NO_X BUDGET TRADING PROGRAM

2003 Progress and Compliance Report

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Introduction

The NO_X Budget Trading Program (NBP), is a market-based cap and trade program created to reduce emissions of nitrogen oxides (NO_X) from power plants and other large combustion sources in the eastern United States. NO_X is a prime ingredient in the formation of ground-level ozone (smog).

Building on prior efforts to reduce summertime NO_X emissions in the Northeast, eight northeastern states and the District of Columbia implemented the NBP in 2003. Eleven additional states joined the program in May 2004. NO_X emission levels and baselines for states that complied with the program in 2003, as well as for eleven additional states beginning compliance in 2004, are presented in this report. When fully implemented the NBP is expected to achieve significant reductions in summertime NO_X emissions across much of the eastern U.S.

This report finds that, in states that participated during the first year of the program, ozone season (May through September) NO_X emissions from power plants and other large combustion sources were reduced by more than 30 percent from 2002 levels. These emission reductions occurred despite an increase in heat input (a measure of power generation) at affected sources. Emissions have also been reduced by 70 percent from 1990 levels due to the combination of the NBP and other NO_X control programs. In 2003, of the total affected population of approximately 1,000 units, all but 7 were in compliance. NO_X emissions were reduced on days with peak emissions. In addition, the NO_X allowance market has been active.

In anticipation of entering the NBP and in response to other NO_X control programs, particularly annual NO_X reductions under the Acid Rain Program, the eleven states that did not participate in the program until 2004 have also made progress in reducing NO_X emissions. NO_X emissions in these states were approximately 50 percent below 1990 levels. In addition, sources successfully monitored and reported emissions for the first time in 2003.

Ground-level ozone, or smog, is formed from oxides of nitrogen (NO_X) and volatile organic compounds (VOCs) in the presence of sunlight and heat. Levels are highest during the hot summer months when sunlight is strongest. Ozone aggravates asthma, increases susceptibility to respiratory illnesses, and contributes to permanent lung damage. It can also damage forests, reduce the productivity of agricultural crops, and lead to the decay of monuments and buildings.

Ozone continues to be a pervasive air pollution problem. In April 2004, EPA released a list of 126 areas that do not meet the new health-based 8-hour ozone standard. In most cases, the Agency's findings are based on air quality data from 2001 through 2003. The ozone nonattain-

8-Hour Ozone Standard (promulgated in 1997):

The 8-hour standard is met when the 3-year average of the annual fourth highest daily maximum 8-hour average concentration is less than 0.08 ppm (parts per million).

What Does It Mean?

EPA collects ozone data on an hourly basis. Essentially, 8-hour average ozone concentrations at a monitor cannot exceed 0.08 ppm more than three days per year. For compliance purposes:

- Hourly ozone measurements are used to compute 8-hour average concentrations.
- The daily maximum 8-hour average is recorded for each day.
- For each year, the fourth highest daily maximum concentration is calculated.
- These annual fourth highest daily maximum concentrations are averaged over three-year periods.
- If the average exceeds 0.084 ppm (0.085 rounds up), the area is designated as a "nonattainment area."

ment areas, shown in Figure 1, include 474 counties that are home to 159 million people—more than half of all Americans. The majority of these areas are in the NO_X SIP call states. As many of the states with nonattainment areas plan for the future, the NBP emission reductions will be an essential component of their strategies for attaining the 8-hour ozone standard.

This report presents the results of the first year of the NBP for affected sources in states with compliance requirements in 2003, as well as emissions data for NBP sources in other states that reported their emissions in 2003. Along with the results of the first year of the NBP, this report presents baseline NO_X emission levels prior to the program (for 1990 and 2000). As the program matures and as EPA continues to assess progress, these baselines will help EPA analyze emission trends and the impact of NO_X reductions achieved by NBP sources.

8-hour Ozone Standard Attainment and Nonattainment Areas in the U.S. as of April 2004

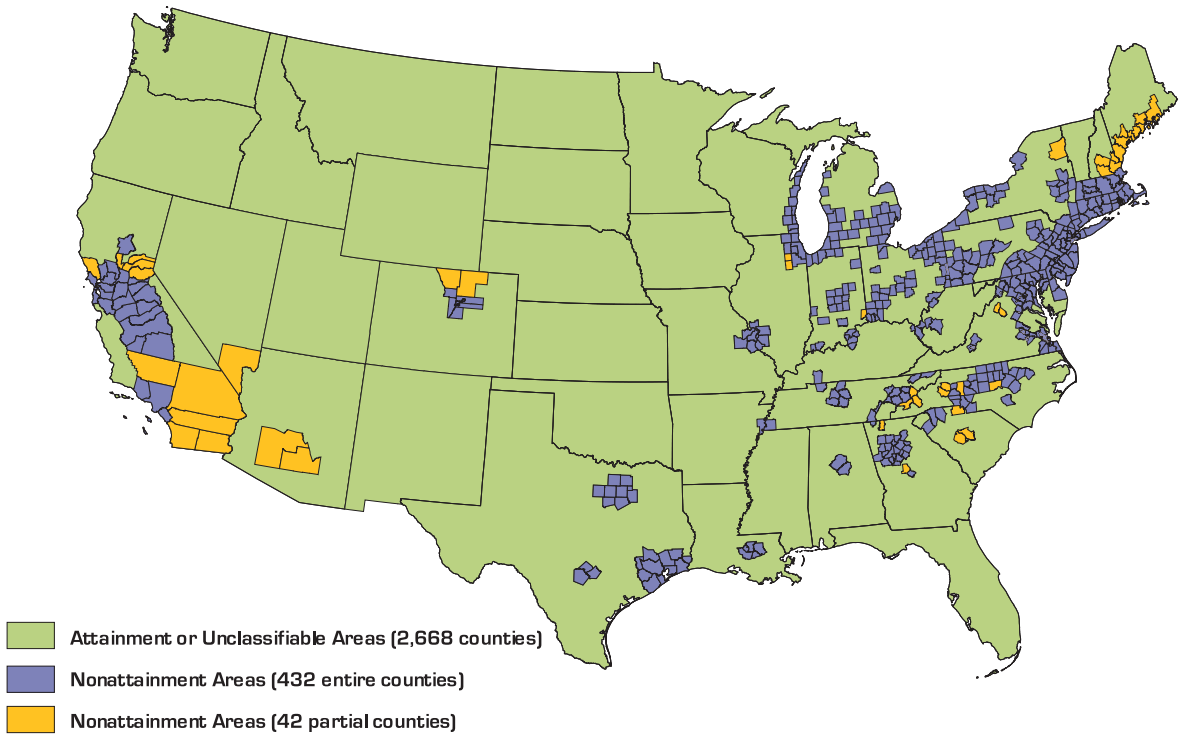


Figure 1
Many counties in the NBP region do not meet the 8-hour ozone standard.

Source: EPA

What Is the NO_x Budget Trading Program?

EPA and the States Have Taken Steps to Address Regional Transport

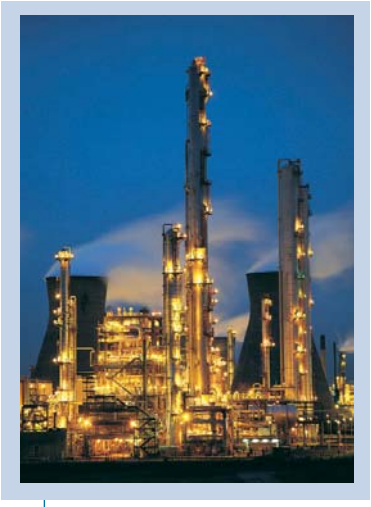
Created after years of scientific research and air quality data showed that upwind NO_x emissions can contribute significantly to ozone nonattainment in downwind states, the NO_x Budget Trading Program (NBP) follows several other major efforts to reduce NO_x from large, stationary sources. These initiatives include the Acid Rain Program, the Ozone Transport Commission's (OTC) NO_x Budget Program, New Source Review, New Source Performance Standards, application of Reasonably Available Control Technology to existing sources, and other state and local efforts.

