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Vehicular emission of volatile organic compounds (VOCs) from a tunnel study in Hong Kong

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Abstract. Vehicle emissions of volatile organic compounds (VOCs) were determined at the Shing Mun Tunnel, Hong Kong in summer and winter of 2003. One hundred and ten VOCs were quantified in this study. The average concentration of the total measured VOCs at the inlet and outlet of the tunnel were 81 250 pptv and 117 850 pptv, respectively. Among the 110 compounds, ethene, ethyne and toluene were the most abundant species in the tunnel. The total measured VOC emission factors ranged from 67 mg veh^{-1} km^{-1} to 148 mg veh^{-1} km^{-1}, with an average of 115 mg veh^{-1} km^{-1}. The five most abundant VOCs observed in the tunnel were, in decreasing order, ethene, toluene, *n*-butane, propane and *i*-pentane. These five most abundant species contributed over 38% of the total measured VOCs emitted. The high propane and *n*-butane emissions were found to be associated with liquefied petroleum gas (LPG)-fueled taxis. Fair correlations were observed between marker species (ethene, *i*-pentane, *n*-nonane, and benzene, toluene, ethylbenzene and xylenes – BTEX) with fractions of gasoline-fueled or diesel-fueled vehicles. Moreover, ethene, ethyne, and propene are the key species that were abundant in the tunnel but not in gasoline vapors or LPG. The ozone formation potential from the VOCs in Hong Kong was evaluated by the maximum increment reactivity (MIR). It was found to be 568 mg of ozone per vehicle per kilometer traveled. Among them, ethene, propene and toluene contribute most to the ozone-formation reactivity.

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