

Elevated ozone levels have been associated with observed increases of hospital admissions for respiratory diseases such as asthma and decreased lung function of children attending summer camp. It is estimated that ozone damage to crops, forests, natural systems and synthetic materials is significant and exceeds \$2 billion per year lost to crops alone. Ozone is not directly emitted into the air, but instead is formed in the atmosphere from reactions of "precursor" pollutants in the presence of sunlight and warm conditions. The major ozone precursor emissions are oxides of nitrogen (NO_x) and volatile organic compounds (VOC).

In the last 25 years great progress has been made toward achieving healthy air quality under the Act. However, over 100 million people still live in areas that do not meet the ozone health standard. Continued reductions in ozone precursor emissions are important to protect public health, and represent a tremendous challenge for our nation's citizens and industries.

The 1990 Amendments to the Act established new deadlines for meeting the health standard for ozone and substantially increased EPA, State and industry attainment efforts. All areas that have not yet attained and maintained the ozone standard are categorized as marginal, moderate, serious, severe, or extreme areas. Each category has a compliance deadline, ranging from 3 years (for marginal areas) to 20 years (for extreme areas; e.g., Los Angeles). All such areas have requirements for reasonably available control technology (RACT) for major stationary sources of VOC and NO_x and with the exception of marginal areas have defined rates of progress (ROP) for reducing ozone precursor emissions.

The smog reduction programs in the U.S. are typically based on traditional forms of environmental regulation: source-specific emissions standards (e.g., RACT) set on a uniform basis for categories of similar sources. Even though set as performance standards, these regulations have a tendency to treat all sources within a category the same and to be oriented toward the lowest common denominator, that is, toward sources within the class that have the greatest difficulty and/or greatest cost of control. Such standards simultaneously miss substantial opportunities for cheap emissions controls by "better" sources, and impose a disproportionately high cost (per ton of pollutant reduced) on a smaller group of sources. Government frequently lacks information on untapped but cost-effective control options, and sources have no incentive

to be forthcoming. Government also tends to overlook smaller or unconventional sources.

Recognizing some of these problems in traditional regulations, EPA has developed policies permitting an increasing variety of "emissions trading" approaches since the late 1970's. The EPA "bubble," "netting," and "offset" programs allow certain kinds of trading of emissions reduction obligations within the pre-existing regulatory structure. These programs use the existing command and control regulations as a baseline for trading.

The results of these existing programs have been mixed. Overall, the volume of existing source trading has been small, perhaps due to high transaction costs associated with the bubble policies. New sources have found it possible through netting to avoid both time- and resource-consuming Government review processes. Bubbles, netting and offsets have reduced sources' overall compliance costs. However, there have been significant problems of quality control, reducing the environmental effectiveness of the programs.

A. Emerging Market-Based Approaches for Ozone Control

The 1990 Act Amendments recognized the merit of market-based solutions to pollution control. The Amendments introduced a market-based allowance trading system for sulfur dioxide to control acid rain. The Amendments also included a requirement, in certain cases, for economic incentive programs (EIP's) to be used as part of States' plans to meet the ozone and carbon monoxide standards in designated nonattainment areas. In 1994, EPA issued the EIP rule, which provided rules and guidance for establishing EIP's. Two market-based approaches have emerged that show particular promise for EIP's or other ozone related trading systems: emissions budget programs and, more recently, the open market approach.

1. Emissions Budgets: ("Cap and Trade")

Emissions budget programs have been highly successful where they have been implemented to date and offer the potential for high integrity achievement of environmental goals and considerable cost savings. Emissions budgets programs are predictable, flexible, offer low transaction costs, and in practice have yielded both unexpectedly high rates of innovation and unexpectedly lower costs. The cost of the acid rain program is proving to be considerably lower than expected—in large part because of the flexibility and innovation

allowed under an emissions budget program. Estimated national annualized cost of the program at the time of enactment (1990) was \$4 billion; the current (December 1994) estimate from the General Accounting Office is \$2 billion (Market-Based Pollution Control Programs, ICF Kaiser, Inc. May 11, 1995). Recent scrubber costs are about half of their historic level and their removal efficiency has increased. Prices for low sulfur coal are also lower than expected because of increased production, increased use of low expense coal cleaning, bundling of allowances with fuel sales, and competition in transportation. The Regional Clean Air Incentives Market (RECLAIM) program is expected to cut Southern California NO_x emissions by 80 percent over 10 years while saving about \$58 million annually compared to traditional regulations (ICF Kaiser, 1995). Well-designed emissions budget proposals offer the highest degree of certainty for the environment and sources alike, and EPA wants to do everything possible to support and encourage them. The EPA is currently providing strong support for ongoing State development of emissions budget approaches for large-scale regional control of NO_x in the Northeast Ozone Transport Region (OTR), and for VOC emissions in Chicago and Los Angeles.

Notwithstanding their substantial benefits, emissions budget programs are unlikely to capture all of the market-based opportunities to achieve environmental results with reduced cost and greater flexibility. Emissions budget programs have required considerable start-up time and effort. They require agreement on (1) The universe of covered sources, (2) baseline emissions levels, (3) the emissions cap and its rate of decline, (4) the allocation of emissions allowances, and (5) standardized monitoring and measurement techniques for determining each source's emissions. Experience with RECLAIM and the acid rain program shows that obtaining agreement on these points can take several years. As a result, emissions budget programs have been applied to date mostly to well-measured pollutants from relatively uniform industrial sectors, e.g., oxides of sulfur (SO_x) and NO_x from utilities. Start-up time should decline, however, as experience is gained. The RECLAIM program and the Chicago program are making great strides in extending emissions budget programs to some categories of VOC sources.

The EPA is committed to continue providing financial and staff support to emissions budget development projects,