Title IV of the 1990 Clean Air Act Amendments created the Acid Rain Program. This program, which achieved large SO_2 reductions from power plants through a cap and trade program, also required coal-fired power plants throughout the country to reduce their NO_x emission rates (NO_x emissions per unit of heat input). The goal of the Title IV NO_x program was to achieve and maintain an annual 2 million ton reduction in NO_x emissions from what emissions would have been in 2000 without the program. This goal has been surpassed. In 2002, due

A Quick Snapshot of National and Regional NO_x Control Programs

- **Acid Rain NO_x Reduction Program (ARP)**—Annual, national program controlling NO_x emissions from electric generating units. Sources are required to meet certain rates of NO_x emissions. There is no cap on emissions or allowance trading. The program began in 1996 with a second phase beginning in 2000.
- **Ozone Transport Commission (OTC) NO_x Reduction Programs**—States in the Northeast collaborated to achieve ozone-season NO_x reductions in several phases. In Phase I, sources were required to reduce their annual rates of NO_x emissions to meet Reasonably Available Control Technology requirements. In Phase II, states participated in a cap and trade program, the OTC NO_x Budget Program, to achieve additional reductions during the ozone season. In 2003, the OTC NO_x Budget Program was replaced by the larger NO_x Budget Trading Program.
- **NO_x State Implementation Plan (SIP) call**—Building upon analyses done by the Ozone Transport Assessment Group (OTAG), this rule was finalized by EPA in 1998. It required states significantly contributing to ozone nonattainment problems in other states to reduce their NO_x emissions during the ozone season beginning in 2003. This rule gave states the flexibility to reduce emissions through various means and gave them the option to participate in the NO_x Budget Trading Program.
- **NO_x Budget Trading Program (NBP)**—An ozone season cap and trade program intended to help states meet their NO_x SIP call required reductions. States in the OTC began to comply in 2003 and many other states across the East and Midwest began to reduce emissions in 2004. Twenty-one states and the District of Columbia are participating or will participate in the future.

to Title IV and other state actions, annual NO_X emissions from Acid Rain Program sources were more than 3 million tons lower than what they would have been without Title IV. However, because there is no cap on Acid Rain Program NO_X emissions, NO_X emissions may increase in the future as demand for electricity continues to grow.



The 1990 Clean Air Act Amendments also established the OTC to mitigate interstate transport of pollution in the Northeast. In September 1994, eleven states and the District of Columbia signed a Memorandum of Understanding (MOU) committing to reduce NO_X emissions throughout the region. In 1995, the OTC states required existing sources to meet Reasonably Available Control Technology (RACT) limits, and in 1999 through 2002, most of the OTC states achieved deep NO_X reductions through an ozone season cap and trade program for NO_X called the OTC NO_X Budget Program. The OTC states that participated in this trading program included Connecticut, Delaware, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and the District of Columbia.[1]

Separate from the activity in the OTC, EPA and the Environmental Council of the States formed the Ozone Transport Assessment Group (OTAG) in 1995. This workgroup brought together interested states and other stakeholders, including industry and environmental groups. Its primary objective was to assess the ozone transport problem and develop a strategy for reducing ozone pollution throughout the eastern half of the U.S.

The NO_X SIP Call Requires Significant Summertime NO_X Reductions across Eastern States

Based on the findings of OTAG, EPA proposed the NO_X SIP call in 1997 and finalized it in 1998. This rule concluded that NO_X emissions in twenty-two states and the District of Columbia contribute to ozone nonattainment in other states, and the rule required affected states to amend their state implementation plans (SIPs) and limit NO_X emissions. EPA set an ozone season NO_X budget for each affected state, essentially a cap on emissions from May 1 to September 30 in the state. The first control period was scheduled for the 2003 ozone season.

The NO_X SIP call did not mandate which sources must reduce emissions but, rather, required states to meet an overall cap (or budget) and gave them flexibility to develop control strategies to meet the cap. The NBP was developed to help states achieve highly cost-effective NO_X emission reductions.

[1] Vermont and Maine also signed the MOU but chose to meet their NO_X reduction goals outside of the trading program. Northern Virginia is also part of the OTC but did not sign the MOU and has not participated in the OTC NO_X reduction programs. This report, therefore, does not refer to Virginia as one of the OTC states in terms of trading program implementation.

The NBP is a cap and trade program for large electric generating units (EGUs) and large industrial boilers, turbines, and combined cycle units. In this type of program, the emissions budget sets a "cap" on emissions at a specified level. Sources are provided "allowances" (each allowance represents one ton of emissions), and each year the source must hold sufficient allowances to cover all NO_X tons the source emits during the ozone season. To monitor emissions, sources use continuous emission monitoring systems (CEMS) or other approved monitoring methods under EPA's stringent monitoring requirements (40 CFR Part 75). If a source's emissions are less than the allowances it holds, the source can sell the unused allowances or bank the allowances for use in a future ozone season.

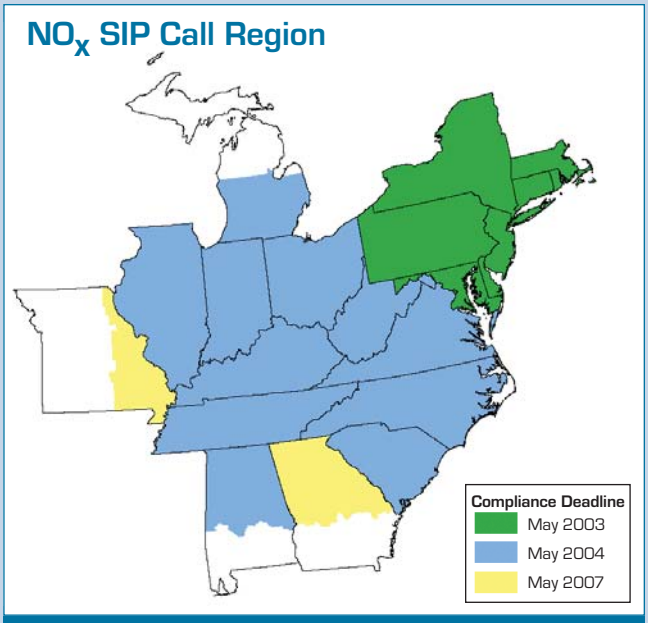


Figure 2
Participation in the NBP is phased in across the region.

Source: EPA

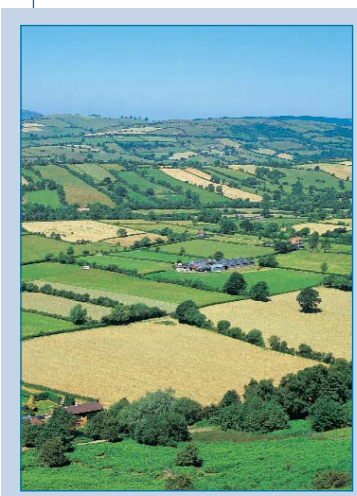
The NO_X SIP call faced many legal challenges. Although the U.S. Court of Appeals for the D.C. Circuit largely upheld most of the final rule, the court's decision resulted in Wisconsin and portions of Georgia and Missouri being removed from the list of areas where reductions are required (decreasing the number of affected states to 21 states and the District of Columbia).[2] In addition, the initial deadline for emission reductions under the NO_X SIP call was delayed until May 31, 2004. The OTC states had been set to achieve additional reductions in May 2003 under the OTC trading program. With the exception of New Hampshire, these states instead began to implement the NBP in May 2003.[3] New Hampshire is not affected under the NO_X SIP call and is not part of the NBP.

The OTC states were joined in the NO_X SIP call by Alabama, Illinois, Indiana, Kentucky, Michigan, North Carolina, Ohio, South Carolina, Tennessee, Virginia, and West Virginia on May 31, 2004 (see Figure 2). All of these states have chosen to meet the NO_X SIP call requirements through participation in the NBP. Affected portions of Georgia and Missouri will be required to comply with the NO_X SIP call in 2007. In Alabama, Georgia, Michigan, and Missouri, only a portion of each state is subject to the NO_X SIP call. Because Georgia and Missouri are not yet participating in the program, this report does not discuss results for these states.

[2] Due to litigation, EPA stayed the NO_X SIP call findings with respect to the 8-hour ozone standard for all affected states (65 FR 56245). On April 21, 2004, EPA's final NO_X SIP call Phase II Rulemaking determined that Wisconsin would not be included in the rule based on the 1-hour ozone standard (69 FR 21609). However, in the future, EPA may still consider lifting the stay with respect to the 8-hour standard for all affected states, including Wisconsin (69 FR 21608).

[3] The overall reduction goals set for the NBP under the NO_X SIP call are generally consistent with reduction levels planned for 2003 in the OTC states, and many program features, such as allowance tracking and reporting, are consistent between the two programs.

Understanding Baselines and Budgets: Guidelines for Program Evaluation



Progress in reducing emissions under a cap and trade program can be evaluated primarily in two ways. NO_X Budget Trading Program (NBP) emissions can be compared to:

- A baseline level of emissions (emissions from a period prior to the start of the program), or
- The reduction goals—or budgets—set for the NBP in the rules of each affected state.

EPA believes both assessment approaches can provide valuable insights on emission reductions achieved by the program, and the following sections clarify the assumptions and approaches used to derive baseline and budget levels for purposes of program evaluation. EPA plans to assess emission changes under the NBP on a regular basis.

Understanding Emission Levels Prior to the Program Can Help Us Measure Progress

To measure progress in reducing ozone season NO_X emissions, it is helpful to understand how emissions under the program compare to emissions prior to the program. EPA has chosen 1990 as a baseline year because it represents emission levels before the implementation of the 1990 Clean Air Act Amendments, and can document progress achieved under the amendments. The 1990 baseline period also was used throughout the Ozone Transport Assessment Group (OTAG) process, which led to the development of the NO_X SIP call.

