

**POLLUTION CONTROL STRATEGIES
IN THE
NORTHEAST AND MID-ATLANTIC STATES
TO CLEAN UP GROUND LEVEL OZONE:**

**PROGRESS TO DATE AND A LOOK
TOWARDS THE FUTURE**

September 1998

Ozone Transport Commission

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EXECUTIVE SUMMARY

Ground level ozone, the primary constituent in photochemical smog, has been a major problem in the Northeast and Mid-Atlantic States. Ozone is a regional problem because ozone and the pollutants that cause ozone can move over large distances over State lines. States therefore need to work together to develop regional solutions.

Under the Clean Air Act, States must develop plans, known as State Implementation Plans, or SIPs, which document the emission control measures used to meet the health-based ozone standards. The States, in cooperation with the Ozone Transport Commission (OTC), a commission created to address ozone transport in the Northeast/Mid-Atlantic region, have done more to reduce ozone on a multi-state basis than any other region in the country outside of California. Over the last twenty years or more, numerous pollution reduction strategies have been developed and implemented for stationary sources of air pollution and motor vehicles in the Northeast/ Mid-Atlantic region. In addition, in contrast to most other areas of the country, most of these strategies have been implemented Statewide. It is now projected that the region will be able to meet the original health-based ozone air quality standard, but only if EPA's recent proposal to reduce nitrogen oxides (NO_x) emissions across the eastern United States is finalized.

With the completion by the U.S. Environmental Protection Agency (EPA) of a new health-based ozone air quality standard in July 1997, there are now two ozone air quality standards. The new standard is averaged over eight hours of ozone readings. It is expected to be more difficult to reach than the older standard, averaged over one hour of ozone readings. The next phase of emission reductions will be focused on attainment of this new standard. The Northeast and Mid-Atlantic States are prepared to study what more may be needed to reach this goal and take the necessary next steps.

In summary:

- Northeast and Mid-Atlantic States have generally implemented more types of emission reduction measures than States elsewhere in the country, other than California, to clean up their own ground-level ozone (smog) problems. Unlike most other States of the country, these measures have generally been implemented Statewide, as opposed to just individual metropolitan areas.
- These measures are producing pollution reductions now, and will produce even more in the future. By the year 2007, a 43% reduction in NO_x emissions is projected for the region compared to 1990;
- Meeting the first of two health-based ozone air quality standards in the region depends on EPA's proposal to reduce NO_x emissions being implemented throughout the eastern United States as originally proposed.
- Northeast and Mid-Atlantic States are willing to do more to reduce air pollution, and will evaluate possible new pollution control strategies to reach the new ozone air quality standard.

BACKGROUND

Air pollution control in the United States is based on a Federal-State partnership. The Federal government, specifically the U.S. Environmental Protection Agency (EPA) is responsible for setting health-based air quality standards. The States are responsible for putting together air quality plans, known as State Implementation Plans, or SIPs, which document how States will meet the health-based air quality standards.

The Northeast and Mid-Atlantic States have long had air quality readings which periodically exceed the ozone air quality standard, and have undertaken extensive efforts to address the problem. Ground level ozone is the primary constituent in smog, and has been shown to be a regional problem throughout the eastern United States. Under the Clean Air Act, which was last amended in 1990, Northeast and Mid-Atlantic States must implement a number of specific emission reduction strategies. Unlike areas outside the Northeast and Mid-Atlantic States, many of these strategies are required to be implemented Statewide. These States have also cooperated in developing additional regional measures to reduce the transport of ozone through the Ozone Transport Commission (OTC), a regional commission created by Congress in 1990.

With EPA's revision of the health-related air quality standards in July 1997, there are two air quality standards for ozone. The original standard is known as the "one-hour" standard, while the new standard is known as the "eight-hour" standard, to represent the amount of time that is used to come up with an average air quality level. The new eight-hour standard will likely require somewhat greater emission reductions than the one-hour standard, but additional time is allowed for meeting the new standard in order to implement additional air pollution control measures.

