

## Section 2 — Changes in Emissions

To assess the effectiveness of the NO<sub>x</sub> Budget Trading Program (NBP) in 2005, this section compares nitrogen oxides (NO<sub>x</sub>) emission levels in 2005 to levels in 1990 and 2000 (baseline years), and 2003 and 2004. These results include emissions from affected sources in states included in the NBP (see Figure 3).

### Ozone Season NO<sub>x</sub> Reductions under the NO<sub>x</sub> Budget Trading Program

Figure 5 shows the total ozone season NO<sub>x</sub> emissions for all affected sources in the NBP region in 2005 compared to 1990, 2000, 2003, and 2004. In 2005, NBP sources emitted about 530,000 tons of NO<sub>x</sub>, reducing emissions by about 11 percent from 2004, 57 percent from 2000, and 72 percent from 1990.

Many of the NO<sub>x</sub> reductions since 1990 are a result of programs implemented under the Clean Air Act such as the Acid Rain NO<sub>x</sub> Reduction Program and other state, local, and federal pro-

#### Baseline Years for Measuring Progress under the NO<sub>x</sub> Budget Trading Program

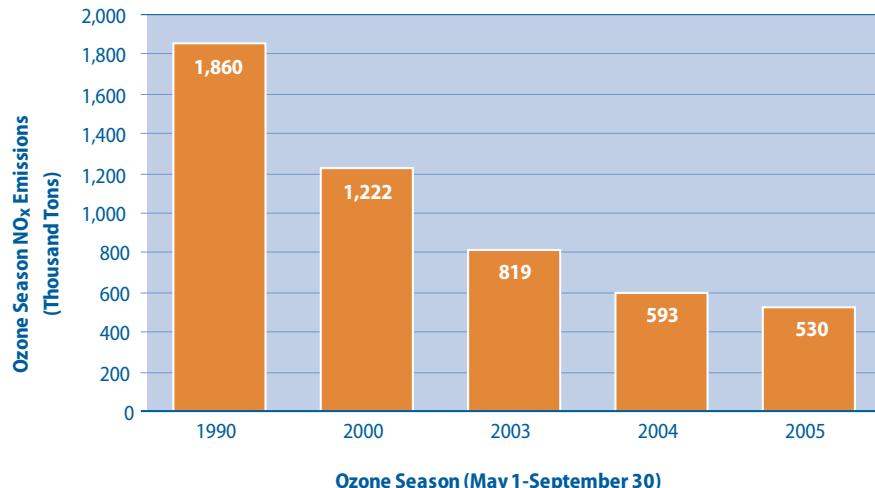
EPA has chosen two baseline years for measuring progress under the NBP:

- **1990**, which represents emission levels before the implementation of the 1990 Clean Air Act Amendments.
- **2000**, because most of the reductions due to the implementation of earlier NO<sub>x</sub> 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.

grams. The significant decrease in NO<sub>x</sub> emissions after 2000 largely reflects reductions achieved by the Ozone Transport Commission (OTC) and NBP.

NO<sub>x</sub> emissions in 2005 were lower than in 2004, despite a 7 percent increase in total heat input as sources continue to reduce average NO<sub>x</sub> emission rates, expressed as pounds of NO<sub>x</sub> emitted per

**Figure 5: Ozone Season Emissions under the NO<sub>x</sub> Budget Trading Program**



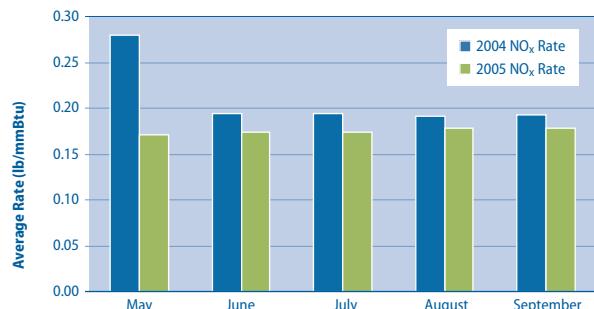
Source: EPA

## What Is Heat Input?

Heat input is the heat derived from the combustion of fuel in a unit. It is a simple way to track ozone season power generation or utilization of affected units. The overall ozone season heat input to affected NBP sources increased by about 7 percent between 2004 and 2005, although there was no significant change in the number of NBP sources. However, despite the increase in ozone season power generation in 2005, NBP sources still achieved substantial NO<sub>x</sub> emission reductions (11 percent).