For the 1990 ozone season emission estimates, data were derived from annual 1990 National Emission Inventory (NEI) data. The Ozone Transport Commission (OTC) states used the 1990 NEI data to develop a refined 1990 ozone season inventory as part of their efforts to reduce ozone in the region.[4] In this report, EPA is using the OTC's refined NEI inventory for the OTC states, and EPA has developed an ozone season inventory directly from the NEI for the non-OTC states.

Emissions have been reduced greatly since 1990, but many of these reductions result from control programs other than the NBP. To better reflect the reductions that can

[4] 1990 OTC NO_X Baseline Emission Inventory, U.S. EPA, EPA-454/R-95-013, July 1995.

be attributed to the NBP, emissions from the 2000 ozone season are also presented here. The year 2000 was chosen because most of the reductions due to the implementation of earlier NO_X regulatory programs under the 1990 Clean Air Act Amendments had already occurred by 2000, but sources were not yet implementing the NBP at that time. Emissions in 1990 and 2000 both provide valuable information for evaluating the extent to which the NBP and other control programs are providing reductions in NO_X levels.

In 2000, the stringent emissions reporting requirements for Acid Rain Program and OTC NO_X Budget Program sources provide accurate ozone season NO_X data for most of the NBP units, and those units account for well over 90 percent of all the emissions from affected sources in most NBP states in 2000. There is no comparable, quality-assured emissions monitoring data for units that are not affected by either of these programs. These units include industrial units and non-Acid Rain Program electric generating units outside the OTC region. Therefore, to approximate these 2000 ozone season NO_X emissions for industrial units, EPA has used the most recent NEI data available (1999). To approximate 2000 emissions for non-Acid Rain Program electric generating units, EPA used data developed to set the NO_X SIP call state budgets.[5]

Figure 3 shows the total 1990 and 2000 baseline ozone season NO_X emissions. Between 1990 and 2000, affected sources in the region reduced ozone season NO_X emissions by approximately 600,000 tons (34 percent), mainly due to the requirements of the annual Acid Rain Program and seasonal OTC program.

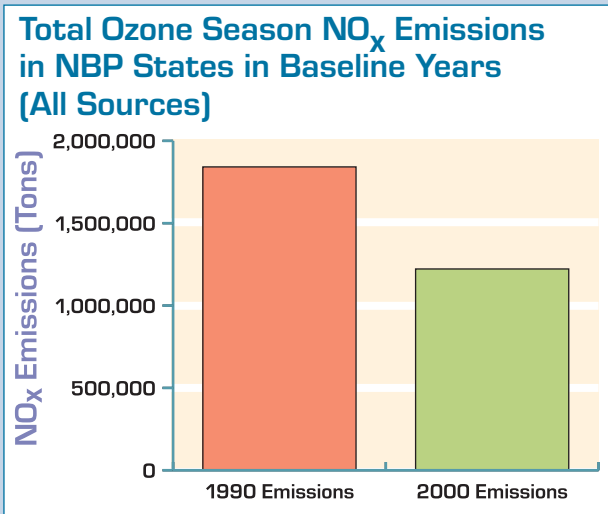


Figure 3
Ozone season NO_X emissions were reduced by over one third between 1990 and 2000 in the NBP region.

Source: EPA

States Were Required to Reduce Emissions to Meet a Budget

States were given budgets, or caps, on their ozone season emissions. These are the target levels they are expected to achieve under the NBP. The actual number of allowances a state allocates to sources for a certain year under the program may not be equal to the state's budget. States may hold back some of the budget to set aside allowances for new units, energy efficiency or renewable energy projects, or other pur-

[5] These data represent ozone season emission estimates for the 1995 or 1996 ozone season. However, EPA is using these data instead of NEI data because of difficulty in identifying non-Acid Rain electric generating units in the NEI. Because the emissions from these units represent only a small percentage of the overall emissions (typically less than 1 percent of the non-OTC states overall EGU emissions), EPA believes that the use of the 1995/1996 data will not significantly change the total 2000 ozone season emissions estimates presented in this report.

poses. Another factor that affects the amount of allowances allocated by each state is the Compliance Supplement Pool (CSP). The CSP is a pool of extra allowances included in the NO_X SIP call to help sources comply with the trading budgets in the first two years of the program. EPA established the CSP pool to address concerns about electricity reliability at the beginning of the program.

States may distribute their respective CSP allowances based on early reductions, directly to sources based on a demonstrated need, or by some combination of the two methods. In the OTC states, CSP allowances generally were distributed to sources based on a pro rata share of banked allowances that the sources held in the OTC NO_X Budget Program. Allowances from the CSP in a given state may be used to cover emissions during the first two control periods in that state. For the states that began to comply in 2003, CSP allowances can be used only in the 2003 and 2004 ozone seasons, while in most of the remaining NBP states, the allowances can be used only in the 2004 and 2005 ozone seasons.[6]

Figures 4 and 5 help illustrate the levels of reductions that would be needed to meet the emission reduction goals set by the NBP. Emissions for 1990 and 2000 show progress in reducing NO_X prior to the program. Budgets are presented to demonstrate the overall reduction goals of the program, and budgets with CSP allowances demonstrate the reduction goals in the early years of the program. By comparing baselines and budgets, it is easy to see how much further each state would be expected to reduce emissions to meet their target levels of emissions.

Baseline Emissions and Target Reduction Levels in OTC States Participating in the NO_X Budget Trading Program*

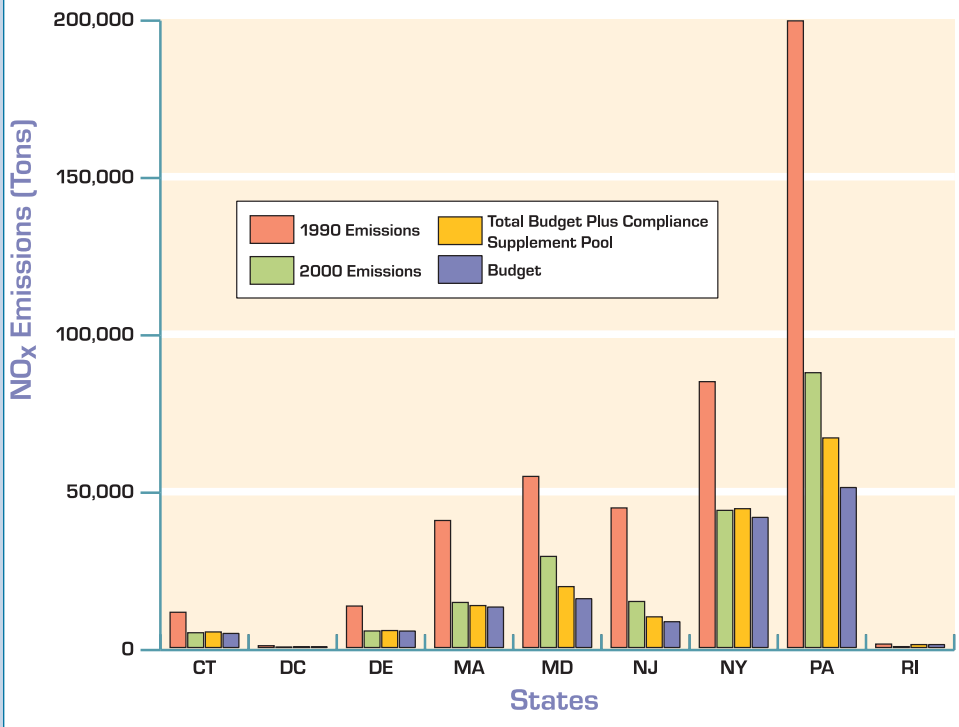


Figure 4
Through the OTC NO_X program, the Acid Rain Program, and other Clean Air Act requirements, the OTC states have made significant progress in reducing ozone season NO_X emissions from 1990 levels.

* New Hampshire participated in the OTC program but is not affected by the NBP.

Source: EPA

[6] In North Carolina, the state allowed certain sources to use CSP allowances to meet state reduction requirements in 2003, but those allowances would be deducted from their 2004 allowance allocations under the NBP.

Figures 4 and 5 show that all states in the NBP were required to achieve substantial reductions from 1990 levels to meet their budgets. By 2000, the OTC states had made significant progress toward that goal. They reduced emissions approximately 55 percent in the region through the OTC NO_X program, the Acid Rain Program, and other Clean Air Act requirements. Because of this, overall, the OTC states generally only had to achieve small reductions between 2000 and 2003 to meet the target reductions for the NBP.