Even with all of the emission control efforts of the Northeast and Mid-Atlantic States, air quality analysis has shown that attainment of the one-hour standard is not possible without reducing ozone and pollutants that cause ozone that are transported from other States. Since 1994, the OTC has called on EPA for action to reduce the transport into its region. Initiated by the Environmental Council of States (ECOS), the Ozone Transport Assessment Group (OTAG), a group of representatives from government, industry, environmental groups, and others, met during 1995, 1996, and 1997, to develop recommendations to EPA on how to deal with the ozone transport phenomenon in the eastern United States. OTAG's recommendations in July 1997 were followed by a formal proposal by EPA for reductions in emissions of nitrogen oxides (NO_x) over 22 States and the District of Columbia. This proposal, which is known as EPA's "SIP call," because EPA is planning to call for revisions to the SIPs from the affected States, is supposed to be finalized by EPA in September 1998.

This report was developed to document the completion of one major phase of air pollution clean-up in the Northeast and Mid-Atlantic States, and the beginning of another, in anticipation of EPA's final SIP call. This report includes information on the specific actions taken by the States within the Northeast and Mid-Atlantic region to make this possible. This success also underscores the importance of putting EPA's proposal into effect with regional emission reductions at the level and at the time proposed by EPA.

SUMMARY OF CONTROL MEASURES IMPLEMENTED BY NORTHEAST AND MID-ATLANTIC STATES

Under Section 184(a) of the Clean Air Act, a control region known as the "Ozone Transport Region" or OTR was established. Included within this region were Connecticut, Delaware, the District of Columbia, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont, and that part of Virginia within the Washington, DC, Consolidated Statistical Metropolitan Area (CMSA).

Included here as Attachment 1 is a summary of all of the control measures that are being implemented within the region. Many of these measures are required statewide across the States of the region, as opposed to being implemented in specific metropolitan areas in other States. These measures include the following:

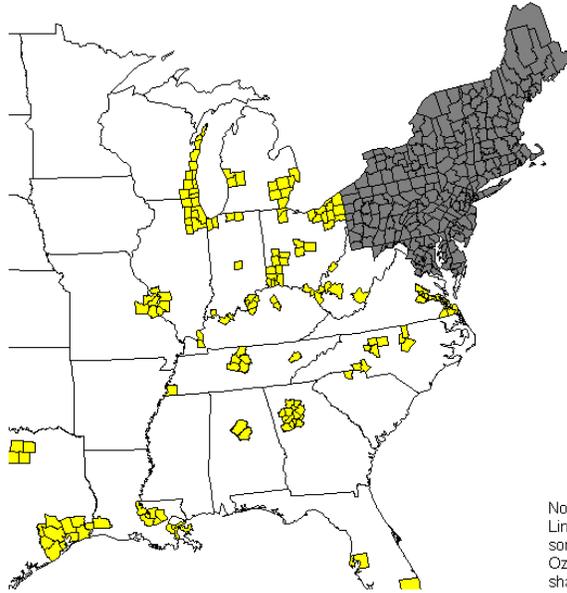
- all urban measures required explicitly under the Clean Air Act required of other States as well;
- all regional measures required explicitly under the Clean Air Act not required of other States, including stringent review of new stationary sources;
- regional measures needed for one-hour standard attainment developed under OTC agreements; and
- additional urban and Statewide measures adopted on a State-by-State basis to contribute towards attainment of the one-hour standard.

Figure 1 provides a geographical portrayal of where emission controls for ozone has been implemented in the eastern United States, and contrasts the regional approach of the OTR with the metropolitan approach of other areas.

This list of control measures documents efforts that go well beyond what has been done in other areas. Measures that reduce emissions from motor vehicles (mobile source controls) illustrate this point. For example, reformulated gasoline is being implemented throughout the Northeast Corridor, from the Northern Virginia suburbs of Washington, D.C., all the way into northeastern New England. In addition, a number of States have been in the forefront of efforts to control volatile organic emissions from automobiles, by restricting gasoline volatility in the last 1980s, and by installing "Stage II" vapor recovery for vehicle refueling at gasoline stations. Also, new Low Emission Vehicle (LEV) programs, both regionally and in individual States, are providing cleaner cars to the region than are available in other parts of the country outside of California.