million Btu of heat input (lb/mmBtu). Figure 6 shows the average monthly emission rates for the 2004 and 2005 ozone seasons. The average rate decreased each month when comparing 2004 to 2005, with the most notable reductions occurring in May. Between the 2004 and 2005 ozone seasons, emission rates in May dropped almost 39 percent. This sharp decline occurred primarily

**Figure 6:** Comparison of Average Monthly NO<sub>x</sub> Emission Rates in the NO<sub>x</sub> Budget Trading Program, 2004 and 2005



**Source:** EPA

because sources in the non-OTC states did not have to comply until May 31, 2004. Excluding May, the average emission rate decreased each month during the 2005 ozone season by 0.02 lb/mmBtu, or almost 10 percent from 2004.

**Table 1:** Comparison of 2003, 2004, and 2005 Ozone Season NO<sub>x</sub> Emissions, Heat Input, and NO<sub>x</sub> Emission Rates in the NO<sub>x</sub> Budget Trading Program

| Units by Fuel Type | Ozone Season NO <sub>x</sub> Emissions (tons) |                  |                  | Ozone Season Heat Input (mmBtu) |                       |                       | Ozone Season NO <sub>x</sub> Emission Rate (lb/mmBtu) |      |      |
|--------------------|---|------------------|------------------|---------------------------------|-----------------------|-----------------------|---|------|------|
|                    | 2003  | 2004             | 2005             | 2003                            | 2004                  | 2005                  | 2003  | 2004 | 2005 |
| Coal               | 770,000<br>(94%)                              | 548,000<br>(93%) | 475,000<br>(90%) | 4.72 billion<br>(84%)           | 4.71 billion<br>(83%) | 4.90 billion<br>(81%) | 0.33  | 0.23 | 0.19 |
| Oil                | 25,000<br>(3%)                                | 25,000<br>(4%)   | 32,000<br>(6%)   | 260 million<br>(5%)             | 260 million<br>(5%)   | 310 million<br>(5%)   | 0.19  | 0.19 | 0.21 |
| Gas                | 24,000<br>(3%)                                | 20,000<br>(3%)   | 23,000<br>(4%)   | 590 million<br>(11%)            | 690 million<br>(12%)  | 840 million<br>(14%)  | 0.08  | 0.06 | 0.05 |
| Total              | 819,000                                       | 593,000          | 530,000          | 5.57 billion                    | 5.66 billion          | 6.05 billion          | 0.29  | 0.21 | 0.18 |

**Notes:**

- The NO<sub>x</sub> tons are rounded to the nearest 1,000 tons and the heat input values are rounded to the nearest 10 million mmBtus. Totals represent the sum of the rounded values. The 2003 through 2005 data represent the full ozone season, May 1 to September 30, for each year.
- The average emission rate is based on dividing total reported ozone season NO<sub>x</sub> emissions for each fuel category by the total ozone season heat input reported for that category. The average emission rate expressed for the total is the heat input weighted average for the three fuel categories.

**Source:** EPA

## Ozone Season Generation and Emission Reductions by Fuel Type

Table 1 provides the total emissions and heat input for NBP units by fuel type for the 2003, 2004, and 2005 ozone seasons. Coal-fired units accounted for all of the emission reductions from 2004 to 2005, decreasing emissions by about 73,000 tons. The majority of these reductions (about 67,000 tons) came from coal-fired units that operated add-on controls during the 2005 ozone season (see Section 4, Compliance and Market Activity).