While the OTC states were well on their way to meeting their budgets by 2000, the non-OTC states generally still had more work to do to meet their budgets. Between 1990 and 2000, the non-OTC states had reduced NO_X emissions by approximately 27 percent through the Acid Rain Program and other Clean Air Act requirements, but they still had to reduce emissions substantially to meet their target reductions for the NBP. Note that the scale in Figure 5 reflecting NO_X emissions in states outside the OTC is different from the scale in Figure 4 for the OTC states.

Baseline Emissions and Target Reduction Levels in Non-OTC States Participating in the NO_X Budget Trading Program as of May 2004*

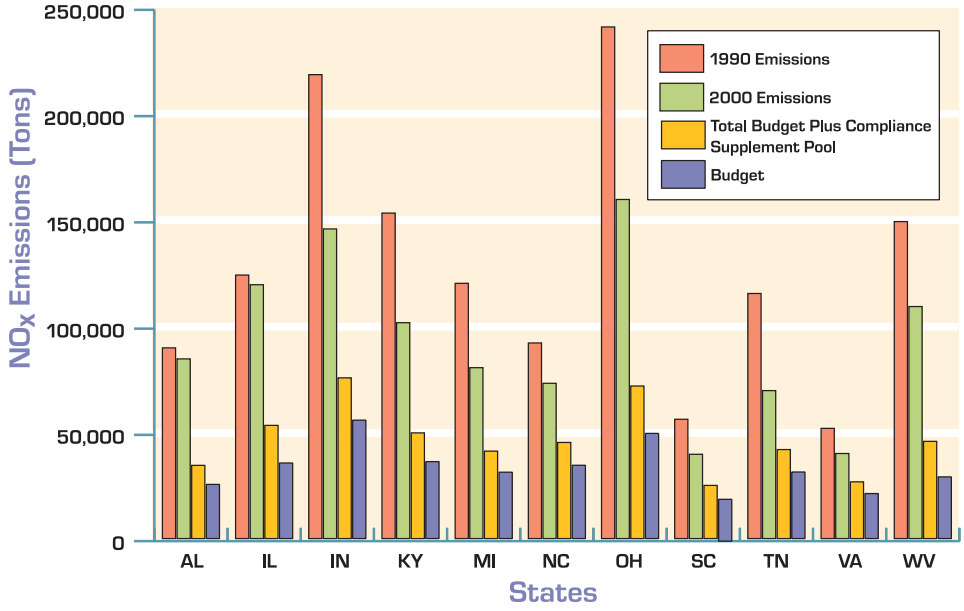


Figure 5
Through the Acid Rain Program and other Clean Air Act requirements, the non-OTC states have achieved more than a 25 percent reduction in ozone season NO_X emissions from 1990 levels and are poised to realize further significant reductions.

* Georgia and Missouri will not enter the NBP program until 2007.

Source: EPA

Based on the information in Figures 4 and 5, the overall NO_X allowance budgets with and without Compliance Supplement Pool NO_X allowances are:

OTC states:	139,593 (plus 25,031 CSP) allowances	=	164,624 allowances
Non-OTC states:	366,475 (plus 141,152 CSP) allowances	=	507,627 allowances
Regional total:	506,068 (plus 166,183 CSP) allowances	=	672,251 allowances

The NBP Affects a Significant Number of Units

Based on data reported to EPA, there are nearly 2,600 affected and operating units in the NBP states, including the states that joined the program in 2004. About 1,000 of these units are in states in the OTC that complied in 2003, while about 1,600 are in non-OTC states that did not have to comply in 2003.

The term "unit" means a fossil fuel-fired combustion boiler, turbine, or combined cycle unit. At a given facility, there may be multiple units. Electric generating units (EGUs) provide electricity for sale. Many EGUs in the NBP are also covered by the Acid Rain Program, although the NBP also includes other EGUs (such as some simple combustion turbines, cogenerators, and independent power producers) that are exempt from the Acid Rain Program. About 62 percent of all units in the NBP are also affected by the Acid Rain Program, while other EGUs comprise about 25 percent of the total units, and non-EGUs make up the other 13 percent.

Industrial units are sources that provide electricity or steam for use at their industrial facility, with little or no electricity generated for off-site use. The Acid Rain Program covers EGUs but not industrial units. However, the OTC trading program included industrial units, and EPA also decided to include industrial boilers, turbines, and combined cycle units in the NBP. Of the total affected NBP population of nearly 2,600 units, approximately 350, or about 13 percent, are industrial units. This is an increase from the OTC trading program, where about 6 percent of the sources were industrial units. Figure 6 provides a detailed breakdown of the classification of NBP units.

Units Affected by the NBP—A Comparison of Electric Generating Units and Industrial Units for OTC and Non-OTC States

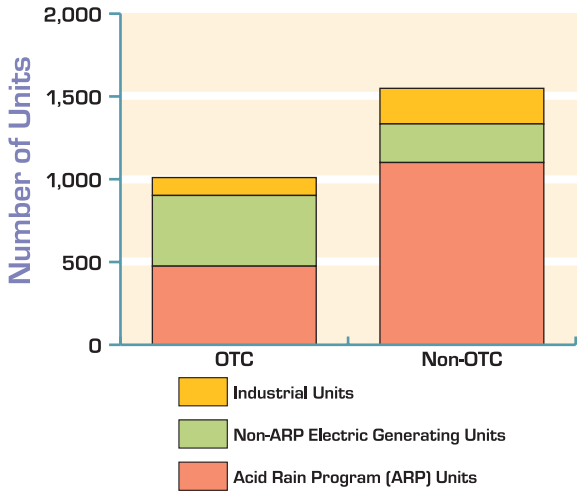


Figure 6
About 60 percent of the units affected by the NBP are also affected by the Acid Rain Program. In addition, the NBP incudes many other electric generating units, which were not included in the Acid Rain Program.

Source: EPA

The NBP includes boilers, turbines, and combined cycle units from a diverse set of industries. Some of the OTC states also have included other combustion units, such as cement kilns and process heaters. This diversity has contributed to a wide range of compliance strategies as facilities faced varying control costs and compliance needs to meet the requirements of, first, the OTC trading program and, later, the NBP. The various industrial sources participating in the program have also created additional trading flexibility for EGU compliance. So far, the inclusion of industrial sources appears to have been beneficial to the trading programs without creating disproportionate burdens on these sources. These sources have followed the same monitoring and reporting requirements as EGUs and have participated in the market, buying and selling allowances.

Performance under the NBP in 2003 Already Shows Positive Results

In 2003, only sources in the Ozone Transport Commission (OTC) states were required to hold allowances to cover NO_X emissions during the ozone season. In most of the other states affected by the NO_X SIP call, states required sources to begin monitoring and reporting ozone season emissions and heat input data in May 2003, even though the first control period did not begin for them until May 31, 2004.[7] Thus, the following sections generally focus on results in the OTC region, although there is a brief review of the reported 2003 emissions in the other states.

Summertime NO_X Emissions Have Declined across the Region

Figure 7 shows the combined 1990 baseline, 2000 baseline, trading budget, and 2003 emission levels for both the OTC states and the other NO_X Budget Trading Program (NBP) states. The 2003/2004 trading budget levels in Figure 7 are presented with and without the Compliance Supplement Pool (CSP) allowances. The budgets for OTC states represent the 2003 budgets, while the budgets for the other states represent the first control period in 2004.

Regional Baselines, Trading Budgets, and 2003 NO_X Emissions*

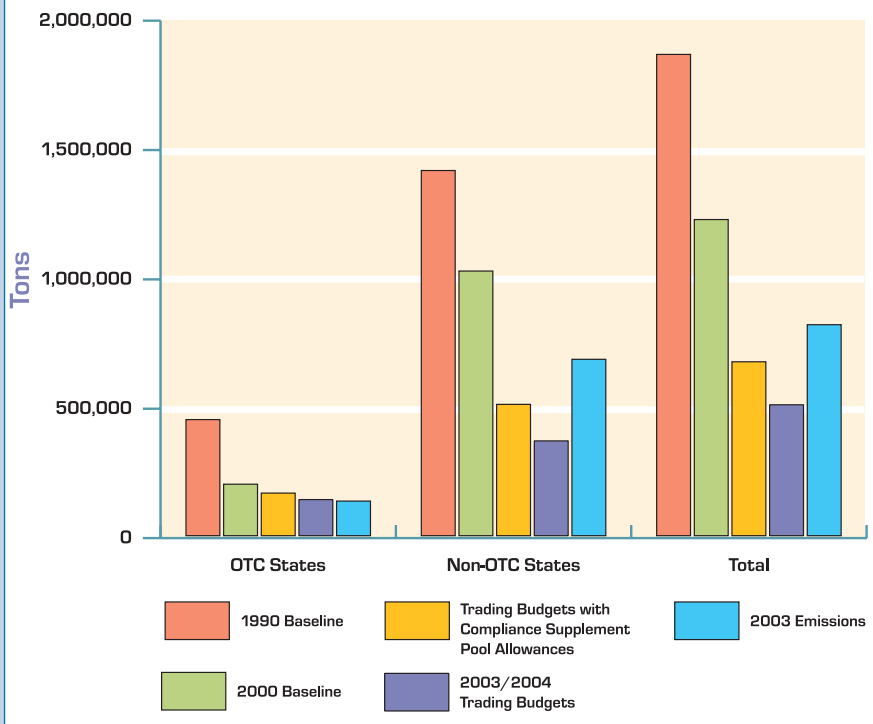


Figure 7
In 2003, ozone season NO_X emissions were down 56 percent from 1990 levels across the entire NBP region.

