State Implementation Plan

PLAN TO IMPROVE AIR QUALITY IN THE WASHINGTON, DC-MD-VA REGION

February 19, 2004

State Implementation Plan
"Severe Area SIP"

Prepared for:
District of Columbia Department of Health
Maryland Department of the Environment
Virginia Department of Environmental Quality
On behalf of the Metropolitan Washington Air Quality Committee

METROPOLITAN WASHINGTON COUNCIL OF GOVERNMENTS

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Demonstrating Rate of Progress for 2002 and 2005;
Revision to 1990 Base Year Emissions; and
Severe Area Attainment Demonstration
for the
WASHINGTON DC-MD-VA
NONATTAINMENT AREA

Prepared by:

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EXECUTIVE SUMMARY

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1.0 EXECUTIVE SUMMARY

The Clean Air Act Amendments of 1990 (CAAA or Act) represent an unprecedented commitment to protecting public health and the environment. Title I of the Act classifies areas that exceed national health-based air quality standards based upon the severity of their pollution problem (marginal, moderate, serious, severe, and extreme) and, accordingly, prescribes increasingly stringent measures that must be implemented and sets new deadlines for achieving the standards. The Act also establishes specific emissions reduction requirements to ensure that continual progress toward attainment is made.

High levels of ozone are a health problem. When it is breathed into the lungs, ozone reacts with lung tissue. It can harm breathing passages, decrease the lungs' working ability and cause coughing and chest pains; eye and throat irritation; breathing difficulties even for healthy individuals, but especially for those with respiratory problems such as allergies, asthma, bronchitis and emphysema; and greater susceptibility to respiratory infection.

Not only does ozone pose a threat to human health, but also it poses a threat to the health of natural ecosystems. Scientific evidence suggests that air pollution weakens the immune systems of many types of vegetation and can cause significant crop damage. In addition, rain and snow wash air pollution deposited on vegetation and architectural surfaces into the streams and rivers of the region and finally into the Chesapeake Bay.

This document, the Severe Area Attainment Plan for the Metropolitan Washington Nonattainment Area, is a plan to improve air quality in the Washington region to meet the national air quality standard for ozone (one-hour ozone standard). The Plan consists of two Rate of Progress demonstrations, for the period 1999-2002 and for the 2002-2005; and an attainment demonstration for 2005.

Additionally, the plan includes commitments by the states to meet requirements for severe nonattainment areas, commitments by the states to meet additional EPA requirements for the Washington region including a contingency plan for 1999 rate of progress, contingency plans for the 2002 and 2005 rates of progress, and an analysis of Reasonably Available Control Measures. The plan presents revised emissions inventories for 1990, 2002 and 2005 based on the MOBILE6 mobile emissions model, the revised travel demand model Version 2.1c, and includes technical corrections to the inventories.

The Severe Area Attainment Plan is intended to show the progress being made to improve air quality in the Washington nonattainment area and the efforts underway to assure that all necessary steps are taken to reach the federal health standard for ground-level ozone by 2005. The plan has been prepared by the Metropolitan Washington Air Quality Committee to comply with the Clean Air Act Amendments of 1990 and with EPA requirements for the Washington region as stated in EPA's reclassification of the Washington region (January 2003) and in EPA's conditional approval of the Metropolitan Washington region's State Implementation Plan (April 2003).

TABLE A
SUMMARY OF CONTROL STRATEGIES
VOC and NOx Benefits of Control Measures
(1990-2005)

