NRC Faults Science Behind Ozone Regs

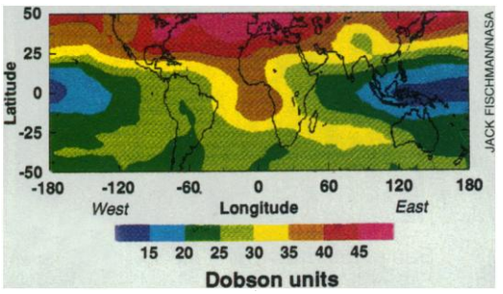
Emissions of one ozone precursor have been underestimated; a "fundamental change" in controls may be needed

TWENTY YEARS OF REGULATION AIMED AT reducing the most harmful component of smog—tropospheric ozone—have been based on inadequate measurements and are focused too strongly on one pollutant, says a report released last month by the National Research Council (NRC). As a result, it's perhaps no surprise that ozone levels have been rising: According to the Environmental Protection Agency (EPA), about 67 million people are now routinely exposed to ozone concentrations that exceed standards set under the Clean Air Act.

At the heart of the problem, says the report, is the fact that emissions of one of the precursors of ozone, a class of compounds called volatile organic chemicals (VOCs), have been chronically underestimated. The implication is that regulations designed to control the release of VOCs from sources such as automobile exhausts, chemical plants, and petroleum refineries have been less effective than anticipated, and despite billions of dollars worth of pollution control measures, a "fundamental change" in U.S. ozone reduction strategy might be necessary. Moreover, the report faults the statistical calculations that researchers and regulators use to predict changes in ozone levels, arguing that these measurements are prone to periodic weather fluctuations that might mask long-term ozone trends.

Ozone, a double-edged sword, both protects and degrades human health. Not to be confused with the steadily disappearing stratospheric ozone, which absorbs ultraviolet radiation and in doing so prevents thousands of cases of skin cancer every year, Earth-hugging tropospheric ozone attacks the lungs and erodes gas exchange. The two ozones arise from completely different processes, says Charles E. Kolb Jr., a physical chemist at Massachusetts-based Aerodyne Research Inc. The NRC report calls for a national research program for tropospheric ozone similar to one already in place for stratospheric ozone.

Tropospheric ozone forms when sunlight catalyzes a reaction between VOCs and either nitric oxide or nitrogen dioxide, two gases spewed into the atmosphere by cars and power plants during the combustion of fossil fuels that together are known as NO_x. For years, ozone policy makers shied away from putting stringent caps on NO_x emissions because of the difficulty of reducing NO_x releases and because under some conditions, nitric oxide can actually decrease ozone levels when it combines with ozone to form more benign compounds, says Richard Scheffe, an environmental engineer and ozone policy maker at EPA. However, the report says that because VOC emissions have been underestimated, there is a high ratio of VOCs to NO_x in some areas. In such regions, the report concludes, it may be better to concentrate on the less abundant pollutant to prevent the formation of ozone. "The control of NO_x emissions will probably be necessary in addition to, or instead of, the control of VOCs," the report says.



Elevated ozone. *Tropospheric ozone levels during July and August 1979-1989. Data from the Nimbus 7 satellite show that the northern latitudes fare worst during the summer months.*

Tighter NO_x controls aren't news to the EPA, says Scheffe. Research findings in the past few years have already forced tighter NO_x controls in the form of amendments to the Clean Air Act of 1990 that call for cutting utility emissions of NO_x and tightening NO_x tailpipe standards. The EPA is still working out the cost of recently implemented NO_x controls such as better stack gas scrubbers and proposed improvements in combustion technology such as changes in engine air flow and fuel mixtures, says Scheffe.

The EPA-commissioned report comes down hard on the agency for its failure to develop accurate methods for measuring VOCs. "Ozone problems persist in part because regulatory agencies have not been monitoring the precursors of ozone adequately to establish the validity of their own emissions inventories," says John H. Seinfeld, a Caltech chemical engineer who chaired the 15-member NRC committee that wrote the report. Emissions inventories underestimate airborne VOCs by two or three times, says chemist Barbara J. Finlayson-Pitts of California State University at Fullerton. Scheffe admits that "there probably wasn't a focus on putting resources into developing VOC inventories that there should have been." But, he counters, because of the high degree of uncertainty in any measurement of ephemeral ozone precursors, "we're not convinced the measurements are off as much as the academy purports them to be."

"Nobody really knows" why the amount of airborne VOCs, especially those produced by moving sources such as automobiles, are frequently misjudged, Finlayson-Pitts says. "The problem is there are so many hydrocarbons out there it's been hard to keep track of them," she says. One source of VOCs ignored until recently are those produced by trees and other vegetation, says William L. Chameides, a geophysicist at the Georgia Institute of Technology who served on the NRC panel. Biogenic VOCs such as isoprene are an important ozone precursor not only in the rural United States, but also in heavily wooded cities such as Atlanta and regions such as the Northeast, he says. "I don't know if you can make a blanket statement saying biogenic VOCs contribute X amount of ozone, but...even in Los Angeles, isoprene constitutes a large fraction of the hydrocarbons that can lead to the formation of ozone in the presence of NO_x," Chameides says. In regions with high concentrations of biogenic VOCs, adds Seinfeld, controlling NO_x may be crucial.

"The EPA needs to embrace this report," says Terry Yosie, a vice president of the American Petroleum Institute (API), which along with the EPA, the Department of Energy, and the Motor Vehicle Manufacturing Association funded the report. Yosie, whose organization has a financial stake in ozone precursor emission controls, contends that it will take "a lot of push from a lot of people" to get the EPA to undertake the fundamental reexamination of ozone policy that's called for in the NRC report. In a statement, the EPA defended its ozone policy and said the agency disagrees "with those who misuse the report to suggest that we do not know enough to proceed with the nation's ozone control effort." But after two decades of zero progress in reducing tropospheric ozone, all that can be seen on the horizon is the noxious brown streak of smog that keeps on growing. ■ RICHARD STONE