

Science for Environment Policy

Airborne polycyclic aromatic hydrocarbon levels falling faster in cities than rural areas

Levels of airborne polycyclic aromatic hydrocarbons (PAHs) are falling at urban and rural sites in Europe and North America, according to recent research. These results contribute to growing evidence demonstrating that the legislation to reduce these harmful emissions has been successful. Concentrations of PAHs in urban areas were highest, the researchers found, but they were also declining at the fastest rate.

PAHs are air pollutants emitted from human activities, such as burning fossil and biomass fuels and agricultural waste. They are of particular concern because they are known to have **toxic effects** and some may damage DNA, causing cancer.

As part of two ongoing air-monitoring activities, the **EMEP**¹ under the Convention on Long Range Transboundary Air pollution and the US **IADN** project, researchers collected PAH samples from three European sites: Košetice (Czech Republic), Aspvreten (Sweden) and Spitsbergen (Norway), and from five sites in North America around the Great Lakes: Chicago, Cleveland, Sturgeon Point, Sleeping Bear Dune, and Eagle Harbor. These sites range from remote (Aspvreten, Spitsbergen, Eagle Harbor and Sleeping Bear Dunes) to rural (Sturgeon Point and Košetice) to urban (Chicago and Cleveland).

The researchers analysed the air samples taken between 1996 and 2010 for nine PAHs which persist in the atmosphere over long periods. From this, they obtained a picture of differences in their distribution across the sites and their occurrence over time.

Four PAHs (benz[*a*]anthracene, benzo[*a*]pyrene, indeno[1,2,3-*cd*]pyrene and benzo[*ghi*]perylene) were detected at all nine sites. The sum of their combined concentrations varied between 90 picograms per cubic metre (pg/m³) in Sleeping Bear Dunes, 1 500 pg/m³ in Košetice, with the highest in Chicago (2400 pg/m³). PAH concentrations from the urban sites in Chicago and Cleveland were 5-170 times higher (20 times on average) than those in rural sites in Europe and North America, depending on the individual PAH and location.

The relatively high concentrations detected at Košetice were surprising, especially as levels were approximately three times higher than at another rural site, Sturgeon Point, and both locations have a similar population of around 70 000 people living near the sampling site.

There could be two reasons for this, say the researchers. The first is differences in the types of fuel used by the local populations. Inhabitants of Sturgeon Point typically use natural gas and petrol, whereas people living in Košetice predominantly use coal and wood, which release more PAHs. Secondly, people are spread out on separate farms around Sturgeon Point, whereas in areas such as Košetice people live in clustered villages, often close together.

Although the concentrations of PAHs varied considerably between different sites, overall the researchers found an encouraging trend of decreasing levels. PAH concentrations in the more urban areas, which were the highest, were declining at the fastest rate. For example, PAH concentrations typically halved every six years in Chicago and every eight and a half years in Cleveland. However, in Košetice, concentrations halved every 17 years and every 16 years in Spitsbergen.

The number of monitoring sites was limited; however, these results, alongside previous research, show that legislation in Europe and North America to reduce PAH emissions has been effective.



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