		VOC Reductions tons/day		NOx Reductions tons/day	
Ref No.	***Control Measure***	***2002****	***2005*****	***2002****	***2005*****
POINT SOURCE MEASURES					
7.2.5	Non-CTG VOC RACT to 50 tpy	1.2	1.2	0	0
7.2.9	State NOx RACT and Regional NOx Transport Requirement	0	0	203.8	279.4
7.4.7	Expanded Non-CTG VOC RACT and State Point Source Regulations to 25 tons/yr	2.4	2.5	0	0
SUBTOTAL		**3.5**	**3.7**	**203.8**	**279.4**
AREA SOURCE MEASURES					
7.2.2	Stage II Vapor Recovery Nozzles	15.1	15.1	0	0
7.2.6	Phase II Gasoline Volatility Controls	2.6	2.3	0	0
7.3.1	Reformulated Surface Coatings	16.7	17.5	0	0
7.3.2	Reformulated Consumer Products	4.1	4.3	0	0
7.3.4	Reformulated Industrial Cleaning Solvents	0.9	1.0	0	0
7.3.5	Standards for Locomotive	0.0	0.0	2.9	3.1
7.4.3	Surface Cleaning/Degreasing for Machinery/Automotive Repair	4.1	4.4	0	0
7.4.4	Landfill Regulations	2.4	2.5	0	0
7.4.5	Seasonal Open Burning Restrictions	7.4	7.4	1.6	1.6
7.4.6	Stage I Expansion (Tank Truck Unloading)	1.5	1.6	0	0
7.4.8	Graphic Arts Controls	3.8	4.0	0	0
7.4.9	Auto body Refinishing	9.3	9.8	0	0
7.4.10	RESERVED				
7.4.11	Ozone Transport Commission (OTC) Portable Fuel Containers Rule	0.9	2.6	0	0
7.4.12	Ozone Transport Commission (OTC) Architectural and Industrial Maintenance Coatings Rule	12.3	12.3	0	0
7.4.13	RESERVED				
7.4.14	Ozone Transport Commission (OTC) Solvent Cleaning Operations Rule	9.0	9.0	0	0
SUBTOTAL		**90.2**	**93.6**	**4.5**	**4.7**
ON-ROAD MEASURES					
7.2.1	High-Tech Inspection/Maintenance				
7.4.1	Reformulated Gasoline (on-road)				
7.2.3	Federal "Tier I" Vehicle Standards and New Car Evaporative Standards	56.0	80.5	44.9	85.8
7.3.6	Heavy-Duty Diesel Engine Rule				
7.2.4	Tier 2 Motor Vehicle Emission Standards				
7.3.3	National Low Emission Vehicle Program				
7.5	Transportation Control Measures	0.3	0.3	0.5	0.7
SUBTOTAL		**56.3**	**80.8**	**45.4**	**86.5**

NON-ROAD MEASURES

7.2.7	EPA Non-Road Gasoline Engines Rule	22.2	26.6	0	0
7.2.8	EPA Non-Road Diesel Engines Rule	0	0	14.9	22.1
7.2.10	Emissions standards for spark ignition marine engines	1.3	3.1	0	0
7.2.11	Emissions standards for large spark ignition engines	0	0.6	0	0.5
7.4.2	Reformulated Gasoline (off-road)	2.7	2.9	0	0
SUBTOTAL		**26.2**	**33.3**	**14.9**	**22.6**

VOLUNTARY MEASURES (Multiple Source Sectors)

7.6	Voluntary Bundle	3.2	3.2	0.2	0.2

TOTAL REDUCTIONS	**179.4**	**214.7**	**268.7**	**393.3**

* Reductions included in the 2002 Rate of Progress demonstration, occurring between 1990 and January 2004.
** Reductions included in the 2005 Rate-of-Progress and attainment demonstrations, occurring between 1990 and November 15, 2005.

1.1 Background

In 1990 the Environmental Protection Agency (EPA) classified the Metropolitan Washington region as "serious" for ozone nonattainment and required the region to submit to the U.S. Environmental Protection Agency (EPA) revisions to the State Implementation Plans (SIPs) demonstrating how emissions that contribute to the formation of ozone will be reduced by 15% from 1990-1996 and by 3% per year until the area reaches attainment of the standards. The attainment date for the Washington region was November 15, 1999. The Washington region was also required to submit a demonstration, based upon an urban air quality model, to show that ozone concentrations would be reduced to levels below the federal standard by 1999.

The region did not meet the Clean Air Act Amendments deadline of November 15, 1999. Analysis suggests this was due to transported pollution from outside the region. The region's photochemical modeling results demonstrated the effect of transported pollution, which contributed from 20-30% of the pollution on the worst days of summer. EPA issued guidance in 1997 dealing with transported pollution based on photochemical modeling of 23-state region including the northeast, mid-Atlantic and Midwestern states conducted through the Ozone Transport Assessment Group. In January 2001 EPA granted the Washington region an extension of its attainment deadline to November 2005. On July 2, 2002, The U.S. Circuit Court of Appeals for the District of Columbia vacated EPA's extension and remanded the action to EPA in a ruling in *Sierra Club v. EPA*. The Court decided that EPA had a non-discretionary duty under the Clean Air Act to reclassify the region when it failed to attain the standard in November 1999.

