Smog: It's Not All Cars' Fault

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Hazy days. Smog hovers over the University of California, Riverside, campus.

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Faced with some of the world's worst smog, China banned half of Beijing's cars from the city's center in advance of this summer's Olympics. Indeed, when most of us see hazy skies, we think tailpipes. But a new study reveals that cars are a smaller part of the problem than previously thought: Vapors from paint, fumes from outdoor barbecues, and even the fresh scent emitted by trees may contribute to the majority of urban air pollution. And that means regulatory agencies, such as the U.S. Environmental Protection Agency (EPA), may need to rethink how they regulate the skies.

Particulate pollution, a major ingredient of hazy skies, has been linked to higher death rates from asthma, heart disease, and other ailments. Some of these fine particles--suspended in air as primary organic aerosols--are tiny flecks rich in carbon, often from sources such as diesel exhaust. But not all air pollution starts out as soot. Secondary aerosols begin life as gases and chemically react in the atmosphere to form particles. Yet scientists don't know how big of a role these secondary aerosols play in smog.

Suspecting that secondary aerosols are a major contributor to air pollution, Kenneth Docherty, an atmospheric chemist at the University of Colorado, Boulder, and colleagues filtered particles from the air in Riverside, California, a city east of the Los Angeles air basin known for its haze. To distinguish between primary and secondary aerosols, the scientists used techniques such as mass spectrometry to determine the amount of elemental carbon, water-soluble carbon, and carbon monoxide in the particles. Aerosols first emitted as particles are rich in carbon, and secondary aerosols are chock-full of oxygen, says Jose-Luis Jimenez, an atmospheric scientist at the University of Colorado, Boulder, who was also involved in the study.

Five different tests revealed that between 70% and 90% of the particulate matter above the city started out as chemically reactive gas--i.e., secondary aerosols--the team will report in the 15 October issue of *Environmental Science and Technology*. Research in Mexico City suggested that secondary aerosols made up two-thirds of particulate pollution, but earlier studies in Los Angeles showed the reverse, Jimenez says. If the new findings are true, that's a problem, says Joost de Gouw, an atmospheric chemist at the National Oceanic and Atmospheric Administration in Boulder who was not involved in the study. EPA primarily curbs particulate air pollution by limiting primary aerosol emissions from diesel exhaust, he notes, so "controlling particles may not be sufficient. ... You may have to control the precursor gases."

But researchers need to understand exactly where these secondary aerosols are coming from before they can suggest ways to reduce them, says de Gouw. Although diesel exhaust may be a source of secondary aerosols, paint and solvents, outdoor barbecues, and vegetation also contribute significantly, he says. A follow-up study will try to identify--and quantify--the sources of these secondary aerosols, says Jimenez.

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