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DEVELOPING CHEMICAL SOURCE PROFILES FOR GREATER CAIRO, USING POSITIVE MATRIX FACTORIZATION (PMF) RECEPTOR MODELING

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The purpose of this paper is to demonstrate that Positive Matrix Factorization (PMF) can generate modeled source profiles and calculate source attributions from ambient data sets, where there are limited chemical source profiles available. Gravimetric measurements from the Cairo Air Improvement Project confirmed that the greater Cairo area suffers from extremely high particulate levels, with PM10 and PM2.5 for 2000 often exceeding 100 µg/m3 and 50 µg/m3, respectively. Various receptor models including the Chemical Mass Balance (CMB) and Positive Matrix Factorization (PMF) were applied in order to calculate the source attributions. CMB requires that the measured source compositions be quantitatively represented in the measured ambient samples. This is seldom the case, due to the variability in most source compositions, the aging effect, and secondary reactions amongst gases and particulates in the ambient atmosphere. Chemically analyzed ambient data sets from Cairo were collected at several sites, representing short time intervals during 1999-2002. Major PMF source factors modeled from the Cairo data sets include, motor vehicle emissions, vegetative burning, marine salt, ferro-manganese plant emissions, oil fired power plant, cement plant, secondary ammonium chloride, geological dust, lead smelter, and a copper zinc smelter. Variable amounts of secondary ammonium sulfate and ammonium nitrate are contained in most of the modeled factors. Application of the PMF model was able to identify the major source types and calculate source attributions as well as overcome the issues inherent to the application of the CMB receptor model.