In January 2003 EPA reclassified the Washington, DC-MD-VA nonattainment area as a "severe" nonattainment area.[i] As a severe nonattainment area for one-hour ozone National Ambient Air Quality Standard (NAAQS), the Washington region is required to meet the requirements defined in the Clean Air Act, Section 182 (d) and to attain the standard by November 15, 2005. April 17, 2003, EPA published a final rule to conditionally approve the Washington region's severe area SIP if the three states meet nine commitments to EPA.[ii] The commitments include adopting state regulations to meet CAA Section 182 (d) requirements for severe nonattainment areas and, in addition, to adopt a contingency plan for 1999 Rate of Progress, revise and submit an updated attainment demonstration that reflects revised MOBILE6-based motor vehicle emissions budgets, demonstrate 3 % per year rate of progress from 1999-2002 and from 2002-2005; adopt contingency measures for failure to make rate of progress in those periods, and submit an analysis of Reasonably Available Control Measures for the region.

The Severe Area Attainment Plan for the Washington nonattainment areas has been developed by the Metropolitan Washington Air Quality Committee (MWAQC) in cooperation with Maryland, Virginia and the District of Columbia. Table A identifies the Washington region's control measures to achieve the 18% additional emissions reduction, as required by the CAAA, which demonstrates steady progress in improving air quality by 2005.

Overall, the 2005 rate of progress plan for the Metropolitan Washington region may be summarized as follows:

- 279.4 tons per day of oxides of nitrogen (NOx) reductions and 3.7 tons per day of volatile organic compound (VOC) reductions through the regulation of point sources of pollution, such as factories and power plants;
- 93.6 tons per day of VOC reductions and 4.7 tons per day of NOx reductions from regulating area sources of pollution such as gasoline refueling, automobile repair, consumer products and printing operations;
- 80.8 tons per day of VOC reductions and 86.5 tons per day of NOx reductions from initiatives relating to cars and trucks, the "on-road" or "mobile" sources of pollution; and
- 33.3 tons per day of VOC reductions and 22.6 tons per day of NOx reductions from non-road sources such as lawn and garden equipment, heavy construction equipment and marine engines.
- 3.2 tons per day of VOC reductions and 0.2 tons per day of NOx reductions from voluntary measures spanning multiple source sectors.

1.2 The Ozone Problem

Of the six major air pollutants for which ambient air quality standards have been established under the Clean Air Act, the pollutant that has posed the most prevalent and perplexing problem for the Washington metropolitan area, and for many other American urban areas, is ozone, a principal component of "smog."

Why has the ozone problem been so difficult to solve? First, ozone is not discharged directly. It is formed in, and downwind of, urban areas when sunlight and high temperatures cause complex photochemical reactions to occur between emissions of volatile organic compounds (VOCs) and emissions of oxides of nitrogen (NOx). A number of diverse sources emit these ozone precursors. Major sources of VOC emissions include, but are not limited to, gasoline storage facilities, bakeries, gasoline refueling stations, printing facilities, motor vehicles, lawnmowers, consumer products, and boats. In addition, many species of plants emit VOCs. Principal sources of NOx, which is produced by combustion, include motor vehicles, construction equipment, fossil fuel-fired power plants, and open burning.

Second, the ozone problem is further complicated by the fact that weather conditions play a major role in the formation of ozone and in the severity of the problem. Solar energy drives the reactions that create ozone. When a warm air mass stays in one spot, and winds are calm, smog may stay in place for several days at a time creating severe ozone conditions. While it is not always possible to predict weather conditions that create severe ozone problems, more severe and prolonged episodes can be forecast.

Third, scientists are only beginning to understand how weather conditions, topography, and ozone precursors interact to create ozone. Originally, ozone control strategies focused on reducing VOCs. However, new evidence shows that NOx control is also necessary and, in fact, achieving attainment of the standards may be impossible without it. The complexity of the reactions that cause ozone requires reliance upon computer models of ozone formation to guide the region to the correct mix of VOC and NOx controls.

Fourth, given that smog travels across county and state lines, the ozone problem is regional. Therefore, solving the problem requires considerable coordination and consensus building on the part of local and state governments to develop regional emission control strategies. On the East Coast, governments from Maine to Washington, D.C. and Virginia are required under the Act to form the Ozone Transport Commission (OTC) in order to develop ozone control strategies on a regional basis. The OTC has developed additional point source NOx standards and low-emissions vehicle standards, which are intended to reduce ozone levels from Virginia to Maine.

