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VOC Source - Receptor Relationships in Houston during TexAQS-II

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During the TexAQS-II field campaign in August and September 2006, $C_2 - C_{10}$ volatile organic compounds (VOC) were measured continuously and online at the urban Moody Tower (MT) site. This data set was compared to corresponding VOC data sets obtained at six sites located in the highly industrialized Houston Ship Channel area (HSC). Receptor modeling was performed by positive matrix factorization (PMF) at all sites. Conditional probability functions were used to determine the origin of the polluted air masses in the Houston area. A subdivision into daytime and nighttime was carried out to discriminate photochemical influences. Eight main source categories of industrial, mobile, and biogenic emissions were identified at the urban receptor site, seven and six, respectively, at the different HSC sites. Amongst these categories, natural gas / crude oil, LPG, and vehicular exhaust contributed most to the total measured VOC mass, followed by fuel evaporation, aromatics, petrochemical sources from ethylene and propylene, and biogenic sources. Based on PMF analyses of different wind sectors, the total VOC mass was estimated to be twofold at MT with wind directions from HSC compared to air from a typical urban sector, for petrochemical compounds more than threefold. Despite the strong impact of air masses influenced by industrial sources at HSC, still a significant fraction of the total mass contributions at MT can be apportioned to other sources, mainly motor vehicles and aromatic solvents. The investigation of diurnal variation in combination with wind directional frequencies revealed the greatest HSC impact at the urban site during the morning, and the least during the evening.