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NEW FOCUS FOR CONTROLLING URBAN OZONE? EMPHASIS ON RESTRICTING NITROGEN OXIDES MAY BE NEEDED TO REDUCE OZONE IN CITIES

Successful control of ground-level ozone pollution in U.S. cities will likely require a new emphasis on restricting the gaseous emissions of nitrogen oxides. Nitrogen oxides react with hydrocarbons in the presence of sunlight to form ozone pollution in the atmosphere.

Current strategies for controlling this pollution in the United States focus on limiting the hydrocarbons generated by man-made sources. New data indicate that these control efforts have been rendered largely ineffective by the presence of highly-reactive hydrocarbon compounds produced by natural sources such as trees.

Analysis of atmospheric chemistry in urban, rural, tropical and unpolluted marine environments has found that elevated concentrations of ozone are associated with high levels of nitrogen oxides, said Dr. William Chameides, director of the School of Earth and Atmospheric Sciences at the Georgia Institute of Technology. That means the chemical process which produces ozone may be better controlled by reducing the amount of nitrogen oxides present in the atmosphere rather than by attempting to limit the hydrocarbons, he suggests.

"Whenever you go into an environment with high levels of ozone, you will also find high concentrations of nitrogen oxides (NOx)," Chameides explained. "On the other hand, we can find many environments with hydrocarbon concentrations as high as those of Los Angeles where we don't see high ozone concentrations. The reason for that difference is the level of NOx."

Efforts to control ozone in U.S. cities should therefore be changed to focus on controlling nitrogen oxides, Chameides believes. His comments were part of a session on "Urban and Regional Ozone" at the annual meeting of the American Association for the Advancement of Science (AAAS) February 13 in Boston.

Ozone forms in the atmosphere through a chemical reaction between nitrogen oxides and hydrocarbon compounds in the presence of sunlight. There are many different sources for the two types of compounds, but both types must be present before ozone can be created.

In formulating ozone control strategies, scientists once believed they could ignore the presence of naturally-produced hydrocarbons because these biogenic compounds account for only a few percent of the hydrocarbons measured in a typical urban area.

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But laboratory studies of the biogenic compounds have since shown them to be much more reactive than their man-made (anthropogenic) cousins -- so reactive that they actually account for more than 30 percent of the ozone-forming chemical reactions in some urban areas.

That means, argues Chameides, that even if all man-made hydrocarbons could be eliminated through tough air pollution controls, enough of the biogenic compounds would remain to carry out the reaction which forms ozone.

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>
> ***- Dr. William Chameides***

Even in Los Angeles, not known for extensive tracts of forested lands, biogenic compounds account for 30 percent of the hydrocarbon reactivity. In more sylvan cities like Atlanta, the natural compounds account for an even higher percentage of the hydrocarbon reactivity, Chameides said.

In rural areas, the biogenic compounds account for a majority of the hydrocarbon reactivity measured. But because the rural areas do not have as high concentrations of nitrogen oxides as cities, their summertime ozone levels are lower.

The research studied actual air chemistry measurements in urban areas such Atlanta, Los Angeles, Detroit, Columbus and Baton Rouge; rural areas in Georgia and Pennsylvania; tropical rain forests in Brazil, and "pristine" environments in the Atlantic and Pacific Oceans.

"The total hydrocarbon reactivity measured in all four areas is essentially the same. However, the NOx concentrations increased by several orders of magnitude from the tropical and marine environments to the urban areas," he explained. "This suggests that what is causing the ozone to be increasingly higher is not an increase in hydrocarbons, but the increase in nitrogen oxides."

Chameides argues that the current strategy, which costs an estimated $30 billion a year to implement, now needs revision.

"We have the technology to reduce NOx levels, and we could change our patterns of fuel burning," he said. "It does not make any sense in my mind to keep trying to control hydrocarbons."

Both hydrocarbons and nitrogen oxides are formed by the burning of fuel in automobiles. Fossil-fuel burning facilities like powerplants also produce nitrogen oxides.

In addition to causing human health problems, ozone pollution stunts the growth of plants -- including agricultural crops grown for food. Chameides warns that as urban areas grow with the world's expanding population, ozone pollution could threaten the world's ability to produce enough food.

"Where we grow our food most intensely is where we have our highest NOx concentrations, because this is where we are supporting the urban-industrial population," he said. "That problem is likely to get worse."

Chameides and other members of the AAAS session served on a National Research Council (NRC) panel which reported on the ozone problem last spring. Many of the findings presented by Chameides at the AAAS meeting were contained in a paper published April 20, 1992 in the Journal of Geophysical Research.

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