The Ozone Transport Assessment Group (OTAG) worked to quantify and reduce the amount of ozone and its precursors, which move from one state to the next within the 37 eastern states. The work of OTAG led EPA to issue proposed rules, which require many of the eastern states to reduce those pollution emissions most likely to contribute to ozone transport.

1.3 SIP Process

The Act requires states to develop and implement ozone reduction strategies in the form of a State Implementation Plan (SIP). The SIP is the state's "master plan" for attaining and maintaining the National Ambient Air Quality Standards (NAAQS).

Once the Administrator of the EPA approves a state plan, the plan is enforceable as a state law and as federal law under Section 113 of the Act. If the SIP is found to be inadequate in EPA's judgment to attain the NAAQS in all or any region of the state, and if the state fails to make the requisite amendments, under Section110(c)(1), the EPA Administrator may issue amendments to the SIP that are binding.

EPA is required to impose severe sanctions on the states under three circumstances: the state's failure to submit a SIP revision; on the finding of the inadequacy of the SIP to meet prescribed air quality requirements; and the state's failure to enforce the control strategies that are contained in the SIP.

Sanctions include: withholding federal funds for highway projects other than those for safety, mass transit, or transportation improvement projects related to air quality improvement or maintenance beginning 24 months after EPA announcement. No federal agency or department will be able to award a grant or fund, license, or permit any transportation activity that does not conform to the most recently approved SIP.

1.4 Rate of Progress Demonstrated in Previous SIPs

The Clean Air Act requires that serious nonattainment areas ensure progress toward the attainment goal by achieving a 15% reduction in volatile organic chemicals (VOCs) by 1996, and an additional 9% by 1999. To demonstrate attainment, the Act requires the region to demonstrate, through the use of photochemical air quality computer models, that ozone will reach the level of the standard.

MWAQC approved several State Implementation Plans to meet the requirements for serious nonattainment areas: the 15 % Plan, the Phase I Plan and the Phase II Plan. MWAQC

approved the "15% Plan" in January 1994. [iii] MWAQC approved revisions to this plan in February 1998.[iv] MWAQC approved the Phase I Attainment Plan, which includes the 9% rate of progress requirements, in October 1997 and revised it in April 1999.[v] This plan outlined how the region would reduce pollutants by the additional 9% requirement from 1996–1999 and discussed efforts to identify attainment requirements.

MWAQC approved the Attainment Plan (Phase II) in April 1998 and revised it in January 2000.[vi]The Phase II plan summarized the results of photochemical air quality modeling and provided information on trends in actual measured ozone levels. The plan showed that the Washington metropolitan region is likely to attain the federal one-hour standard for ozone in 2005 when the emission control measures currently proposed are fully implemented and after 'ozone transport' is reduced. In July 1998, EPA provided the States and MWAQC with additional modeling analysis performed as part of their efforts in support of the NOx SIP Call. This analysis evaluated the likelihood that the Washington Nonattainment area would reach the one-hour ozone standard after ozone transport is reduced. This evidence has been used to supplement the findings of the local modeling project and strengthens the conclusions of the original Phase II Plan approved by MWAQC.

Due to the use of MOBILE6, EPA's newest approved model for estimating mobile emissions in the Severe Area SIP, the Severe Area SIP inventories are not comparable to those of previous SIPs. The Severe Area SIP builds on previous SIPs by including the attainment demonstration results and the control measures adopted in the previous SIPs. The Severe Area SIP emissions inventories and rate of progress calculations differ from previous plans' emissions inventories and target inventories for rate of progress because the mobile inventory portion is modeled differently. For a detailed explanation of the differences in the modeled mobile inventories, see Chapters 3 and 4.

1.5 The 1999-2002 Rate of Progress Plan

The Washington region provided for a 0% reduction in VOC emissions and a 9% reduction in NOx emissions to satisfy the 9% rate of progress requirement for 1999-2002. Growth in VOC that might otherwise occur from 1999-2002 was more than offset by reductions attributable to adopted control measures. Total reductions achieved from 1990-2002 will total 179.4 tons per day of VOC and 268.7 tons per day of NOx. These reductions will enable the region to meet its emissions targets of 347.7 tons per day of VOC and 626.3 tons per day of NOx. Table 1-1 summarizes the emission reductions that will be achieved as part of the 2002 rate of progress.