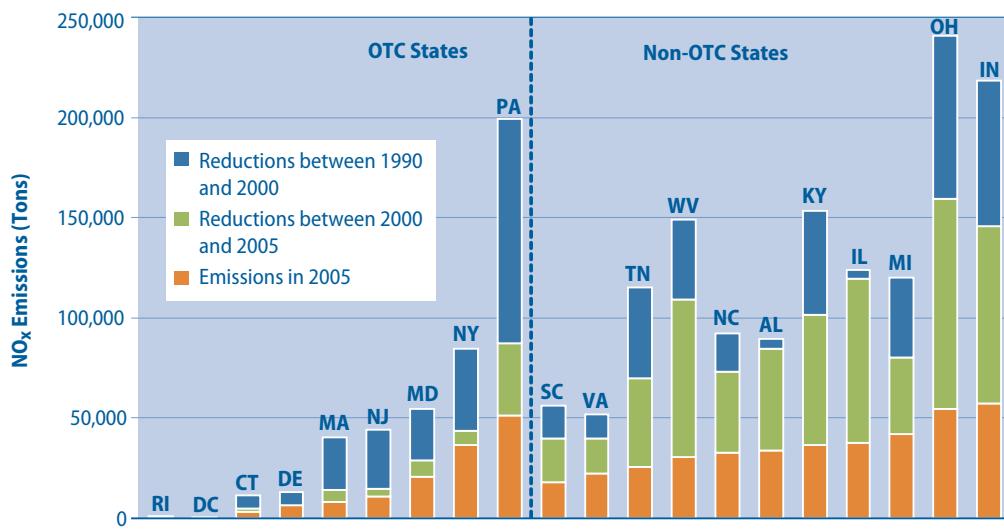
The most dramatic result is the continued decrease in NO<sub>x</sub> emission rates leading to these reductions for coal-fired units, despite an increase in heat input from these units between 2004 and 2005. The largest increase in heat input came from oil-fired and gas-fired units, which increased emissions by about 10,000 tons between 2004 and 2005 largely due to increased utilization.

## State-by-State Reductions

The NBP states have achieved significant reductions in ozone season NO<sub>x</sub> emissions since the baseline years 1990 and 2000 (as shown in Figure 7). All states have achieved reductions since 1990 as a result of programs implemented under the Clean Air Act Amendments, with many states reducing their emissions by more than half since 1990. The decrease in NO<sub>x</sub> emissions after 2000 largely reflects reductions achieved by the OTC and NBP.

While the NBP achieved an 11 percent decrease in NO<sub>x</sub> emissions overall from 2004 to 2005, Figure 8 shows that the emission reductions from 2004 to 2005 varied somewhat from state to state. Given that 2005 was the first full ozone season compliance period for states outside the OTC, those states saw the most significant reductions from 2004.

**Figure 7: NO<sub>x</sub> Budget Trading Program State-by-State Ozone Season NO<sub>x</sub> Emission Reductions from 1990 and 2000**

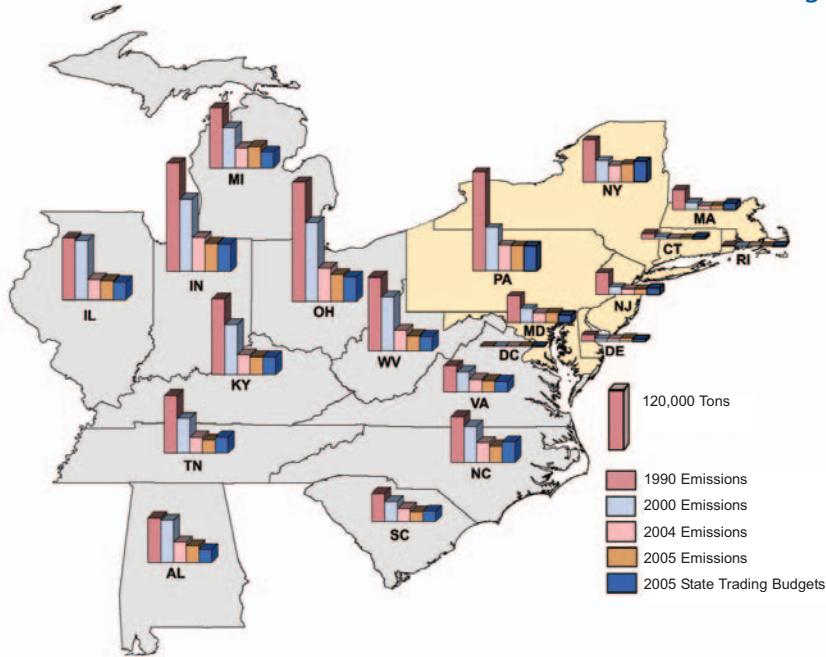


**Notes:**

- Because emissions in the District of Columbia and Delaware increased between 2000 and 2005 by approximately 146 and 1,282 tons, respectively, there is no green bar shown in the figure for those states.
- For each state, the total bar (i.e., the sum of the orange, green, and blue stacked bars) depicts emissions in 1990. The sum of the green and orange stacked bars depicts emissions in 2000, and the orange bar depicts emissions in 2005.
- Results in Alabama and Michigan represent ozone season emissions from only the affected portion of each state (see Figure 3).

