European Commission

Science for Environment Policy

Cyclists map Antwerp air pollution with on-bike monitors

18 September 2014
Issue 356

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Source: Peters, J., Van den Bossche, J., Reggente, M., *et al*. (2014) Cyclist exposure to UFP and BC on urban routes in Antwerp, Belgium. *Atmospheric Environment*. 92: 31-43. DOI: 10.1016/j.atmosenv.2014.03.039.

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Cyclists with pollution monitors and GPS trackers attached to their bicycles have produced detailed maps of Antwerp's air quality, as part of a recent study. Their data show that a gap of just a few metres between cycle lanes and cars significantly reduces cyclists' risk of inhaling high levels of ultrafine particle pollution.

Personal 'mobile monitoring' is attracting increasing attention as a way of understanding how much air pollution we are exposed to, and to help evaluate its risk. Small monitors attached to a person are a promising low-cost technology, which show how pollution levels for an individual vary with precise location and time. They therefore offer a higher resolution picture of air pollution exposure than provided by conventional static monitors which are dotted around urban centres.

The researchers equipped cyclists in Antwerp, Belgium, with the special monitoring bicycles and sent them on two fixed routes around the city centre. The first route was 2 km long, the second was 5 km, and they went through both low- and high-traffic areas. They were ridden a total of 354 times over 11 days, with the rides taking place between 07:00 and 13:00 each day.

The study, which received some funding through the EU EveryAware project, focused on two pollutants: ultrafine particles (particles with a diameter of less than 0.1 micrometres) and black carbon. Both are emitted by traffic and both have been linked with health issues, including breathing and heart problems.

The data revealed how pollution levels can vary within a single street. For instance, ultrafine particle concentrations rose from around 50 000 particles per cm^3 (pt/cm^3) to 80 000 pt/cm^3 on one section of a busy street because of a short tunnel. Black carbon concentrations shot up from 3 micrograms per m^3 (µg/m^3) to 17 µg/m^3 in the tunnel, compared with a section of the street next to a green space.

A cycle lane on the same street varied in its distance from the traffic, and hence also influenced cyclists' exposure to the traffic. One section of the cycle lane, which was 2 m away from the driving lane, exposed cyclists to 50 000-80 000 pt/cm^3 of ultrafine particles. However, a separate section, 5 m from the traffic, reduced exposure to 30 000-50-000 pt/cm^3.

The mere presence of cycle lanes made a difference. Generally, streets without cycle lanes, which lead cyclists to ride behind vehicles, increased exposure compared with streets that did have lanes.

Average ultrafine particle levels varied between 20 000-46 000 pt/cm^3 along the streets ridden. Black carbon levels ranged from an average of 3.2 µg /m^3, to 9.7 µg /m^3. As would be expected, the highest levels of pollution were on streets with the most traffic and during the rush hour in the morning. High levels of pollution were also recorded in streets with tall buildings on either side ("street canyons") where pollution is trapped.

The mobile monitoring method not only provides a detailed picture of pollution, but can also be used to inform plans for new cycle lanes and routes which avoid pollution hotspots, the researchers propose.

1.EveryAware (Enhance Environmental Awareness through Social Information Technology) was supported by the European Commission under the Seventh Framework Programme. See: www.everyaware.eu