Table 1-1
Washington Nonattainment Area
Control Strategy for the 1999-2002 Rate of Progress
Ozone Season Daily Emissions (tons per day)

Description	VOC	NOx
2002 Uncontrolled Emissions	526.3	880.1
2002 Controlled Emissions	346.9	611.4
Emission Reductions from Control Measures	179.4	268.7

1.6 The 2002-2005 Rate of Progress Plan

The Washington region provided for a 0% reduction in VOC emissions and a 9% reduction in NOx emissions to satisfy the 9% rate of progress requirement for 2002-2005. Growth in VOC that might otherwise occur from 2002-2005 was more than offset by reductions attributable to adopted control measures. Total reductions achieved from 1990-2005 will total 214.7 tons per day of VOC and 393.3 tons per day of NOx. These reductions will enable the region to meet its emissions targets of 339.3 tons per day of VOC and 539.0 tons per day of NOx. Table 1-2 summarizes the emission reductions that will be achieved as part of the 2005 rate of progress.

Table 1-2
Washington Nonattainment Area
Control Strategy for the 2002-2005 Rate of Progress
Ozone Season Daily Emissions (tons per day)

Description	VOC	NOx
2005 Uncontrolled Emissions	540.5	880.8
2005 Controlled Emissions	325.8	487.5
Emission Reductions from Control Measures	214.7	393.3

1.7 Establishment of a Budget for Transportation Mobile Emissions

As part of the development of the plan, MWAQC in consultation with the Transportation Planning Board (TPB) will establish a mobile source emissions budget or maximum allowable levels of VOC and NOx. This budget will be the benchmark used to determine if the region's long range transportation plan (CLRP) and six year transportation improvements program (TIP) conform with the Clean Air Act Amendments of 1990. Under EPA regulations the projected mobile source emissions for 2005 becomes the mobile emissions budget for the region unless MWAQC takes actions to set another budget level.

The 2005 mobile emissions inventory reflects the most recent models available, MOBILE6 and the Travel Demand Model Version 2.1, used by COG's Transportation Planning Department, and the most recent data available, namely 2002 vehicle registration data. The methodology used to project the following mobile inventory for the 2005 attainment year and the 2002 and 2005 rates of progress and to recalculate mobile inventories for milestone years is discussed in detail in Chapter 3.2.3 and Chapter 4.1.3.

VOC = 97.4 tons/day NOx = 234.7 tons/day

1.8 Attainment Demonstration

The 2005 attainment demonstration analyzes the progress of the region towards attainment of the one-hour ozone standard. The states in the Metropolitan Washington region performed photochemical modeling in 1997 using the Urban Airshed Model (UAM-IV) to demonstrate attainment of the one-hour ozone standard. The modeling runs were performed for two episodes in 1991. Modeling future year scenarios, the results of the modeling demonstrated that the region would attain but for transported pollution from outside the region.[vii]

In 1999 EPA undertook a photochemical modeling study to estimate Tier 2 benefits for the year 2007 in major cities including Washington region. This study showed that the design value in Washington region in that year would come down to 116 ppb. Therefore, it seems plausible that the 2005 design value will be lower than the one-hour ozone standard (125 ppb).

Urban Airshed model (UAM-IV) has inherent uncertainties. Over or under prediction may result from uncertainties associated with emission inventories, meteorological data, and representation of ozone photochemistry in the model. Previous photochemical modeling performed for the Washington region using UAM-IV model over predicted ozone levels. Therefore, EPA guidance provides for other evidence (Weight of Evidence) to address these model uncertainties so that proper assessment of the probability to attain one-hour ozone standard can be made.

Based on EPA's guidance, a number of Weight of Evidence analyses were undertaken to find out if the Washington region has the potential to attain in 2005. One of these analyses included an estimation of the projected attainment year design value. Based on this analysis which is described in Chapter 11, the 2005 design value was estimated to be about 116 ppb, providing further evidence that the region will attain in 2005.

Following EPA guidance, additional analyses were done comparing the rate of emissions reductions between the two mobile models, MOBILE5b and MOBILE6. A comparison of the rates of reduction in mobile source emissions between 1990 and 2005 calculated using the two mobile models, MOBILE5b and MOBILE6, indicates the rate of emissions reductions

from the 1990 baseline emissions is greater with MOBILE6 than with MOBILE5b calculations. This is further evidence that the region will attain in 2005.

Another comparison was performed for the rates of reduction in total emissions between 1990 and 2005, including newly modeled Severe Area mobile source emissions and mobile emissions contained in the original modeled attainment inventory. It was found that the rate of emissions reductions from the 1990 baseline emissions is greater in case of Severe Area SIP emissions (which contain MOBILE6 emissions) than the original modeled attainment inventory (which contains MOBILE5b emissions). This analysis supports the conclusion hat the region will attain in 2005.

