Resolution of Local and Regional Sources Using Near Road and Background Measurement Sites

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The assessment by the World Health Organization (WHO) International Agency for Research on Cancer (IARC) in 2013 concluded that outdoor air pollution is carcinogenic to humans, with the particulate matter component of air pollution most closely associated with increased cancer incidence, especially lung cancer. The near-road air monitoring network in Toronto was established prior to the 2015 Pan Am& Parapan Am Games to study traffic-related air pollution in urban communities. The near-road monitoring study was conducted at two near-road sites and an urban background site in Toronto, with a view towards creating additional near-road monitoring stations across Canada. Two near-road stations were located within 10 m and 15 m of Highway 401 (Highway) and an arterial roadway in Downtown Toronto (Downtown), respectively, while the urban background site was located on Toronto Island. Air pollutants measured included ozone, nitrogen oxides, fine particulate matter ($PM_{2.5}$), black carbon, heavy metals, organics, inorganic ions, ultrafine particles, etc. Black carbon was also monitored at additional near-road and background sites across southern Ontario and regional levels of ozone were also measured at 444 meters above the ground on the CN Tower.

This presentation will provide three examples that illustrate how a combination of near-road and background measurements can be used to examine the contributions of local and regional sources. These measurements will be used to:

- Identify and resolve local and regional $PM_{2.5}$ sources based on hourly metals, organics, inorganic ions, and black carbon measurements.
- Resolve the extent to which fossil fuels and biomass burning contribute to local and regional contributions of black carbon.
- Evaluate the influence of local pollutants on regional ozone levels by comparing ozone and nitrogen oxides concentrations on the ground level and the CN Tower.

The overall concentration of trace metals in $PM_{2.5}$ at the highway near-road site was considerably higher than the level at the downtown near-road site by a factor of 3. Regional scale $PM_{2.5}$ was found to be a major source (>60%) at both locations, with high similarity observed in the temporal variation at both sites. The traffic source accounted for 14% and 30% of the total $PM_{2.5}$ mass at the Downtown and Highway sites, respectively, with a strong spatial heterogeneity between the two sites.