* Total emissions in the non-OTC states in 2003 were higher than the budget levels for those states because the first control period in those states did not begin until 2004. In the OTC states, 2003 emissions were lower than the budget with or without Compliance Supplement Pool (CSP) allowances.

Source: EPA

[7] In North Carolina, sources were not required to monitor and report data in 2003, although many sources did so voluntarily (over 75 percent of the sources provided data).

Despite the fact that the 2003 ozone season was not a control period in the non-OTC states, the universe of sources in the entire NBP area reduced emissions in 2003 by more than 50 percent from year 1990 baseline levels and by about 33 percent from year 2000 baseline levels.[8] In 2003, OTC states had reduced emissions 70 percent from 1990 levels and 33 percent from 2000 levels. While many of the reductions from the 1990 baseline represent other programs implemented under the Clean Air Act (such as NO_X reductions under the Acid Rain Program, the OTC trading program, and other state rules), the significant decrease since the 2000 baseline documents additional reductions that, at least to some degree, reflect early reductions as sources begin to implement controls and other operating changes in anticipation of the NBP.

OTC States Continue to Reduce below Total Allocated Allowances

During the OTC trading program, emissions were less than allowances in every year of the program (1999-2002). That trend continued under the NBP in 2003. In the participating OTC states, ozone season NO_X emissions in 2003 were approximately 134,000 tons, 18 percent less than the number of NBP allowances allocated in 2003. In addition, 2003 emissions in these states were more than 30 percent less than their emissions in 2002.

Emissions in many of the OTC states were below allocations in 2003 (see Figure 8). Exceptions included Delaware, where emissions were essentially the same as allowances allocated by the state (emissions were only about 20 tons higher than allocations). In addition, emissions in Maryland and New Jersey in 2003 were higher than allocations by about 1,750 tons in Maryland and about 1,250 tons in New Jersey. However, Maryland chose to only allocate about 2,200 of its CSP allowances, while New Jersey allocated about 5,000 fewer allowances than the budget authorized in the NO_X SIP call. New Jersey is using a smaller budget to ensure that local areas will reach attainment with the ozone standard. While sources in Maryland and New Jersey acquired allowances from sources in other states to comply with the program in 2003, emissions in all states, including Maryland and New Jersey, were significantly lower than 2002 levels.

OTC States in the NO_X Budget Trading Program: Ozone Season NO_X 1990 and 2000 Baselines, Budget, and 2003 Emissions

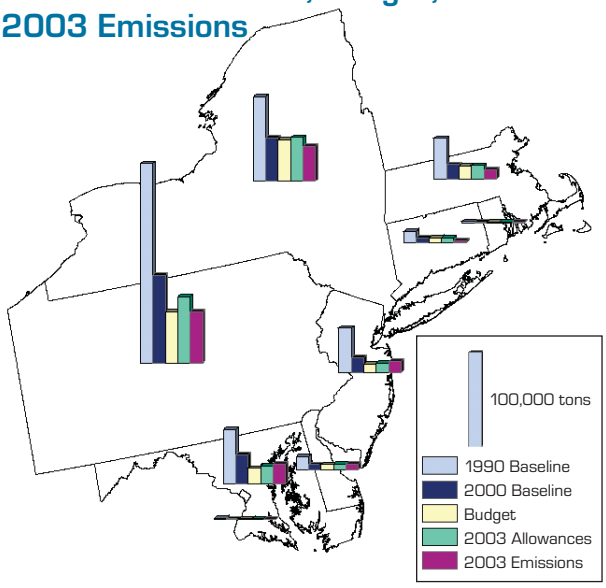


Figure 8
NO_X emissions from NBP units in the 2003 ozone season in the OTC region were below allocations.

Source: EPA

[8] Note that the information available in the non-OTC states excludes several North Carolina units that did not monitor in 2003. The reported emissions for North Carolina in 2003 reflect roughly 90 percent of the total ozone season emissions for affected sources, so the reductions from baseline levels shown in Figure 7 still generally hold even if all North Carolina sources had reported ozone season emissions in 2003.

Other NBP States Will Need to Reduce Emissions in 2004

In 2003, ozone season emissions were substantially lower than the 1990 and 2000 baseline levels even for the states that did not begin to comply with the program until 2004. Figure 9 shows budget levels for 2004 and beyond in these states. A comparison of 2003 emissions with 2004 budgets demonstrates that some additional reductions will be necessary for these states to eventually reach their budgets.

Due to litigation, the 2004 control period for these states began on May 31, instead of May 1. The allowance allocations for 2004, however, are based on a full five-month ozone season. Because of the shorter control period in 2004 and CSP allowances distributed in 2004 to help sources comply with the program, EPA anticipates that these states will have to achieve only modest reductions in 2004 to comply with the program. In 2005 and subsequent years, the control period will begin on May 1, and deeper reductions will be necessary.

Non-OTC States in the NO_X Budget Trading Program: Ozone Season NO_X 1990 and 2000 Baselines, Budget, and 2003 Emissions

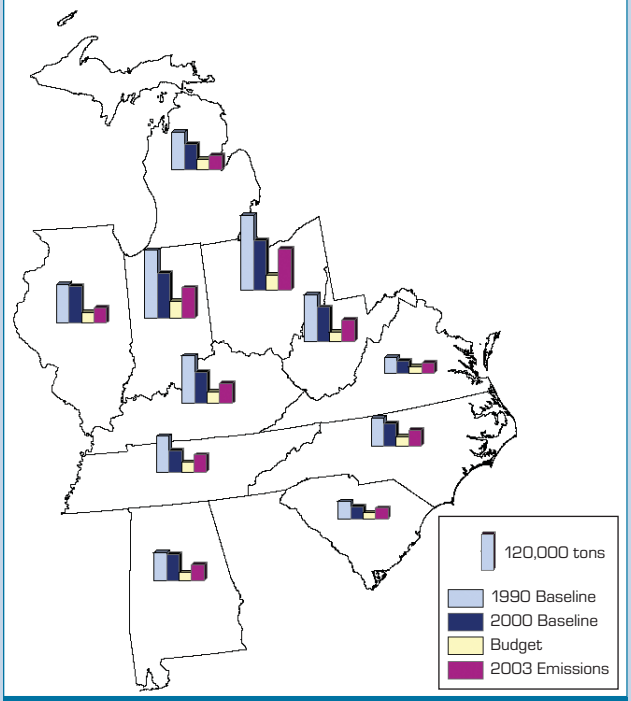


Figure 9
In the non-OTC states, 2003 ozone season NO_X emissions were far below 1990 and 2000 baseline levels, although further reductions will be necessary in 2004 to achieve compliance.

Source: EPA

Daily Emission Trends in OTC States Continue to Show Significant Decreases

Studies indicate that many of the health effects associated with ozone are attributable to short, peak exposures. The ozone standard was developed to protect against such short-term exposures. The NBP, however, is a seasonal program that ensures significant average regional NO_X reductions in the ozone season, and there have been concerns that a seasonal cap would not sufficiently reduce short-term, peak NO_X emissions that may occur on hot, high electricity demand days, when ozone formation often is a concern.

In the OTC states, the data from the OTC trading program in 1999 through 2002 and the NBP results for 2003 indicate that these trading programs have reduced average daily emissions, as well as the highest daily NO_X emissions in the ozone season. Average daily emissions and highest daily emissions from affected units declined significantly in 2003 as sources began to comply with the NBP (see Figure 10). This decline provides evidence that a seasonal trading program can

reduce peak daily emission levels. Although ozone formation is a complicated process that is strongly influenced by the weather, reducing peak daily emissions is expected to help reduce peak ozone concentrations.

These findings are consistent with a 2003 analysis of OTC emissions during ozone episodes between 1999 and 2002.[9] The study found that, while NO_X emissions from OTC sources tended to be higher during ozone episodes, these emission increases were related to increased electricity demand, and such increases would also have occurred even under a rate-based or command and control program. That study found that plant operators did not change or relax control strategies during high ozone periods.