These measures complement measures, such as motor vehicle inspection/maintenance (I/M), which are explicitly required by the Clean Air Act. States with ozone nonattainment problems are required to implement upgraded I/M programs. (Most States in the OTR have been implementing basic I/M programs since the 1970s or 1980s.) Many of these upgraded programs are already operating, and legislation or other plans are in place for other new programs. Full implementation is expected within two years.

FIGURE 1
Emission Control Areas in the Eastern U.S.



Note:
Limited NO_x controls are required on some utility power plants outside the Ozone Transport Region (darker shaded area). However, NO_x waivers have been granted in many of the lighter shaded areas, removing the requirement for Clean Air Act NO_x controls in these areas.

REDUCING REGIONAL EMISSIONS OF NITROGEN OXIDES (NO_x) AND THE DEVELOPMENT OF EPA'S PROPOSAL TO REDUCE NO_x OVER THE EASTERN UNITED STATES

Many initial State emission reduction measures were intended to reduce volatile organic compounds (VOC) emissions. VOC emissions have been identified as contributing to the ozone generated in urban areas. As a result of actions taken in the 1970s, 1980s, and 1990s, virtually every major point source of VOC in the Northeast and Mid-Atlantic States is now controlled. Additional scientific information has confirmed the key role of regional emissions of nitrogen oxides (NO_x) in generating ozone regionally. The Northeast and Mid-Atlantic States have been in the forefront of this effort as well. For example, 11 States and the District of Columbia agreed in September 1994 to an Ozone Transport Commission Memorandum of Understanding (MOU) to dramatically cut the emissions of NO_x from major stationary sources. The provisions of this agreement, known as the OTC NO_x MOU, are summarized in Attachment 2.

Technical analyses have long shown that the Northeast and Mid-Atlantic States could not realistically meet the original one hour ozone standard without reducing ozone and emissions that cause ozone which are transported into the region. Other regions faced a similar problem in late 1994. As indicated above, at the request of the OTC and many others, EPA supported State formation through ECOS formation of the Ozone Transport Assessment Group (OTAG), which met for two years from 1995 to 1997. OTAG confirmed in great detail the role of regional NO_x emissions in ozone formation and transport.

Since OTAG's recommendations for regional NO_x reductions were made in July 1997, EPA has relied heavily upon its analysis and conclusions. In particular, EPA's proposal for major NO_x reductions in November 1997 across the eastern United States was based largely upon the work of OTAG. If finalized with the emission reductions and timing originally proposed, EPA's SIP call will provide significant reductions in ozone and the pollutants causing ozone which are transported into the Northeast and Mid-Atlantic States.

MEETING THE ONE-HOUR OZONE STANDARD AND THE ROLE OF EPA'S PROPOSAL

This combination of reductions from inside and outside the Northeast and Mid-Atlantic States has enabled EPA and States to project eventual attainment of the one-hour ozone air quality standard by the dates required by the Clean Air Act. By the end of this month, most States within the region are expected to have submitted documentation of how the one-hour standard can be met. This is a major milestone, and indicates that it is now possible to look ahead to implementation of key measures already identified, and how to meet the new eight-hour standard finalized by EPA in July 1997.

These measures are already providing important emission reduction benefits, and are projected to produce even more in the future. Including implementation of EPA's SIP call (which is roughly equivalent to the last phase of the OTC NO_x MOU for stationary sources), Figures 2 through 4 show that expected NO_x emission reductions in the year 2007 are projected to be about 43% within the OTR. Based on data from OTAG, percentage reductions of VOC emissions also are also expected to be about 43%.