In addition, the Rate-of-Progress inventories for the attainment year 2005 are lower than the modeled attainment inventories. This means that the projected attainment year emissions are lower than the limit set for maximum emissions to attain the one-hour standard for ozone. This if further evidence supporting the conclusion that the region will attain in 2005.

1.9 Analysis of Reasonably Available Control Measures (RACM)

An extensive list of potential control measures was analyzed and evaluated against criteria used for potential RACM measures. Individual measures must meet the following criteria: will reduce emissions by the beginning of the Washington region's 2004 ozone season (May 1, 2004); are enforceable; are technically feasible; are economically feasible, defined as a cost of $10,000 to $20,000 per ton or less; would not create substantial or widespread adverse impacts within the region; and do the emissions from the source being controlled exceed a *de minimis* threshold, defined as 0.1 tons per day. A final short list of RACM measures that met most of the criteria was evaluated against two remaining criteria, the ability to reduce the region's ozone levels to 124 parts per billion by 2004 and the potential for intensive and costly implementation.

Because it is unclear to what extent the NOx SIP Call, a significant NOx control measure, will be implemented by the beginning of the 2004 ozone season, it is extremely difficult to determine how many additional tons the region would need to reduce in order to ensure that 124 ppb is consistently achieved. As a result, the region is taking a conservative approach and estimating that any group of measures that would collectively reduce ozone by 1 ppb or more could enable the region to meet the 124 pbb standard in 2004. In order to reduce 1 ppb of ozone, any RACM measures would need to collectively reduce 8.8 tpd NOx or 34.0 tpd VOC.

If implemented collectively, the short list of RACM measures would reduce 5.1 tons per day VOC and 3.4 tons per day NOx. This does not meet the 34.0 tons per day VOC or 8.8 NOx required to reduce regional ozone levels to 124 parts per billion by May 1, 2004. Chapter 8 contains further details.

1.10 Contingency Measures

In the event that the reductions anticipated in the 2002 or 2005 rate of progress demonstrations or the 2005 attainment demonstration are not realized within the timeframes specified, contingency measures must be implemented. EPA issued guidance says that contingency measures must provide for a 3% reduction in baseline emissions. The Washington region has adopted measures to satisfy the requirement for contingency measures keyed to the 1996-1999 rate-of-progress and 1999 attainment demonstrations. The Phase II Reformulated Gasoline (RFG) program provides VOC reductions in excess of the 13.0 tons per day necessary to meet this requirement. Other control measures also meet this requirement, as described in Section 12.1.3. The District of Columbia, Maryland and Virginia have identified contingency measures for the 2002 and 2005 rate of progress demonstrations and the 2005 attainment demonstration. Chapter 12 contains additional detail on the contingency measure requirements.

1.11 Document Contents

Chapter 2	presents a detailed overview of the Clean Air Act, the region's reclassification to severe nonattainment area, the requirements for severe nonattainment areas, additional commitments by the states to EPA, the region's air quality planning process, the role of the states and the proposed plan.
Chapter 3	presents revisions to the 1990 base year inventory using MOBILE6 and Travel Demand Model Version 2.1 to revise base year mobile emissions inventories and including corrections to nonroad, area and stationary source emissions.
Chapter 4	presents the 2002 and 2005 projected inventories using MOBILE6 and Travel Demand Model Version 2.1 to revise 2002 and 2005 projected and a discussion of the growth projection methodology.
Chapter 5	presents 2002 rate of progress requirements. These are MWAQC's Calculations of how many tons per day of emissions must be reduced in the Washington region in order to meet the rate of progress requirements and also describes the control strategy and associated target emissions levels for the 9% reduction requirement.
Chapter 6	presents 2005 rate of progress requirements. These are MWAQC's calculations of how many tons per day of emissions must be reduced in the Washington region in order to meet the rate of progress requirements and also describes the control strategy and associated target emissions levels for the additional 9% reduction requirement.

Chapter 7 outlines the strategies that the states will implement to achieve the 3% per year reductions in VOC and NO_X.

Chapter 8 discusses the analysis of Reasonable Available Control Measures (RACM).

Chapter 9 discusses mobile source conformity issues and establishes the mobile emissions budgets for the Metropolitan Washington region.

Chapter 10 presents the states' schedules and adoption of regulations to meet requirements for severe nonattainment areas and presents the states' April 2003 commitments to EPA.