Daily Ozone Season Emission Trends for Former OTC Trading States Only*

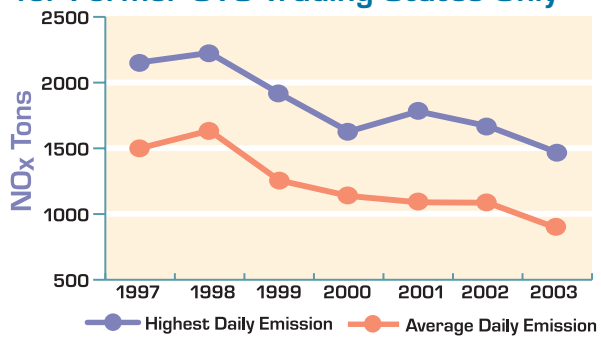


Figure 10
Emissions data for NBP units show that daily emissions have been reduced, even on the days with the highest emissions.

*1997 and 1998 data for Acid Rain Program units only; 1999-2003 data represent those units plus all other affected units.

Source: EPA

Emissions Reductions Were Achieved Despite Increases in Generation in the Control Region

Under a cap and trade program, there are many ways that sources can reduce emissions. One method is to utilize units with high emissions less and to shift generation to lower-emitting units within the program or to sources that are not affected by the program. For example, a plant operator could choose to run a unit with high emissions less often. The generation could be taken up by a lower emitting unit at the plant, by a plant outside of the control region that would not be affected by the program, or by a generator in another sector of the power industry (e.g., a new gas-fired unit). In the NBP, if generation shifts to units upwind of the control area with high rates of NO_X emissions, ozone would be transported into the region and the effectiveness of the program would be reduced. In 2003, with only a portion of the NBP states complying with the program, the potential for this type of shifting was a concern.

For the 2002 ozone season, OTC sources reported 1.6 million mmBtu of heat input. In 2003, that number increased to 1.7 million mmBtu. By comparison, heat input for Acid Rain Program units in non-OTC states declined from 4.9 million mmBtu in 2002 to 4.7 million mmBtu in 2003.

Heat input is the heat derived from the combustion of fuel in electric generation. It is a way to track utilization of affected units. Heat input levels from affected sources in the OTC states increased between 2002 and 2003 without the addi-

[9] Farrell, Alex. (2003) Temporal Hotspots in Emission Trading Programs: Evidence from the Ozone Transport Commission's NO_X Budget. Presented at Market Mechanisms and Incentives: Applications to Environmental Policy Conference. Washington, D.C.

tion of a significant number of sources. This indicates that, on average, sources in the OTC region were able to increase their generation while still complying with the NBP. Meanwhile, in the non-OTC NBP states, total heat input levels declined between 2002 and 2003 (based on data available for Acid Rain Program units only). While some sources in the OTC may have shifted their generation to sources in non-OTC states in response to the first year of the NBP, it appears that this generally was not a preferred compliance strategy. Sources in the OTC appear to have achieved the emission reductions from 2002 levels through means other than reducing utilization of affected sources and increasing power generation outside the region.

Sources Achieved a High Rate of Compliance in 2003

Under the NBP, sources must hold sufficient allowances to cover their ozone season emissions each year. Sources can maintain the allowances in compliance accounts (established for each unit) or in an overdraft account (established for each facility).[10] The overdraft account allows greater flexibility in "bubbling" between units, managing banked allowances from previous years, managing transferred allowances from other sites, or managing allowances purchased from other NBP participants. The sources have a two-month window after the end of the control period to move allowances between accounts (and buy or sell additional allowances) so that they can ensure their emissions do not exceed allowances held. Once that period ends, allowances may not be transferred into or out of these accounts while EPA reconciles emissions with allowance holdings and identifies the appropriate allowance deductions from the accounts for program compliance.

Nearly all of the NBP sources that participated in 2003, both EGUs and industrial units, held sufficient allowances to cover their emissions at the time that EPA performed reconciliation. There were seven sources that had allowance deficiencies (a total of 75 allowances). In cases where the source does not hold enough allowances to cover their emissions, the program requires a penalty deduction (3 allowances for each excess ton of emissions) from these sources' allocations for the next control period. Figure 11 summarizes the allowance reconciliation process for 2003.

NO_x Allowance Reconciliation Summary in 2003 (OTC States Only)

Total Allocated 2003 Allowances	**162,152**
Allowances Held in Compliance and Overdraft Accounts	148,938
Allowances Held in Other Accounts*	13,214
Allowances Deducted for 2003 Emissions	**133,659**
Banked Allowances**	**28,493**
Allowances Held in Compliance and Overdraft Accounts	15,279
Allowances Held in Other Accounts*	13,214
Penalty Allowances Deducted* (from future year allowances)**	**225**

* Other Accounts refer to general accounts in the NO_x Allowance Tracking System (NATS) that can be held by any source, individual or other organization, and state accounts.
** Does not reflect take back of 1,315 allowances by Pennsylvania for underutilization of specific sources.
*** These penalty deductions are made from future vintage year allowances, not 2003 allowances.

Figure 11

Source: EPA

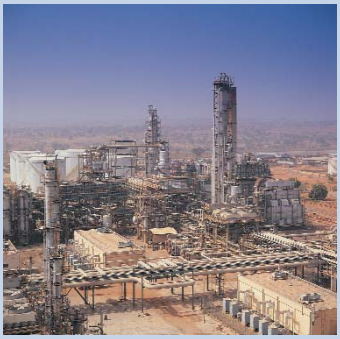
[10] New Jersey does not use overdraft accounts.

Market Activity, Banking, and Compliance Costs

At the start of a cap and trade program, it is worthwhile to evaluate how different components of the program are beginning to perform because a new market is becoming established, new sources are beginning to comply with the program, and many sources are facing more stringent requirements than ever before. This section examines some of these features, including how the NO_X allowance market is maturing, how sources are complying with the monitoring requirements, and what types of control technologies sources are beginning to install to meet long-term program requirements.

A Healthy Market in NO_X Allowances Continues under the NO_X Budget Trading Program

Allowance transfer activity can involve three main types of transfers:



- Transfers to or from the state as allowance allocations or allowance surrenders;
- Transfers within a company or between related entities (holding company transfers to an operating subsidiary, for example); and
- Transfers between separate economic entities. These transfers are categorized broadly as "economically significant trades."

In 2003, economically significant trades represented approximately 40 percent of the total transfers between entities other than a state. The economically significant trades provide the strongest indicator of true market activity because they represent an actual exchange of assets between unaffiliated participants.

Since 2003 is the first year of the NO_X Budget Trading Program (NBP), there are no previous data for all participating states to which the volume of trades can be accurately compared. The 2003 trading activity was higher than any year under the Ozone Transport Commission (OTC) program, and EPA expects a significant increase in 2004 as more sources comply with the program. As in the OTC trading program, industrial sources have actively traded allowances, and industrial sources represent about 8 percent of the economically significant trades at this time.

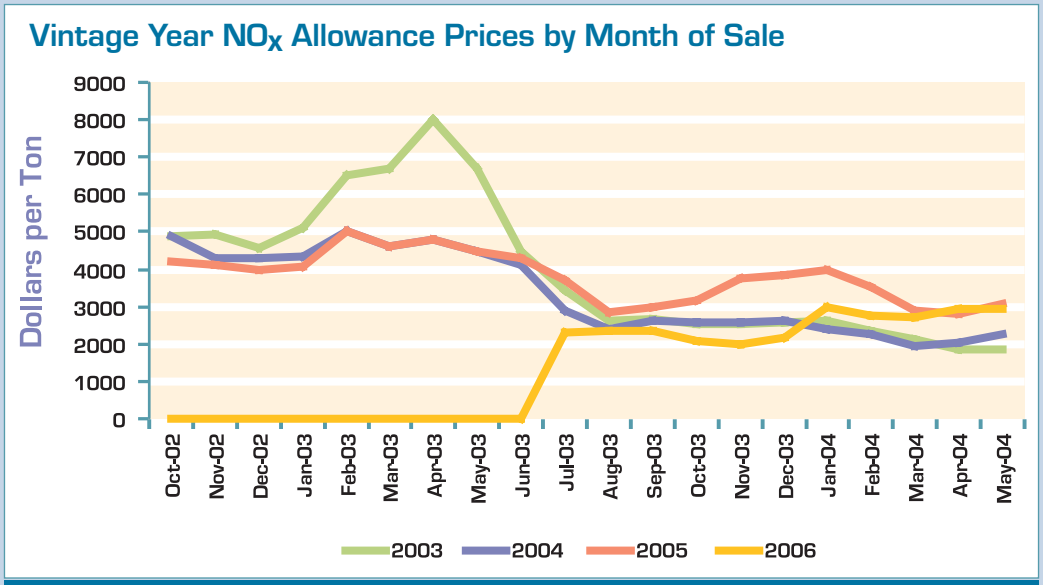


Figure 12
NBP allowance prices have fallen sharply after some early price spikes.

Source: Evolution Markets, LLC and Cantor Environmental Brokerage

The price for NO_X allowances continues to fluctuate as companies evaluate ongoing trends in control installations, energy demand, and other factors that affect the overall costs of control under the NBP. Recent prices are down appreciably from early 2003 (see Figure 12). This suggests that, as the program progresses and the uncertainty of allowance availability decreases, further price reductions may occur. This result is consistent with price behavior observed during implementation of the OTC trading program.

