Policy Forum

Ozone Pollution: The Hard Choices

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Ozone, the major component of photochemical smog, is arguably the most politically and economically intractable environmental problem facing the nation. With succeeding attainment deadlines passed and some 68 areas out of compliance, Congress, in reauthorizing the Clean Air Act (CAA), must now decide: (i) to impose Draconian measures to possibly attain the standard everywhere by early in the next century; (ii) to strike a compromise that, although imposing unprecedented cost and disruption, still leaves some areas above the standard into the more distant future, maybe forever; or (iii) in my view the wisest course, to conclude that more information and a broader public debate about a fundamentally different approach are needed before the nation sets its course.

Tropospheric ozone is formed when reactive hydrocarbons are mixed with nitrogen oxides in the presence of sunlight. The atmospheric chemistry is complex, and requires much further study that could lead to new control approaches. The prevailing opinion has been, however, that usually and in most locations the reaction is hydrocarbon-limited, and hydrocarbon emissions are the focus of controls. Hydrocarbon sources are all but ubiquitous. Some are from natural processes that may contribute as background one-fourth or more of the allowed ozone level. As to anthropogenic sources, industrial processes, solvents, paints, dry cleaning fluids, and inks are an important group. Consumer products ranging from aerosol propellants to household cleaners are another. The private automobile is a major contributor; it is dominant in some locations.

The role played by sunlight and heat means that ozone formation is limited to the daylight hours, and concentrations of concern occur only during summer. Peaks are observed in the afternoon after a series of hot, sunny, windless days. Basin topography, such as in Los Angeles, concentrates the pollutant. As a further complication, ozone and its precursors imported from up-wind locations can be superimposed upon those that are locally produced, and because this source is out of phase, it can yield plateaus of elevated ozone.

Negative effects of ozone are well documented. Short-term exposure to elevated levels increases the probability of pulmonary irritation, the primary basis of the current 1-hour standard. There is mounting evidence of chronic effects from longer term or recurring exposures at or below levels of acute concern. Human exposure, though, is limited to time out of doors because structures protect occupants. Ozone also lowers crop yields, retards tree growth, damages ornamental plants and shrubs, and may increase susceptibility to acid rain and insect damage. It damages materials such as rubber, some plastics and dyes, and paints. Smog also lowers visibility.

Under the CAA, the federal government determines the national standard and the states are required to enact regulations to attain it in each air quality region. Noncompliance is defined to exist when, during a 3-year running period, the standard is exceeded for 1 hour, more than 3 days, at one monitor in the air quality region. At one extreme, areas out of compliance may violate the standard only slightly at one monitor, and then only for a few hours; at the other extreme, southern California experiences peaks up to three times the standard, and violates it at least 1 hour about two-fifths of the days.

To achieve hydrocarbon reductions sufficient to avoid violations in a seriously affected area such as southern California would involve a broad, intense, assault. To one degree or another, consumer products would have to be reformulated or banned; industries such as refining and petrochemicals (that, even when tightly controlled, emit substantial hydrocarbons) would have to be relocated elsewhere; dispersed businesses such as auto refinishing, dry cleaning, printing, and baking would have to install substantial (sometimes not yet available) new controls or disappear; and contributions from transportation would have to be cut drastically. Realistically, a few regions would not achieve such reductions with current (much less growing) populations even after extensive economic, transportation, and life-style changes.

The question of which of these actions makes sense—how far to go in controlling ozone—is absent from the current debate. The CAA reflects the view that freedom from harmful air pollution is a fundamental right the federal government must provide to all its citizens. Yet, there is another way of looking at the matter, and that is in terms of how much to accommodate *each* of the values government fosters when it is impossible to achieve *all* (or any completely). This approach suggests that the actions to reduce ozone must pass a balancing test. To perform that test requires some understanding of the benefits derived from different levels of control so they can be compared (if only roughly) to what is sacrificed, with both benefits and sacrifices conceived and evaluated as broadly as possible. Again, the approach of the CAA has made such understanding, and the research to inform it, irrelevant.

The task of controlling ozone is far more difficult, and the science behind controls less well understood, than was thought when the CAA was passed and amended. For those and more fundamental reasons, it is time to rethink the current approach, addressing at least three intertwined policy issues. The first is the basis on which the standard is set. The second is the way it is applied across geographic areas. The third is who is to decide.

There should be a separation between finding an effect and deciding what to do about it. Some effects are more serious than others, and affect more people, but the way the CAA is now written it is almost as if a cancer were equivalent to a cold, one expected case of cancer were indistinguishable from an epidemic, and as much social disruption, other risk, and economic cost should be imposed to avoid the one as to avoid the other. Explicit flexibility is needed to discriminate among adverse health and environmental effects and to allow the broader ramifications of different stringencies of standards to be taken into account.

Further, a single ozone limit may not make practical sense in a country as diverse as this. A federally determined range is an alternative. On one end would be the ultimate goal, a level that protected against all adverse effects. At the other would be a level that met the country's considered judgment of a degree of risk beyond which no one should be exposed involuntarily. In terms of its design, a standard that took into account the number of times a year a level is exceeded, for what duration, and by how much, could be more protective, and at lower social cost, than any standard that only considered peak levels.

As to implementation, at the "unacceptable risk" end of the spectrum, stringent efforts should be demanded, with their specific

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design left to the affected regions (and those from which the problem is imported) who can choose the fairest, most efficient actions. Firm, tight schedules, backed up by specific checkpoints with effective federal sanctions, are needed to meet the national interest in assuring basic protection for all citizens.

With regard to the other regions, each will certainly want to move toward achieving better air, but may find itself trapped between reducing ozone and sacrificing other values, including meeting other environmental needs, that its citizens also hold dear. Where to draw the line on a specific type of pollution is not an easy decision, obviously, but it is one those most affected can reasonably be expected to make, and one they can reasonably expect others to honor.

The current debate on ozone is incomplete. There is little public discussion of the actual number of people who are at risk, to what health effects, of what level of concern, for what number of hours per year. There is little attention to the scientific and technical research needed to target controls to do the most good. There is less discussion of alternative uses of some of the direct national resource expenditure of $100 to $150 billion by the year 2000, and over $20 billion per year thereafter, that would be imposed by legislation now under consideration. Much less is there consideration of balancing the personal, regional, and national sacrifices that would be entailed against what would be gained.

More generally, the rhetoric of a United States free of environmental risk is coming up against scientific progress that is able to discover smaller and smaller levels of contamination. At the same time, doing something about the risks imposed by these pollutants is now understood to have broader consequences than before. Too, the demands for other government services (including dealing with other pressing environmental problems) are growing, and the limits on the resources available to meet them are more clear. In this context, a full debate on ozone could serve as a proxy for some of the value conflicts that cannot be long avoided in environmental protection as a whole.

NOTE

1. This essay was drawn from work reported in M. Russell, *Tropospheric Ozone and Vehicular Emissions* (Report ORNL/TM 10908, Oak Ridge National Laboratory, Knoxville, TN, 1988) and *Ozone Pollution: The Hard Choices* (Report ORNL/TM 10909, Oak Ridge National Laboratory, Knoxville, TN, 1988).