Chapter 11 presents the Metropolitan Washington region's demonstration of attainment based on UAMIV modeling and weight of evidence.

Chapter 12 presents contingency measures for the 1999 rate of progress, contingency measures for the 2002 rate of progress demonstration and contingency measures for the 2005 rate of progress and attainment demonstrations.

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[i] EPA 40 CFR Part 81, *Federal Register*, Vol. 68, No. 16, January 24, 2003, pp. 3410-3425.
[ii] EPA 40 CFR Part 52, *Federal Register*, Vol. 68, No. 75, April 17, 2003, pp.19106-19133.
[iii] *Plan to Achieve A Fifteen Percent Reduction in Volatile Organic Compound Emissions for the Washington, DC-MD-VA Nonattainment Area*, MWAQC, January 14, 1994.
[iv] *Revision to the SIP to Achieve a Fifteen Percent Reduction In VOC Emissions and Revision to the 1990 Base Year Emissions Inventory for Stationary, Anthropogenic, Biogenic Sources and Highway Vehicle Emissions of Ozone Precursors for the Washington DC-MD-VA Nonattainment Area*, MWAQC, February 17, 1998.
[v] *Revised State Implementation Plan (SIP) Revision, Phase I Attainment Plan, for the Washington DC-MD-VA Nonattainment Area*, MWAQC, April 16, 1999.
[vi] *State Implementation Plan (SIP) Revision Phase II Attainment Plan, for the Washington, DC-MD-VA Nonattainment Area*, MWAQC, February 3, 2000 and *Revision to State Implementation Plan (SIP) Revision, Phase II Attainment Plan, for the Washington DC-MD-VA Nonattainment Area, Establishing Out-Year Mobile Emissions Budgets for Transportation Conformity*, MWAQC, January 19, 2000.
[vii] See Chapter 11 and Appendix D.

2.0 INTRODUCTION AND OVERVIEW

This document presents the regional air quality plan for attainment of the federal one-hour standard for ground-level ozone being considered by the Metropolitan Washington Air Quality Committee (MWAQC) for the Washington, D.C. multi-jurisdictional nonattainment area. MWAQC was established, by the governors of Maryland and Virginia and the mayor of the District of Columbia to prepare a regionally coordinated air quality plan to comply with the requirements of the 1990 Clean Air Act Amendments (CAAA or Act). MWAQC was established in accordance with Section 174 of the Clean Air Act.

2.1 Clean Air Act Background

The Clean Air Act was passed in 1970 to protect public health and welfare. Congress amended the Act in 1990 to establish requirements for areas not meeting the National Ambient Air Quality Standards (NAAQS). The Clean Air Act Amendments of 1990 (CAAA) established a process for evaluating air quality in each region and identifying and classifying nonattainment areas according to the severity of its air pollution problem. The CAAA defines ground-level ozone as a criteria pollutant and sets a air quality standard for that pollutant of 0.120 parts per million (or 124 parts per billion). Concentrations of ozone at ground level that are at or above 0.120 parts per million exceeds the one-hour ozone public health standard, or NAAQS. The Clean Air Act also sets National Ambient Air Quality Standards for five other criteria pollutants, carbon monoxide, particulate matter, lead, sulfur dioxide and nitrogen dioxide.

The Clean Air Act classifies nonattainment areas as “marginal,” moderate,” “serious,” “severe,” and “extreme” based upon the area’s measured levels of ozone compared to the federal one-hour standard. Areas in a higher classification of nonattainment must meet the mandates of the lower classifications plus the more stringent requirements of their class. In 1991 the Washington area was designated a “serious” nonattainment area for the ozone standard. The boundaries of the Washington nonattainment areas are defined in the *Federal Register*. The Washington nonattainment area includes the District of Columbia, Arlington, Fairfax, Loudoun, Prince William, and Stafford counties, and the cities of Alexandria, Falls Church, Fairfax, Manassas, and Manassas Park in Virginia; as well as Calvert, Charles, Frederick, Montgomery, and Prince George’s counties and the Cities of Bowie, College Park, Gaithersburg, Greenbelt, Frederick, Rockville, and Takoma Park in Maryland. A map of the nonattainment area is shown in Figure 1.