There may have been other factors that account for the drop in allowance prices. Uncertainty of natural gas prices may have led to higher allowance prices early in 2003. Prices then may have dropped due to increases in the supply of allowances. Extra allowances were available because CSP allowances were given for early reductions and because the start of compliance in the 2004 season was delayed from May 1 to May 31.

Banking Occurred in 2003 but Did Not Trigger Flow Control

Under the NBP, banking provisions allow companies to decrease emissions more than required early in the program, and save unused allowances for future use. This creates an economic incentive for sources to achieve deeper reductions early in the program. Banking allows for earlier environmental and health benefits and provides a pool of allowances available to address unexpected events or smooth the transition into deeper emission reductions.

If sources use a large number of banked allowances in one year, the elevated emissions could potentially reduce the environmental effectiveness of the NBP. The NBP's "progressive flow control" provisions were designed to discourage extensive use of banked allowances in a particular ozone season. Flow control is triggered when the total number of allowances banked for all sources exceeds 10 percent of the total budget for the next year. When flow control is triggered, EPA calculates the flow control ratio by dividing 10 percent of the total budget by the number of banked allowances (a larger bank will result in a smaller flow control ratio). The resulting flow control ratio indicates the percentage of banked allowances that can be deducted from a source's account in a ratio of one allowance per ton of emissions. The remaining percentage of banked allowances, if used, must be discounted and deducted at a rate of two allowances per one ton of emissions.

Because emissions were below allowable levels in the first year of the NBP, participating sources banked over 28,000 allowances, nearly 18 percent of the allowances they were allocated in 2003. Banking of greater than 10 percent of allowances would normally trigger flow control. However, in 2003, only the OTC states participated in the NBP control requirements. Given the entry of many additional states in 2004, the overall regional budget grew substantially, above 500,000 tons. Therefore, the number of allowances in the bank is less than 10 percent of the budget and flow control will not apply in 2004. If the broader universe of sources bank a comparable percentage of allowances in 2004, however, flow control is likely to be triggered in 2005.

Why No Flow Control in 2004?

Total number of banked allowances/Total NO_X Budget for 2004 season =

28,493/506,068 = 0.06

Because ratio is < 0.10, flow control is not triggered.

Nearly All Sources in NBP States Began Monitoring and Reporting in 2003

NBP units are required to comply with monitoring provisions specified in the Code of Federal Regulations (40 CFR Part 75, subpart H). The original focus of Part 75 was on electric generating units (EGUs), but EPA has broadened the rule over time to encompass industrial combustion units as well. The industrial units affected under the NBP have successfully met these monitoring requirements as part of their NBP compliance efforts.

Several options are available for NBP units to meet their monitoring requirements. These options are based on the type of unit, the type of fuel combusted, its operating status, and its level of emissions. NBP units are generally required to use a NO_X continuous emission monitoring system (CEMS). CEMS sample, analyze, and directly measure flue gas components on an ongoing basis. In addition to measuring NO_X concentration, units also must measure heat input to

calculate NO_X mass. To calculate heat input, any unit can use a stack flow CEMS, but oil- and gas-fired units instead can use fuel flow meters under Part 75. In addition to the basic NO_X CEMS option, alternative methods of quantifying NO_X emissions are available for certain types of units or for monitoring systems that meet specific criteria, including:

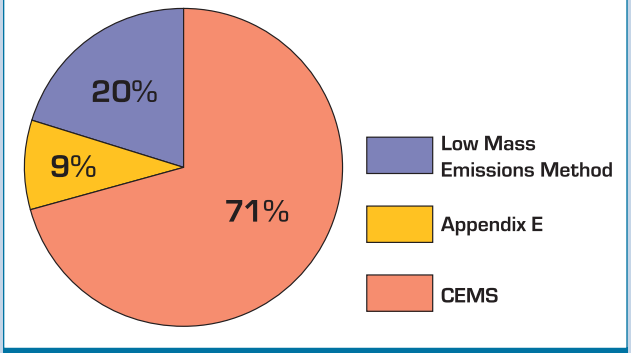


Figure 13
The vast majority of NBP units use NO_X Continuous Emission Monitoring Systems (CEMS) to comply with the monitoring requirements.

Source: EPA

- Part 75, Appendix E, which may be used only by gas and oil-fired peaking units (i.e., units that operate principally when electricity demand is at its highest). Under Appendix E, the NO_X emission rates and the heat input rate for the peaking unit are determined at a minimum of four loads covering the unit's operating range, and the test results are used to establish a correlation curve. Then, when the unit is running during the ozone season, NO_X emission rates are estimated based on the values on the curve that correspond to the unit's measured heat input rates. These Appendix E units all use fuel flow meters to measure heat input under Appendix D so that they do not use any CEMS.

- The low mass emissions (LME) methodology in section 75.19, which allows certain small or infrequently-operated gas and oil-fired units to use conservative fuel-specific default emission rates and estimates of hourly heat input to calculate the hourly NO_X emissions.

- Other monitoring alternatives approved by EPA on a case-by-case basis (subpart E).

As Figure 13 shows, of all the NBP units that are currently operating and that have submitted a monitoring plan, the majority (71 percent) use a NO_X CEMS to comply with the monitoring requirements (these units also use either a stack flow CEMS or Appendix D fuel flow meters to calculate heat input). Nine percent use Appendix E (with fuel flow meters), and 20 percent use the LME methodology. Less than 1 percent (only 4 units) currently use an approved alternative monitoring system under subpart E.

In general, although many units use the non-CEMS monitoring options, the highest emitting sources tend to use CEMS. About 96 percent of all ozone season emissions can be attributed to units that use CEMS as a monitoring method (see Figure 14).

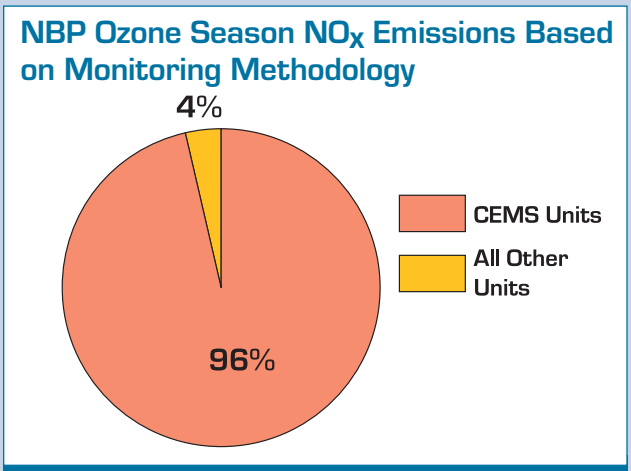


Figure 14
Units with a CEMS account for nearly all of the ozone season NO_X emissions.

Source: EPA

Sources Are Investing in NO_X Controls for Many Units

To meet the emission reduction targets of the NBP, sources can choose from a variety of compliance options. These options include decreasing generation from units that emit NO_X, modifying the basic combustion process to control the formation of NO_X, optimizing boiler operation to minimize NO_X production, using add-on controls, or purchasing allowances from other market participants. Sources can use any one or a combination of these options in a way that best fits their own circumstances.

To meet the NO_X emission limits of the Acid Rain Program, many electric generating units installed combustion controls, including low NO_X burner and overfire air technologies, which modify the combustion process to reduce formation of NO_X from the nitrogen present in the boiler combustion air and fuel. Advances in combustion control technologies continue to provide a cost-effective means of reducing emissions even further for many units.

Add-on control technologies, such as selective catalytic reduction (SCR) or selective non-catalytic reduction (SNCR), are frequently applied for NO_X control. SCR is typically used on larger units in the power sector that can achieve significant emission reductions in a highly cost-effective way. SCR and SNCR are control technologies that achieve NO_X reductions by injecting ammonia (or urea for SCR) into the flue gas within or downstream of the combustion unit to react with NO_X, forming nitrogen and water. SCR uses a catalyst to improve the efficiency of NO_X removal and to allow reactions to occur in a lower temperature range. For units that cannot use other methods to control NO_X, reburning of gas or coal is also an option. In this technique, gas or coal is injected downstream of the primary combustion zone to remove NO_X.

EPA analyses in support of recent NO_X reduction initiatives assume a 90 percent reduction efficiency for SCR on coal-fired boilers (down to 0.06 lb/mmBtu) and an 80 percent reduction efficiency for oil and gas units. For SNCR, EPA assumes a 35 percent reduction for coal-fired boilers and a 50 percent reduction for oil and gas units.[11]

[11] Documentation of EPA Modeling Applications (v2.1) Using the Integrated Planning Model, U.S. EPA, EPA 430/R-02-004, March 2002.