FIGURE 2
1990 NO_x Emissions in the OTR
10,452 Tons/Day

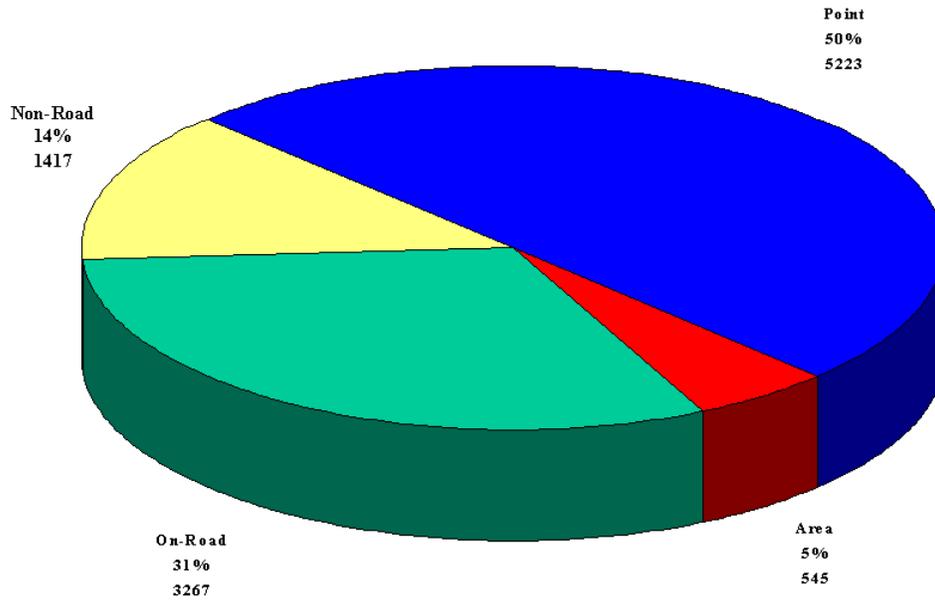


FIGURE 3
2007 NO_x Emissions in the OTR
5,987 Tons/Day

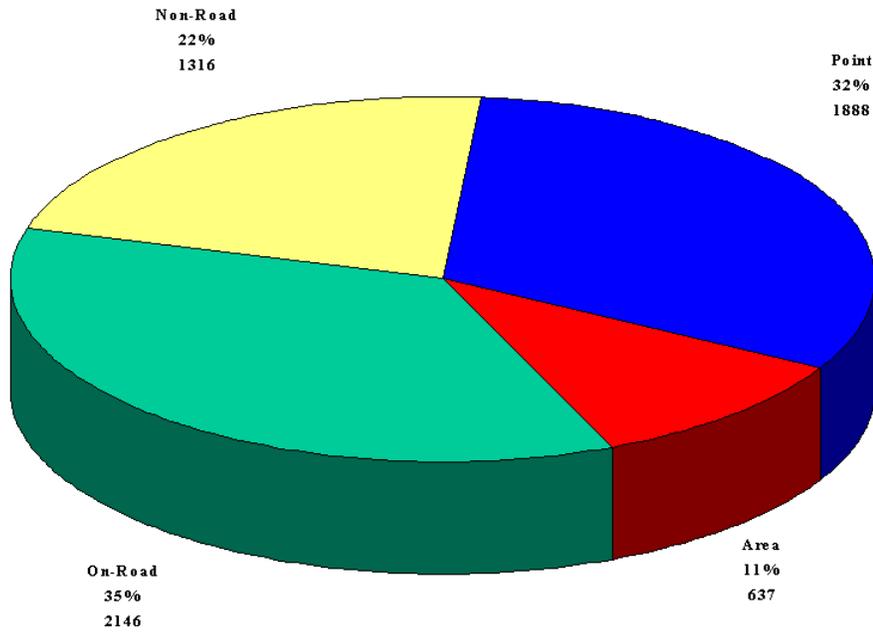
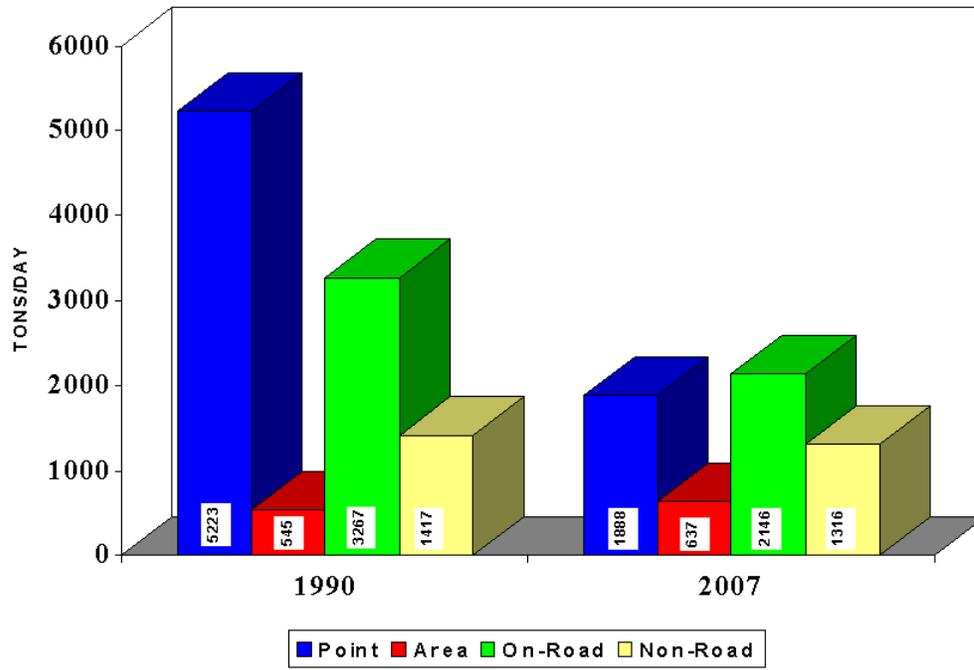


