-based interface to provide a detailed spatial analysis of the source-receptor relationship (Decision Support Tool)



Model Domain
36Km



Nested Grid System
12/4 Km



PM2.5 Data from 1996 shown below in a 36Km Grid System for Eastern United States and Ohio

