# Traffic found to be a major source of atmospheric nanocluster aerosols

July 4 2017, by Bob Yirka

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(Phys.org)—A team of researchers affiliated with several institutions in Finland has found that automobile traffic can be a major source of atmospheric nanocluster aerosols. In their paper published in *Proceedings* *of the National Academy of Sciences*, the group describes how they obtained air samples from several locations in Helsinki and elsewhere and looked for extremely small traffic-originated nanocluster aerosol (NCA) particles and what they found by doing so.

Most everyone knows that automobiles emit pollution, which consists of particles like soot and gasses such as carbon dioxide and carbon monoxide. The result in congested areas is dirty air, which besides being unsightly, is also harmful to health. But as the researchers with this new effort note, less is known about the extremely tiny particles that are also emitted into the air from cars and trucks.

To learn more about such tiny particles, the researchers collected air samples near roadways under various conditions in Helsinki and other spots throughout Europe. They then tested the air samples for both the tiny particles and the nanoclusters that are formed when they combine with other particles. Tiny particles in the air, they note, as well as nanoclusters, come from a variety of sources, not just traffic. They can be emitted by factories, and in many cases, from natural sources such as plants. To separate other sources from those created by traffic, the researchers compared air samples from the same places when the wind was blowing in different directions.

In looking at their data, the researchers report that they found a significant amount of NCA particles with a diameter range of 1.3 to 3.0 nm in urban air near heavily trafficked areas. They also found that a significant portion of the particles were a direct result of traffic, as opposed to other industrial or natural emissions. To show this was the case, they offer statistics such as finding that approximately 20 to 54 percent of NCA particles in a semi-urban roadside site came from traffic emissions.

The researchers note tiny particles are more difficult to study because of their short-lived nature—they bind to other particles and often wind up as part of water droplet formation in the atmosphere. They further note that the smaller the particles, the easier it is for them to make their way deeper into lung passages, causing unknown health problems.

**More information:** Topi Rönkkö et al. Traffic is a major source of atmospheric nanocluster aerosol, *Proceedings of the National Academy of Sciences* (2017). DOI: 10.1073/pnas.1700830114

Abstract
In densely populated areas, traffic is a significant source of atmospheric aerosol particles. Owing to their small size and complicated chemical and physical characteristics, atmospheric particles resulting from traffic emissions pose a significant risk to human health and also contribute to anthropogenic forcing of climate. Previous research has established that vehicles directly emit primary aerosol particles and also contribute to secondary aerosol particle formation by emitting aerosol precursors. Here, we extend the urban atmospheric aerosol characterization to cover nanocluster aerosol (NCA) particles and show that a major fraction of particles emitted by road transportation are in a previously unmeasured size range of 1.3–3.0 nm. For instance, in a semiurban roadside environment, the NCA represented 20–54% of the total particle concentration in ambient air. The observed NCA concentrations varied significantly depending on the traffic rate and wind direction. The emission factors of NCA for traffic were $2.4\cdot10^{15}$ (kgfuel)−1 in a roadside environment, $2.6\cdot10^{15}$ (kgfuel)−1 in a street canyon, and $2.9\cdot10^{15}$ (kgfuel)$^{-1}$ in an on-road study throughout Europe. Interestingly, these emissions were not associated with all vehicles. In engine laboratory experiments, the emission factor of exhaust NCA varied from a relatively low value of $1.6\cdot10^{12}$ (kgfuel)−1 to a high value of $4.3\cdot10^{15}$ (kgfuel)$^{-1}$. These NCA emissions directly affect particle concentrations and human exposure to nanosized aerosol in urban areas, and potentially may act as nanosized condensation nuclei for the condensation of

atmospheric low-volatile organic compounds.



Citation: Traffic found to be a major source of atmospheric nanocluster aerosols (2017, July 4) retrieved 18 April 2024 from
https://phys.org/news/2017-07-traffic-major-source-atmospheric-nanocluster.html