FIGURE 4
NOx Emissions in the OTR



One important caveat needs to be made. Meeting the one-hour standard depends on the reductions outside the Northeast and Mid-Atlantic States included in EPA's proposal. Delay in emission reductions, or weakening of EPA's proposal would ensure that levels of unhealthy air over the one-hour standard would continue to exist in the region.

A recent analysis ("The Costs of Ozone Transport: Achieving Clean Air in the East," Northeast States for Coordinated Air Use Management, July 1998) underscores not only the practical imperative to reduce emissions outside the region, but also the economic benefits. This analysis noted that there would be an additional \$1.4-\$3.9 billion cost in the region just to compensate for transport from outside regional boundaries if EPA's proposal were not implemented. Moreover, the analysis concluded that on the basis of available emissions data,

"Simply stated, there are not enough feasible reductions left in the (region) to reach ozone attainment ... (if) transport (is not significantly reduced). Therefore, it is not a choice between reduction from upwind sources and additional reductions from sources within the (region). Both are needed."

It is therefore critical that EPA's proposal be implemented in its original form, without any weakening delay.

THE NEW EIGHT-HOUR STANDARD

As indicated above, the new eight-hour standard is anticipated to require at least the level of emission reductions as are needed for the one-hour standard and probably more. EPA's SIP call therefore is also expected to provide a foundation for attaining the eight-hour standard as well as the one-hour standard.

Figure 3 shows the relative emissions of NO_x throughout the Ozone Transport Region (OTR) expected in 2007. While new modeling and air quality analysis targeted at the eight hour standard will be needed to determine the level of additional emission reduction needed locally, additional NO_x reductions (and possibly additional VOC emission reductions) will be needed.

States utilize emission inventory data such as that provided in Figure 3 to begin to prioritize where additional emission reductions may need to come from. Based on Figure 3, the three largest source categories are:

- On-road gasoline motor vehicles;
- On-road and off-road diesel vehicles (diesel vehicles are a significant contributor to both on-road and off-road portions of Figure 3); and
- Point sources.

With respect to the first category (and possibly part of the second), EPA has already indicated that they intend to move forward with "Tier 2 emission standards," to be proposed in 1998, finalized in 1999, and effective as early as the 2004 model year. This is an important first step toward meeting the new eight-hour standard.

It is anticipated that more will be necessary though on a regional as well as national basis to meet the new standard, by addressing the source categories listed above. The Northeast and Mid-Atlantic States have started the complex process of strategy evaluation to meet this goal.