Source: EPA

**Figure 8: NO<sub>x</sub> Budget Trading Program Ozone Season**  
**NO<sub>x</sub> Emissions from 1990, 2000, 2004, and 2005, and 2005 State Trading Budgets**

**Notes:**

- The non-OTC states are shaded in gray; OTC states are shown in yellow.
- Results in Alabama and Michigan represent ozone season emissions from only the affected portion of each state (see Figure 3).

**Source:** EPA

Eight states (Connecticut, Massachusetts, New Jersey, New York, North Carolina, Rhode Island, South Carolina, Tennessee) had ozone season emissions below their trading budgets in 2005 (see Figure 8 and Table 2). Three of these states, Connecticut, Massachusetts, and Rhode Island, were below their trading budgets by at least 30 percent. Emissions in eight other states (Alabama, Illinois, Indiana, Kentucky, Ohio, Pennsylvania, Virginia, and West Virginia) remained above their trading budgets. However, all of these states reduced emissions from 2004 levels, and most were within 1 to 6 percent of their respective budgets. In addition, Indiana, Ohio, and West Virginia accounted for more than 50 percent of the total reductions from 2004 to 2005 (about 35,000 tons).

### Cap and Trade: Guaranteed Environmental Results

Cap and trade programs deliver results with a mandatory cap on emissions while providing sources flexibility in how they comply. Cap and trade programs have proven highly effective in reducing emissions from multiple sources on a regional or larger scale. The mandatory cap on emissions is critical to protect public health and the environment and to sustain that protection into the future. Under cap and trade programs, affected sources are allocated authorizations to emit in the form of emission allowances, but the total number of allowances cannot exceed the cap. The cap also serves to provide stability and predictability to the allowance trading market.

**Table 2:** NO<sub>x</sub> Budget Trading Program Ozone Season  
NO<sub>x</sub> Emissions for 1990, 2000, 2004, and 2005, and 2005 State Trading Budgets

| State                   | 1990 Emissions (tons) | 2000 Emissions (tons) | 2004 Emissions (tons) | 2005 Emissions (tons) | 2005 State Trading Budgets (tons) |
|-------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------------------|
| CT                      | 11,203                | 4,697                 | 2,194                 | 3,022                 | 4,477                             |
| DC                      | 576                   | 134                   | 36                    | 280                   | 233                               |
| DE                      | 13,180                | 5,256                 | 5,066                 | 6,538                 | 5,227                             |
| MA                      | 40,367                | 14,324                | 7,483                 | 8,276                 | 12,861                            |
| MD                      | 54,375                | 28,954                | 19,943                | 20,988                | 15,466                            |
| NJ                      | 44,359                | 14,630                | 10,796                | 11,163                | 13,022                            |
| NY                      | 84,485                | 43,583                | 34,161                | 36,645                | 41,350                            |
| PA                      | 199,137               | 87,329                | 52,172                | 51,135                | 50,843                            |
| RI                      | 1,099                 | 288                   | 177                   | 222                   | 936                               |
| <b>OTC States</b>       | <b>448,781</b>        | <b>199,195</b>        | <b>132,028</b>        | <b>138,269</b>        | <b>144,415</b>                    |
| AL                      | 89,758                | 84,560                | 40,564                | 33,631                | 25,497                            |
| IL                      | 124,006               | 119,460               | 40,976                | 37,829                | 35,557                            |
| IN                      | 218,333               | 145,722               | 68,375                | 57,260                | 55,729                            |
| KY                      | 153,179               | 101,601               | 40,394                | 36,734                | 36,224                            |
| MI                      | 120,132               | 80,425                | 39,848                | 42,264                | 31,247                            |
| NC                      | 92,059                | 73,082                | 39,821                | 32,943                | 41,547                            |
| OH                      | 240,768               | 159,578               | 67,352                | 54,358                | 49,499                            |
| SC                      | 56,153                | 39,674                | 25,354                | 18,196                | 19,678                            |
| TN                      | 115,348               | 69,641                | 31,399                | 25,721                | 31,333                            |
| VA                      | 51,866                | 40,043                | 25,443                | 22,309                | 21,195                            |
| WV                      | 149,176               | 109,198               | 41,333                | 30,408                | 29,043                            |
| <b>Non-OTC States</b>   | <b>1,410,778</b>      | <b>1,022,984</b>      | <b>460,859</b>        | <b>391,653</b>        | <b>376,549</b>                    |
| <b>Total NBP States</b> | <b>1,859,559</b>      | <b>1,222,179</b>      | <b>592,887</b>        | <b>529,922</b>        | <b>520,964</b>                    |

**Note:** Results in Alabama and Michigan represent ozone season emissions from only the affected portion of each state (see Figure 3).