Sources report pollution control information, including installation dates, in monitoring plans submitted to EPA. EPA examined these data to determine which units had installed controls. While it is difficult to isolate the reason that a source installed a control, EPA assumed that most, if not all, installations in the last few years that were not in response to other programs (such as New Source Review permitting for new facilities or the Ozone Transport Commission trading program) were likely to be in response to the NO_X Budget Trading Program. Based on that review, there appear to be 75 coal-fired units that report using SCR controls to meet the NBP requirements. Nineteen coal-fired units (only 4 of which are industrial units) appear to have installed SNCR for the NBP. Most of this activity has been in states outside the OTC region, which will require the most significant reductions to meet the NBP requirements. However, since October 2002, when the OTC program was replaced by the NBP, sources in the OTC states have installed SCR controls on 5 units with approximately 4,300 MW capacity, and SNCR on 5 units with about 300 MW capacity. These data indicate that the implementation of the NBP appears to have been an impetus for many units to reduce their NO_X emissions through the use of add-on controls, especially in the states where significant reductions are needed to comply with the NBP.

The combined megawatt capacity of the add-on control installations implemented to meet the NBP requirements is over 47,000 MW (out of over 270,000 MW capacity for affected EGUs in the NBP region).

Ozone Levels Are Decreasing and NO_X Reductions Will Help States Meet the Ozone Standards

Ozone Levels Have Been Decreasing In Most Areas since 1990

EPA released a report on ozone trends in April 2004, finding that ozone levels nationwide were lower in 2003 than they have been since 1980 (The Ozone Report: Measuring Progress through 2003, www.epa.gov/airtrends/ozone.html). EPA's Ozone Report concluded that ozone improvements in 2003 were primarily due to favorable weather conditions across many parts of the nation. In addition, national NO_X and volatile organic carbon (VOC) emissions were at their lowest levels since 1970, due to successful programs controlling NO_X and VOCs.

Figure 15 shows national trends in the fourth highest daily maximum 8-hour ozone concentration (ppm, parts per million) from 1990 to 2003. Nationally, this measure of ozone exposure has been reduced by 9 percent since 1990.

In the East, many metropolitan areas have exhibited an overall improvement in ozone levels since 1990. In most areas, a temporary increase in ozone levels occurred during the mid-1990s, but this increase was followed by decreases in ozone levels beginning in 1998. The improvement in ozone levels in the late 1990s corresponds temporally with reductions in NO_X emissions from stationary sources (mainly through the annual NO_X requirements under

National 8-Hour Ozone Air Quality Trend, 1990-2003, Based on 3-Year Rolling Averages of Annual Fourth Highest Daily Maximum Ozone Concentrations

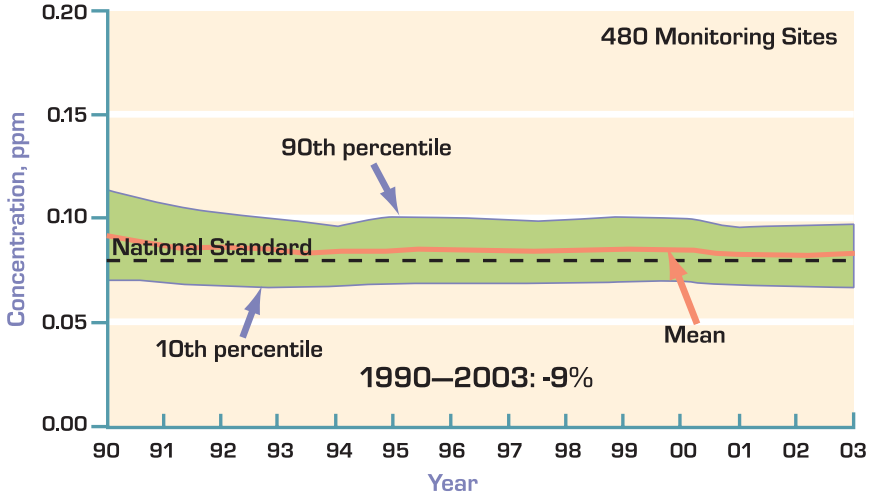


Figure 15
National ozone levels have decreased from 1990 to 2003.

*Black line indicates 8-hour ozone standard. Green band indicates the range of ozone levels from 1990 to 2003.

Source: EPA

the Acid Rain Program and the ozone-season NO_X reductions in the OTC states), along with the NO_X and VOC reductions from mobile sources that occurred during this time period.

A closer look at trends in measured ozone values on a regional level shows differences in progress made since 1990 in the NO_X Budget Trading Program (NBP) states. Figure 16 shows trends in fourth highest daily maximum 8-hour ozone concentration in EPA Regions that include NBP states. The greatest progress in reducing ozone concentrations since 1990 in the NBP states was achieved in the Northeast and Mid-Atlantic states (Regions 1 through 3). This may be partly due to the NO_X reductions achieved by the Ozone Transport Commission (OTC) states from 1999 through 2003. Region 1 (13 percent decrease from 1990 levels) and Region 2 (11 percent decrease) reduced ozone concentrations greater than the national average, while Region 3 (7 percent decrease) has significantly decreased ozone concentrations. Regions 4 and 5 had reductions in ozone concentrations of 6 percent but had lower ozone levels in 1990 and, therefore, less room for improvement. Even small improvements in ozone concentrations, however, are expected to result in substantial benefits to public health when a large population is exposed.

Trend in Fourth Highest Maximum 8-Hour Ozone Concentration (ppm) by EPA Region (1990-2003)

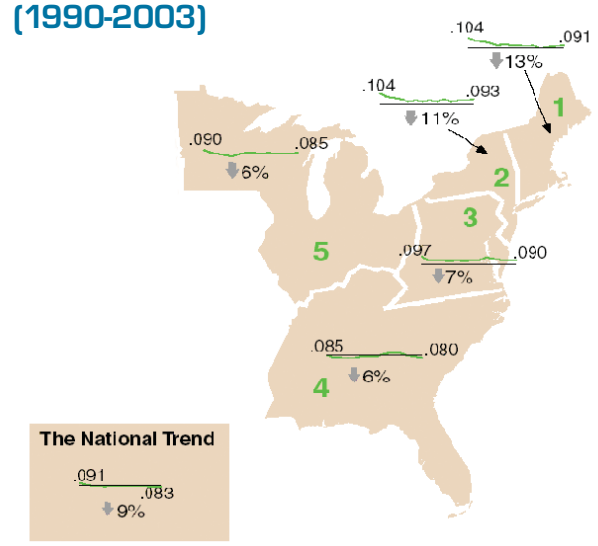


Figure 16
Ozone levels have decreased significantly from 1990 to 2003, especially in the northeastern United States.

*Black line indicates 8-hour ozone standard. Green line indicates ozone levels in the region from 1990 to 2003.

Source: EPA

Additional NO_X Reductions Will Help States Meet the Ozone Standards

Despite improvements in ozone air quality in many areas of the country, ozone continues to be a pervasive air pollution problem, with nearly 159 million people still living in 474 counties across the nation that are in nonattainment areas that do not meet the 8-hour ozone standard. The reductions anticipated under the NBP will help reduce emissions of NO_X and improve air quality.

New national mobile source regulations will also help local areas meet the 8-hour ozone standard by reducing NO_X from heavy-duty diesel engines, highway vehicles, and other mobile sources. Finally, to address the regional component of the residual ozone nonattainment problem, as well as the year-round problems of fine particles, regional haze, and acid deposition, EPA recently proposed the Clean Air Interstate Rule, which by 2015 would reduce annual NO_X emissions from the power industry in 29 eastern states and the District of Columbia by approximately 64 percent from 2002 levels.

Conclusions

When fully implemented, the NO_X Budget Trading Program (NBP) is expected to achieve a significant reduction in ozone season NO_X emissions across much of the eastern U.S. In 2003, affected sources already had reduced ozone season emissions by over one million tons from the estimated 1990 baseline levels and by over 400,000 tons from 2000 ozone season levels, even though the first control period in many states was not until 2004. In the Ozone Transport Commission (OTC) states where 2003 represented the first control period, sources emitted almost 20 percent below the required 2003 budget levels and more than 30 percent below their emissions in 2002. Of the total affected population of approximately 1,000 units, all but seven were in compliance. These achievements occurred despite a small increase in total heat input (plant utilization) in the affected OTC region.

Additional sources joined the program on May 31, 2004, and most of these sources already have at least one year's experience with NBP monitoring and reporting. The review of control data shows that many sources have been actively engaged in installation of pollution control equipment to achieve additional emission reductions. The NO_X allowance market remains active and allowance prices appear to have stabilized from early price spikes. Meanwhile, ozone levels have decreased in the past two decades, although ozone nonattainment remains a persistent problem. The NBP, along with additional control programs being proposed or implemented, should help address this problem. EPA will continue to evaluate all of these issues as additional NBP states begin the control requirements of the program in 2004.

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