ATTACHMENT 1

**CONTROL MEASURES TO REDUCE
GROUND-LEVEL OZONE
IN THE NORTHEAST AND MID-ATLANTIC STATES**

Stationary Source Volatile Organic Compound Regulations

All of the stationary source control measures for volatile organic compounds (VOC) listed here have generally been done on a Statewide basis. Individual Northeast and Mid-Atlantic States have adopted and implemented most if not all of them. On a case-by-case basis, individual States have not adopted a few specific regulations if the emission reductions from these sources in the State would be negligible or if there are no such sources in the States.

STATIONARY SOURCE VOLATILE ORGANIC COMPOUND (VOC) CONTROL MEASURES

Federal VOC measures/State implemented

Group I CTG Rules

Bulk Terminals
Can Coating
Fabric Coating
Fixed Roof Storage Tanks
Flatwood Panel Coating
Gasoline Bulk Plants
Large Appliance Coating
Magnet Wire Coating
Metal Coil Coating
Metal Furniture Coating
Paper Coating
Petroleum Refinery Equipment
Petroleum Refinery Process
Solvent Metal Cleaning
Vinyl Coating
Auto/Light Duty Truck Coating

Group II CTG Rules

External Floating Roof Tanks
Gasoline Tank Trucks
Graphic Arts
Manufacturing of Pneumatic Rubber Tires
Manufacturing of Synthesized Pharmaceuticals
Miscellaneous Metal Parts
Perchloroethylene Drycleaning
Petroleum Refineries Leaks

Group III CTG Rules

Large Petroleum Drycleaners
Manufacturing of Polyethylene and Polystyrene
Fugitive Emissions Chem./Polymer/Resin Manufacturing
Natural Gas/Gas Processing Plant Leaks

Volatile Organic Compounds - State measures

Adhesives
Aerosol Paints
Aerospace Coatings
Aluminum Rolling Mills

Architectural and Industrial Coatings
Autobody Refinishing
Automobile Assembly
Bakeries
Barge & Tanker Operations
Batch Process
Clean-up Solvents
Coke By-Product Recovery Plants
Coke Oven Batteries
Comm. Ethylene Oxide Sterilization
Consumer & Commercial Products
Cutback Asphalt
Degreasing
Glass Forming
Highway Paints
Iron/Steel Foundries
Iron/Steel Industry/Sinter Plants
Landfill Gas Controls
Leather Surface Coating
Marina Gasoline Refueling
Marine Vessel Loading
Offset Lithography
Open Burning
Pesticides
 Agricultural
 Consumer
Pharmaceuticals
Plastic Parts
Publicly Owned Treatment Works
Pulp and Paper
Rule Effectiveness Improvement
Shipbuilding & Repair
Small Rotogravure
Stage I Vapor Recovery
Stage II Vapor Recovery
Synthetic Organic Chemical Manufacturing Industries (SOCMI) Air Oxidation
SOCMI Manufacturing
SOCMI Reactor & Distillation
Textile Finishing
Treatment/Storage/Disposal Facilities
Underground Storage Tank Vents
Volatile Organic Liquid Storage
Wastewater
Wood Products

Stationary Source Nitrogen Oxides Regulations

Rules for Reasonably Available Control Technology (RACT) for nitrogen oxides (NO_x) went into effect for existing sources in the summer of 1995. Implemented rules (I) for Phase II of the NO_x MOU mean that specific rules including budgets have been adopted or proposed to date; planned rules (PL) for Phase II are those that are anticipated for proposal in the fall of 1998. Full compliance is scheduled for May 1999. Lowest Achievable Emission Rate (LAER) and offset requirements have been required for new sources since late 1992.