**Source:** EPA

The District of Columbia, Delaware, Maryland, and Michigan had 2005 ozone season NO<sub>x</sub> emissions that exceeded both the state trading budgets and 2004 emission levels. Delaware, Maryland, and Michigan had emission increases of 1,472, 1,045, and 2,416 tons above 2004 emission levels, respec-

tively. The District of Columbia's emissions tend to fluctuate greatly from year to year as the affected electric generating units provide peaking power to meet seasonal demand (as opposed to more consistently operating base load units). After 2000, the District of Columbia's NO<sub>x</sub> emissions have

remained low at less than 300 tons per ozone season. State-specific factors have strongly affected NO<sub>x</sub> emissions in these states. For example, Delaware experienced a significant jump in both heat input and emissions, primarily associated with two plants. In Maryland, three plants were responsible for over 65 percent of NO<sub>x</sub> emissions in 2005, and emission controls are planned at these plants in upcoming years as required by a federal consent decree and recently passed state legislation.<sup>2</sup> In Michigan, while emissions increased 6 percent from 2004, heat input increased 9 percent during 2005 — the largest increase within the non-OTC region.

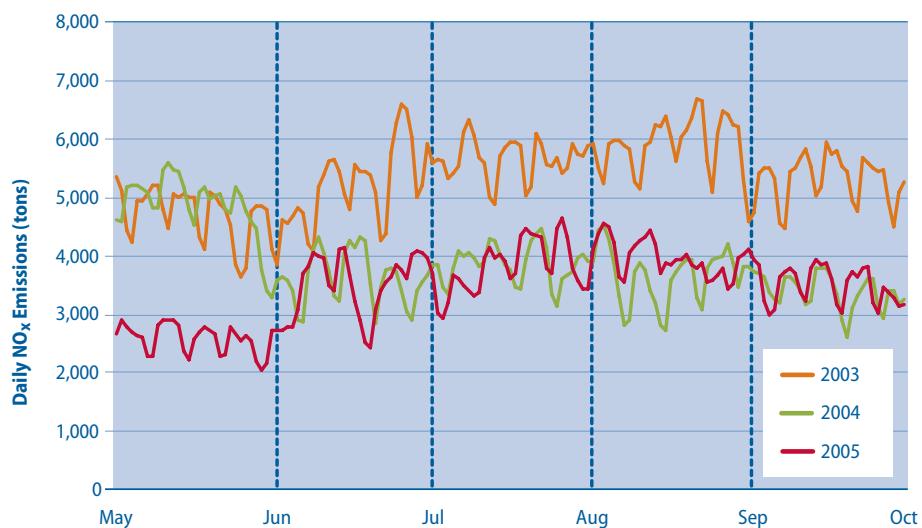
## Daily Emission Trends

Studies indicate that many of the health effects associated with ozone are linked to daily exposure. EPA developed the 8-hour ozone standard to protect against such exposure. Although the NBP ensures significant regional NO<sub>x</sub> reductions throughout the course of the ozone season, there

have been concerns that a seasonal cap would not sufficiently reduce short-term, peak NO<sub>x</sub> emissions that can occur on hot, high electricity demand days.

In practice, the NBP has had a significant impact on daily emissions since the program began in 2003. Figure 9 compares daily NO<sub>x</sub> emissions during 2003, 2004, and 2005 for the NBP region. In 2005, daily NO<sub>x</sub> emission levels for June through September remained comparable to those in 2004. NO<sub>x</sub> emissions in May 2005 decreased nearly 47 percent from May 2004, illustrating the significant reductions achieved by the non-OTC states as they began participating in the program on a full ozone season basis.

**Figure 9: Comparison of Daily NO<sub>x</sub> Emission Levels, 2003–2005**



**Source:** EPA

<sup>2</sup> By 2008, under a federal consent decree, one of the companies with affected units in Maryland will be required to cap emissions from three Maryland plants and one Virginia plant to 6,150 tons per ozone season. The emissions cap in this consent decree should reduce emissions from existing plants in Maryland well below budget levels. The emissions from these four plants totaled over 14,800 tons in the 2005 ozone season. In addition, Maryland recently passed legislation, the Healthy Air Act, which will further lower future NO<sub>x</sub> emissions.