NORTHEAST STATES FOR COORDINATED AIR USE MANAGEMENT (NESCAUM)

NESCAUM Nitrogen Oxides Policy
October 1988

Role of Nitrogen Oxides in the Environment

Nitrogen oxides (NO_x) emissions from vehicles and other sources produce a variety of adverse effects, including direct health and environmental effects. NO_x emissions also react chemically with other pollutants to form ozone, acids, and other highly toxic pollutants. Next to sulfur dioxides, nitrogen oxides are the most significant contributor to acid deposition. NOx also adversely affects terrestrial ecosystems, contributes to global warming and has been found to accelerate the degradation of a wide variety of materials.

Effects of Nitrogen Dioxide

Exposure to nitrogen dioxide (NO_2) emissions is linked to increased susceptibility to respiratory infection, decreased pulmonary function, and increased airway resistance in asthmatics. Most areas of the U.S. currently attain the National Ambient Air Quality Standard (NAAQS) for nitrogen oxides of 100 um/m^3. In recent years, however, several urban areas in the Northeast have measured concentrations of NO_2 just below the NAAQS. The World Health Organization has recommended that a short-term one hour standard of 0.10 - 0.17 ppm be established to protect public health and that this standard not be exceeded more than once a month. In addition, to protect public health, the State of California has adopted a short term NO_2 standard of 0.25 ppm averaged over one hour. If this standard were adopted nationwide, the number of areas in violation of the NO_2 standard would increase greatly.

Oxides of nitrogen have also been shown to adversely affect vegetation. Some scientists believe that NO_x is a significant contributor to forests dying throughout central Europe. Terrestrial effects are even more pronounced when nitrogen dioxide and sulfur dioxide occur simultaneously. Nitrogen dioxide has also been found to cause deleterious effects on a wide variety of materials including textiles dyes and fabrics, plastics, and rubber. In addition, NO_x is responsible for a portion of the brownish coloration in polluted air. Furthermore, NO_x significantly contributes to global warming and the greenhouse effect.

Ozone

Nitrogen oxides are one of the two primary ozone precursors and play a major role in the formation of ambient ozone. Analyses using the Regional Oxidant Model and the Urban Airshed Model (see Attachment 1)

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indicate that the Northeast must reduce NO_x emissions in order to attain the ozone NAAQS. The 1988 ozone season was one of the worst ever recorded in the Northeast in terms of the number of days when the standard was exceeded (53), dramatic increase in the number of monitored exceedances (627), elevated peak values, and widespread pollution exposures (see Attachment 2).

Exposure to elevated ozone levels causes eye irritation, coughing and chest discomfort, headaches, upper respiratory illness, increased asthma attacks, and reduced pulmonary function. Recent studies have documented that healthy young children suffer adverse effects from exposure to ozone at levels below the current standard. Furthermore, numerous studies have demonstrated that ozone damages forest ecosystems and agricultural crops.

The ozone problem has become so ubiquitous because of the long-range transport of ozone and ozone precursor emissions, including NO_x. Rural areas in the Northeast have background levels that frequently approach and occasionally exceed levels where adverse health effects have been observed. In fact, multi-day ozone transport episodes occur frequently in the northeast corridor of the United States (Virginia to Maine) in the summer and result in violations of the ozone NAAQS throughout the region and as far north as Acadia National Park in Maine.

Acid Deposition

Acid deposition results from the chemical transformation and transport of sulfur dioxide and nitrogen oxides. Annually, NO_x emissions are responsible for approximately one-third of the acidity of rainfall. During the winter, the nitric acid contribution to acid rain increases to approximately 50%. In springtime, nitric acid is largely responsible for the acid pulse in snowmelt which has severe impacts on freshwater ecosystems. Over the past several years, the contribution of NO_x to total deposition has increased and will continue to increase in the absence of new control measures.

Toxic Air Pollutants

Nitrogen oxide emissions can react chemically with other air pollutants to form extremely potent air contaminants such as nitrosamines and nitroarenes. Several nitrosamine compounds are classified as animal carcinogens and several nitroarenes are highly mutagenic.