PL=planned
 I=implemented
 N=no regulation
 NA=not applicable

NOx Stationary and Area Source Controls

	CT	DE	DC	ME	MD	MA	NH	NJ	NY	PA	RI	VT	NVA
NOx RACT Rules	I	I	I	I	I	I	I	I	I	I	I	I	I
OTC NOx MOU													
Phase II	I	I	PL	PL	I	I	I	I	PL	I	I	I*	
Phase III	PL	I	PL	PL	PL	PL							
NOx LAER	I	I	I	I	I	I	I	I	I	I	I	I	I
NOx Offsets (1.5:1)*	I	I	I	I	I	I	I	I	I	I	I	I	I
* Greater offset ratios apply in certain areas													
** Implemented by permit conditions													

Mobile Source Controls

The measures shown here are in addition to historical pollution controls implemented by both the States and the Federal governments. Included in programs that reduce mobile source emissions (both on-road and off-road) are:

Federal measures - Tier I vehicles (before initiation of LEV programs)
On-board vapor recovery
Heavy duty vehicle standards (on-road and off-road)
Recreational marine
General marine
Locomotives
Aircraft
Small engines

In most cases, these categories include both standards already implemented, and now, more stringent standards yet to be implemented. In addition, all States with major metropolitan areas are involved with "conformity" reviews, to ensure that their highway systems conform with State air quality plans.

With respect to State measures, many upgraded motor vehicle emissions inspection/maintenance (I/M) programs are now in operation, and all upgraded programs will be in operation within two years. On the attached matrix, those in operation are designated as "I," and those with legislation and other firm plans for implementation are designated as "PL." In addition to the measures listed on the matrix, Stage II vapor recovery for refueling of motor vehicles in gasoline stations has been implemented across the region in major metropolitan areas, and like I/M, in some States has been implemented statewide. LEV programs are always implemented statewide.

UR=under review
 PL=planned
 NLEV=National Low Emission Vehicle
 CLEV=California Low Emission Vehicle
 NA=not applicable

Mobile Source Controls

	CT	DE	DC	ME	MD	MA	NH	NJ	NY	PA	RI	VT	NVA
LEV	NLEV	NLEV	NLEV	CLEV	NLEV	CLEV	NLEV	NLEV	CLEV	NLEV	NLEV	CLEV	NLEV
Revised Light-Duty I/M	I	I	PL	PL	I	PL	PL	PL	I	I	PL	I	I
Federal Reformulated Gasoline	I	I	I	I	I	I	I	I	I	I	I	NA	I
Heavy-duty I/M	PL	UR	UR	PL	UR	PL	PL	I	PL	UR	UR	UR	UR

ATTACHMENT 2

**PROVISIONS OF THE
OZONE TRANSPORT COMMISSION
NITROGEN OXIDES (NO_x)
MEMORANDUM OF UNDERSTANDING (MOU)**

**MEMORANDUM OF UNDERSTANDING
AMONG THE STATES OF THE OZONE TRANSPORT COMMISSION
ON DEVELOPMENT OF A REGIONAL STRATEGY CONCERNING THE CONTROL OF
STATIONARY SOURCE NITROGEN OXIDE EMISSIONS**

WHEREAS, the States of the Ozone Transport Commission (OTC) face a pervasive problem in their efforts to attain the National Ambient Air Quality Standard (NAAQS) for ozone; and

WHEREAS, a 1991 National Academy of Sciences study on ground-level ozone indicates that a combination of reductions in emissions of volatile organic compounds (VOCs) and nitrogen oxides (NO_x) will be necessary to bring the entire Ozone Transport Region (OTR) into attainment by the statutory attainment dates; and

WHEREAS, modeling and other studies confirm that NO_x emission reductions are effective in reducing ozone formation and help to reduce ozone transport; and

WHEREAS, the States of the OTC are requiring major stationary sources of NO_x to implement reasonably available control technology (RACT); and

WHEREAS, by November 15, 1994, the States must submit attainment demonstrations to EPA as State Implementation Plan (SIP) revisions; and

WHEREAS, the implementation of RACT for the control of NO_x emissions will not be sufficient to enable all States in the OTR to reach attainment; and

WHEREAS, the undersigned States seek to develop an effective regional program to reduced NO_x emissions, which would be implemented in conjunction with other measures to control ozone precursors (including state-specific measures, regional measures and Federal measures required under the Clean Air Act); and

WHEREAS, these measures together may enable EPA to approve the States' SIPs and refrain from imposing sanctions that could restrict economic growth throughout the OTR; and

