HEALTH & SCIENCE

Airborne soot more harmful than thought

By Don Hopey
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The tiniest bits of airborne soot from vehicle exhaust, power plants and industries have the potential to affect global climate and take a much bigger toll on human health than previously thought, according to a new study by researchers at Carnegie Mellon University.

Published last week in the journal Science, their findings show that the microscopic particles, altered by chemical processes in the atmosphere, produce more clouds and are potentially more toxic, and their contributions to unhealthy pollution are larger and spread over a wider area.

The research by professors Allen Robinson and Neil Donahue raises questions about the effectiveness of federal particle regulations that were just tightened in September and concludes that the government needs new ways of measuring and regulating smoke and soot.

"One of our key findings is that this chemical processing leads to more particulate matter in the air, meaning that regulators are likely underestimating how sources such as cars and trucks contribute to pollution," said Dr. Robinson, an associate professor of mechanical engineering and engineering and public policy. "We need to take a holistic approach to regulating these sources that account for all emissions."

He said the government's pollution models overestimate direct emissions from diesel trucks, cars and power plants, but fail to accurately account for the more toxic particulates formed aloft. The Carnegie Mellon research shows that the chemical production of particles in the atmosphere also leads to a spreading of pollution over a wider geographic area.

"We're seeing that urban pollution doesn't stay contained in the cities, but impacts rural and other downwind areas, creating even more complicated issues for regulators," Dr. Robinson said.

Airborne particles or soot have long been the least understood components of the global climate system, but ones that pose a serious health risk because they are breathed deep into the lungs.

Approximately 20,000 Americans die prematurely each year because of particle exposure — primarily from heart disease — and almost 70 million live in areas that violate the federal limits.

Each year, soot also causes nearly 300,000 asthma attacks and 2 million lost workdays due to respiratory ailments.

The U.S. Environmental Protection Agency estimates that each ton of soot boosts health costs by $100,000 annually.

The fine airborne particles also play a big role in climate change, the research shows, by forming droplets in clouds that affect how much sun is able to pass through and the amount of moisture that is returned to the planet's surface. That strong influence on cloud formation can alter the global climate.

"The more we understand particulate matter, the more we realize that complexity has been masking our ability to calculate how big a role greenhouse gases have played in inducing global warming," said Dr. Donahue, an associate professor of chemical engineering and chemistry.

"Moreover, the new mechanism we found changes the chemical properties of particles, making them more likely to participate in cloud formation. Therefore, particulate matter may be having a stronger influence on global climate than previously thought."

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