The U.S. EPA's State Implementation Plan for Reducing Regional Transport of NO_X

I. The Issue: How to Connect Air Pollution Standards and Reductions

In 1998, the U.S. Environmental Protection Agency (EPA) and the states developed a plan, referred to as the NO_X SIP Call, to reduce emissions from power plants that were documented to be transporting pollution throughout the Eastern United States. The pollution increased the concentration of ozone in these states, contributing to negative public health and environmental impacts. As a result of extensive modeling, technical cooperation between EPA and the states, and consistent regulations, the NO_X SIP Call has successfully reduced NO_X emissions from power plants in the Eastern United States by over 60% since 1998.

The primary point of this paper is to explain the process by which EPA determined the total amount of reductions to obtain from the power sector. EPA did this by starting with the National Ambient Air Quality Standards as the objective. EPA then modeled different total amounts of emissions reductions to determine which level of reductions would achieve maximum improvement in regional air quality.

II. The Problem: Ozone, Fine Particles and Visibility

In the 1990s, the Northeast States of the U.S. found themselves having significant difficulty meeting the federal ambient air quality standards for ozone, fine particles and the visibility goals of the federal Clean Air Act. Much of this difficulty was due to trans-boundary pollution coming from downwind states.

The Clean Air Act required that emissions originating in one location with negative health and environmental impacts on another location must be reduced as part of the originating state's requirements to control sources of air pollution within its jurisdiction. However, proving that emissions from one location have such impacts requires extensive modeling, as well as regional cooperation. Also, as electricity is imported and export across state-lines and regional power pools, the task of establishing consistent regulatory requirements among states for generating units was additionally problematic because of the risk of creating differential economic impacts.

III. The Standards

The National Ambient Air Quality Standards (NAAQS) for ozone and fine particles were the key targets for improving air quality. The process was also driven by visibility goals. At the time of the NO_X SIP Call in 1998, EPA had proposed the ozone standard at 0.08 ppm over an 8 hour

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period and the fine particle standard at an annual average of 15 micrograms per cubic meter and a 24 hour standard of 65 micrograms per cubic meter.

IV. The Process

The NO_X SIP Call process began when in the mid-1990s several states in the northeast utilized a provision of the Clean Air Act to petition EPA to address this problem. As set out in more detail below, EPA's 1998 regulatory decision was based on extensive air quality modeling and a two-year technical and policy process that involved 37 states, affected industries and non-governmental environmental groups. After these years of evaluation, the EPA approved the petition, agreeing that these states could not achieve and maintain compliance with national air quality standards due to transported air pollution from upwind states.

V. The Decision: What the NO_X SIP Call Required

The decision required aggregate NO_X emissions from power plants in 22 states in the populous eastern United States to be reduced by 63% below baseline levels; it required NO_X emissions from individual units to be reduced by up to 95%, beginning in 2003.

VI. The Bases of EPA's Decision

EPA's decision was based upon:

- Clean Air Act requirements that air pollution transport from one jurisdiction to another required regional approaches and solutions;
- Public health-based air quality standards whose levels were set based on recommendations from nationally recognized scientists and public health experts;
- Robust air quality monitoring networks that were operated by state and local agencies, with monitor siting, quality assurance and quality control procedures approved by EPA;
- Broad use of available and demonstrated technology;
- Flexible mechanisms that permitted the sale of allowances by sources which performed better than required to other sources which needed them for compliance (cap-and-trade framework); and
- Extensive modeling, as described below.

The air quality modeling conducted by the 37-state effort evaluated different potential levels of emissions standards. It evaluated the affects of emissions standards on states' ability to achieve and maintain compliance with public health-based air quality standards. Modelers selected the worst air pollution episodes, those with the longest duration and highest pollutant concentrations, to evaluate the capacity of emissions control technologies to reduce both the duration and concentration of pollutants.

EPA worked with control equipment manufacturers and the utility industry to evaluate the ability of emissions control equipment to be retrofitted onto existing power plants. EPA also developed a strategy that focused on installation of these controls during periods of normal, routine and scheduled maintenance, to minimize interference with operations.

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EPA then completed a macro-level analysis that examined all power plants to which emissions controls would be installed to ensure that overall system reliability could be maintained, and that adequate labor resources and lead time were available to complete equipment installations prior to the effective date of the regulations.

VII. Determining the Target for Reductions

EPA determined an implementation plan for the power sector that would reduce NO_X emissions by about one million tons, to a level of 550.000 tons, a 63% reduction from baseline emissions levels. Modeling showed that this level of reduction would significantly decrease the number of areas in the U.S. that exceeded ozone public health standards, and that it would also decrease the duration of exceedances and the peak concentrations of ozone. The NO_X reductions also helped to reduce formation of nitrates that contribute to regional visibility impairment and elevated concentrations of fine particulates.

EPA's emissions budget was based upon a level of 0.15 pounds of NO_X per million Btu (lb NO_X/MMBtu) (heat input basis). EPA took comment on, but did not endorse, suggestions that emissions budgets be based on all electric generation, including nuclear and hydro (this would have resulted in output-based requirements). The emissions level of 0.15 pounds assumed that larger electric generating units (EGU) would install Selective Catalytic Reduction (SCR)[1] technology to achieve performance that would be significantly below 0.15 lb NO_X/MMbtu; that medium sized EGU would install Selective Non-catalytic Reduction (SNCR) technology to achieve performance of approximately 0.15 lb NO_X/MMBtu; and that smaller units would either purchase allowances from units that achieved better performance, switch fuels, or that a small percentage might install SNCR technology. For comparison, uncontrolled power plants have NO_X emissions that range from 0.3-0.7 lb NO_X/MMbtu (for coal fired units), 0.2-0.5 for oil-fired units, and 0.05-0.3 for natural gas fired units (the range depends upon the age of the power plant).

EPA apportioned emissions to each state based upon the product of 0.15 lb NO_X/MMBtu, and the fossil-fuel fired generation output in that state. States were required to adopt regulations to implement the EPA rules. States had the flexibility to allocate emissions according to state-specific requirements and formulae.

[1] Selective Catalytic Reduction (SCR) can reduce NO_X emissions by up to 95%. SNCR can reduce NO_X emissions 30-50%. SCR was proven as a "best available" technology in the early 1990s, as a result of state and EPA permitting requirements.