WHEREAS, information that the States have collected in their emissions inventories shows that large boilers and other large indirect heat exchangers are the source of a substantial portion of the NO_x emissions in the States, and will continue to be so after they implement RACT;

WHEREAS, the States intend to complete a reevaluation of stationary source controls for 2003 and beyond in 1997, based on results of EPA-approved models and other relevant technical data;

THEREFORE, the undersigned member States hereby agree to propose regulations and/or legislation for the control of NO_x emission from boilers and other indirect heat exchangers with a maximum gross heat input rate of at least 250 million BTU per hour; and

FURTHERMORE, that the States agree to propose regulations that reflect the difference in conditions in (i) the OTR's "Northern Zone" consisting of the northern portion of the OTR; (ii) the OTR's "Inner Zone" consisting of the central eastern portion of the OTR; and (iii) the OTR's "Outer Zone" consisting of the remainder of the OTR; and

FURTHERMORE, that to establish a credible emissions budget, the States agree to propose regulations that require enforceable specific reductions in NO_x emissions from the actual 1990 emissions set forth in each State's 1990 inventory submitted to EPA in compliance with § 182(a) (1) of the Clean Air Act or in a similar emissions inventory prepared for each attainment area (provided that for exceptional circumstances that a more representative base year may be applied to individual sources in a manner acceptable to EPA) subject to public notice; and

FURTHERMORE, that the States agree to develop a budget in a manner acceptable to EPA based on the principles above no later than March 1, 1995; and

FURTHERMORE, if such a budget is not developed by March 1, 1995, that the 1990 interim inventory used by EPA in its Regional Oxidant Model simulations for the 1994 OTC Fall Meeting will be used for the budget; and

FURTHERMORE, that the States agree to propose regulations that require subject sources in the Inner Zone to reduce their rate of NO_x emissions by 65 percent from base year levels by May 1, 1999, or to emit NO_x at a rate no greater than 0.2 pounds per million BTU; and

FURTHERMORE, that the States agree to propose regulations that require subject sources in the Outer Zone to reduce their rate of NO_x emissions by 55 percent from base year levels by May 1, 1999, or to emit NO_x at a rate no greater than 0.2 pounds per million BTU; and

FURTHERMORE, that the States agree to propose regulations that require sources in the Inner Zone and the Outer Zone to reduce their rate of NO_x emissions by 75 percent from base year levels by May 1, 2003, or to emit NO_x at a rate no greater than 0.15 pounds per million BTU; and

FURTHERMORE, that the States agree to propose regulations that require subject sources in the Northern Zone to reduce their rate of NO_x emissions by 55 percent from base year levels by May 1, 2003, or to emit NO_x at a rate no greater than 0.2 pounds per million BTU; and

FURTHERMORE, that the States agree to develop a regionwide trading mechanism in consultation with EPA; and

FURTHERMORE, that in lieu of proposing the regulations described above, a State may propose regulations that achieve an equivalent reduction in stationary source NO_x emissions in an equitable manner; and

FURTHERMORE, that the regulations for May 1, 2003 described above may be modified if (i) additional modeling and other scientific analysis shows that the regulations as

modified, together with regulations governing VOC emissions, will achieve attainment of the ozone NAAQS across the OTR, and (ii) this Memorandum of Understanding is modified to reflect those modeling results and other analysis no later than December 31, 1998; and

FURTHERMORE, that the States agree to propose regulations that are otherwise consistent with the attached recommendations of the OTC's Stationary/Area Source Committee; and

FURTHERMORE, that the undersigned States agree to request that the EPA Administrator determine whether the SIPs of States outside the OTR contain adequate provisions to prohibit the emission of air pollutants in amounts that will contribute significantly to nonattainment of a National Ambient Air Quality Standard (NAAQS) within the OTR, as required under 42 U.S.C. Section 110(a)(2)(D).

Signed September 24, 1994

(Two maps accompany this MOU showing the Ozone Nonattainment Areas in the OTR and the Zones for Regional NO_x Stationary Source Strategy).