

# APPLYING ALTERNATIVE EXPOSURE METRICS IN A MULTIPOLLUTANT EPIDEMIOLOGICAL STUDY

**Halük Özkaynak**, *National Exposure Research Laboratory, U.S. EPA, RTP, North Carolina, USA*

**Vlad Isakov**, *National Exposure Research Laboratory, U.S. EPA, RTP, North Carolina, USA*

**Lisa Baxter**, *National Exposure Research Laboratory, U.S. EPA, RTP, North Carolina, USA*

**Stephen Graham**, *Office of Air Quality Planning and Standards, U.S. EPA, North Carolina, USA*

**Stefanie Sarnat**, *Emory University, Atlanta, Georgia, USA*

**Jeremy Sarnat**, *Emory University, Atlanta, Georgia, USA*

**James Mulholland**, *Georgia Institute of Technology, Atlanta, Georgia, USA*

**Background and Aims:** Epidemiological studies of air pollution have traditionally relied upon surrogates of personal exposures, such as ambient concentration measurements from central-site monitoring stations. This study examines the spatial and temporal variations of alternative measured and modeled exposure metrics for multiple pollutants (i.e., particulate matter, elemental carbon, sulfates, nitrogen oxides, carbon monoxide and ozone), developed and applied within an epidemiological study in a large US metropolitan area.

**Methods:** Several tiers of exposure metrics for ambient traffic-related and regional pollutants were used for predicting health impacts of ambient air quality and population exposures on daily ZIP code level emergency department (ED) visits in Atlanta, GA for the period 1999-2002. The approaches included central site or interpolated monitoring data, regional pollution levels based on measurements or models (CMAQ) and local scale (AERMOD) air quality models, hybrid models, statistically blended modeling and measurement data, concentrations adjusted by home infiltration rates based on LBL algorithms utilizing information on housing stock and meteorology, and the population human exposure (SHEDS and APEX) model predictions.

**Results:** The various exposure metrics were compared in their ability to characterize the spatial and temporal variations of multiple ambient air pollutants across the study area. These metrics were then used to examine associations between ambient air pollution and acute morbidity. The pollutant-specific relative risks (RRs) obtained from epidemiological analyses of the alternative exposure metrics were compared to those obtained from using a conventional approach (i.e., central site data alone). Both pollutant and metric dependent differences were found suggesting a complex exposure prediction error structure among the pollutants studied.

**Conclusions:** Our results suggest the need for case-specific enhancements for future exposure assessments in conjunction with different types of individual or multipollutant air pollution epidemiologic study designs.