Emission Trends for Nitrogen Oxides

NO_x emissions in the United States have increased ten-fold since the turn of the century and have tripled since 1950. Although emissions have declined slightly since 1979, they have recently begun to increase and are projected to increase 50-60% by 2030 (see Attachment 3). This sharp rise in NO_x emissions will be due primarily to an increase in stationary and mobile source emissions.

In the Northeast, approximately 60% of the annual NO_x emissions are from mobile sources and 40% are from utilities and power generation. Annual NO_x emissions from utilities and power generation have increased during the last five years. Although fleet turnover is reducing NO_x

emissions on a per vehicle basis, increases in total vehicle miles traveled in the Northeast is offsetting achieved reductions. NO_x emissions from mobile sources are projected to begin increasing in the early 1990's.

Under the Prevention of Significant Deterioration (PSD) program for major stationary sources, EPA has recently established maximum allowable increases or increments, for ambient NO_x concentrations above current ambient baseline levels. Through the use of top-down Best Available Control Technology determinations for new and modified stationary sources, state and local agencies have the authority to manage and preserve the available NO_x increments.

NO_x Emission Control Options

A. Stationary Sources

Emission control technologies for existing and new stationary sources are available and have been demonstrated to significantly reduce NO_x emissions. Retrofit control options for existing sources include, but are not limited to controlling combustion by lowering excess air, reducing peak flame temperature, and/or shortening residence time. Staged combustion achieved with low NO_x burners or new burner configurations are other examples of retrofit options.

NO_x emission control technology options for new stationary sources include, but are not limited to, controlling combustion with methods mentioned above and installing and reconfiguring burners. Post-combustion techniques include dry and wet processes and selective and non-selective catalytic processes. The non-selective technologies are similar to automobile catalytic convertors. Selective processes include Thermal DeNox (Exxon's non-catalytic process) and SCR, a selective catalytic reduction process.

B. Mobile Sources

The U.S. Environmental Protection Agency regulates vehicle tailpipe emissions. Although the Environmental Protection Agency acknowledges that vehicle NO_x emissions will begin to increase in the 1990's, at this time the Agency does not support more restrictive tailpipe standards for NO_x. California is the only state in the country with the authority to regulate vehicle tailpipe emissions. The California light duty vehicle NO_x standard is 0.4 grams/mile compared to the federal standard of 1.0 grams/mile.

Other states may petition the Environmental Protection Agency for the authority to adopt the California mobile source control provisions. The eight NESCAUM states are considering adopting the California program for model year 1990. If this occurs, NO_x light duty vehicle emissions for the Northeast in 2010 will be approximately 50% less than they would under the current federal program (see Attachment 4). Additional air quality benefits would be achieved if the Northeast implements the full California mobile source program.

Recommended Actions

Because NO_x emissions cause or significantly contribute to a variety of public health and environmental impacts and since cost-effective emission control techniques have been demonstrated for stationary and mobile sources, the NESCAUM Directors agree to the following actions.

1. States will require that new or modified major NO_x stationary sources perform a "top down" Best Available Control Technology (BACT) analysis and install the NO_x emission controls demonstrated to be appropriate.

2. The NESCAUM states will evaluate other appropriate actions that should be instituted to reduce NO_x emissions from existing stationary sources, fuels, and other area sources.

3. The Northeast states will cooperatively evaluate the feasibility, air quality benefits, and associated costs of adopting the California mobile source control program.

4. The Northeast states will continue to monitor NO_x emissions and evaluate their impact. The Northeast states will also analyze, using dispersion models, the air quality impacts of existing source NO_x reduction strategies. Based on this information, each year the Directors will review and, if necessary, update the NESCAUM Nitrogen Oxides Policy.

This policy was adopted by the NESCAUM Board of Directors on October 11, 1988.

Attachment 1 - The Effect of NOx and VOC Emissions Reductions on Ozone Estimates with Urban Airshed Model. David Wackter, Connecticut Department of Environmental Protection.
Attachment 2 - Preliminary Summary of Northeast 1988 Ozone Season, NESCAUM.
Attachment 3 - Long-term Emission Trends, NAPAP.
Attachment 4 - The Potential Impact on Emissions from Motor Vehicles of Adoption of California Standards for Light Duty Vehicles. NESCAUM Report, Michael Walsh.

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