To meet the federal one-hour standard for ozone, nonattainment areas are required to develop regional plans, state implementation plans or “SIP,” to reduce ozone-causing emissions of volatile organic compounds (VOCs) by at least 15 percent by 1996 and at least 3 % more each year until the region’s attainment deadline, and to reduce all ozone precursor emissions to a level sufficient to attain the federal one-hour standard. The CAAA requires serious nonattainment areas to meet the one-hour ozone standard by November 15, 1999.

2.2 Region's Reclassification from "Serious" to "Severe"

Under the 1990 Clean Air Act Amendments, the metropolitan Washington region was defined as a "serious" nonattainment area for the pollutant ozone. The region was required to attain the federal one-hour standard for ground-level ozone by November 15, 1999. The region failed to meet the attainment deadline due to transported pollution from outside the region. The region's photochemical modeling results demonstrated the effect of transported pollution, which contributed from 20-30% of the pollution on the worst days of summer. EPA issued guidance in 1997 dealing with transported pollution, based on the basis photochemical modeling of 23-state region including the northeast, mid-Atlantic and Midwestern states conducted through the Ozone Transport Assessment Group. In January 2001 EPA granted the Washington region an extension of its attainment deadline to November 2005.

The U.S. Circuit Court of Appeals for the District of Columbia vacated EPA's extension and remanded the action to EPA in a ruling on July 2, 2002, in *Sierra Club v. EPA*. The Court decided that EPA had a nondiscretionary duty under the Clean Air Act to reclassify the region when it failed to attain the standard in November 1999. The Court also vacated EPA's approval of the 1996-1999 rate of progress plan and the attainment plan. On December 18, 2002, the United States District Court of the District of Columbia ordered EPA to publish proposed rules to approve or disapprove the attainment demonstration and 1999 rate of progress SIPs by February 3, 2003, and to publish final rules taking action on these SIPS by April 17, 2003.

In January 2003 EPA reclassified the Washington, DC-MD-VA nonattainment area as a "severe" nonattainment area.[1] As a severe nonattainment area for one-hour ozone National Ambient Air Quality Standard (NAAQS), the Washington region is required to meet the requirements defined in the Clean Air Act, Section 182 (d) and to attain the standard by November 15, 2005. April 17, 2003, EPA published a final rule to conditionally approve the Washington region's severe area SIP if the three states meet nine commitments to EPA.[2] The commitments include adopting state regulations to meet CAA Section 182 (d) requirements for severe nonattainment areas and, in addition, to adopt a contingency plan for 1999 Rate of Progress, revise and submit an updated attainment demonstration that reflects revised MOBILE6-based motor vehicle emissions budgets, demonstrate 3 % per year rate of progress from 1999-2002 and from 2002-2005; adopt contingency measures for failure to make rate of progress in those periods, and submit an analysis of Reasonably Available Control Measures for the region. Copies of commitment letters from Virginia, Maryland and the District of Columbia are included in Appendix H.

2.3 SIP Requirements for Severe Nonattainment Areas

The Clean Air Act Section 182 (d) requires severe nonattainment areas to submit revisions to the state implementation plan to meet six additional planning requirements that do not exist for serious areas:

- Lower permit threshold for point sources from 50 tons per year to 25 tons per year
- Lower threshold for definition of "Major" source requiring controls to 25 tons per year

- Require new or expanding sources to offset increased emissions by 1.3:1
- Offset emissions growth due to growth in Vehicle Miles Traveled (VMT) by adopting control measures
- Attainment deadline for Severe Areas is November 15, 2005
- Adopt fee for "failure to attain" to be paid by major sources.

2.4 Additional EPA Requirements for Washington Region

As a result of the court decision in July 2002 in *Sierra Club v. EPA*, EPA requires the Washington region to submit rate of progress plans for two periods, 1999-2002 and 2002-2005; to adopt a contingency plan for 1999 in addition to contingency plans for the two rate of progress plans, and to submit an analysis of Reasonably Available Control Measures. These submittals are required to address deficiencies in the 1999 Rate of Progress Plan ("Phase I Plan"), and the Attainment demonstration ("Phase II Plan"). These SIP documents contain all of the requirements for the severe area state implementation plan or SIP as defined in the CAAA Section 182 and EPA's requirements to address deficiencies in the previous SIPs.

2.5 Rate of Progress Demonstrations in Previous SIPs

The Clean Air Act requires that serious nonattainment areas ensure progress toward the attainment goal by achieving a 15% reduction in volatile organic chemicals (VOCs) by 1996, and an additional 9% by 1999. To demonstrate attainment, the Act requires the region to demonstrate, through the use of photochemical air quality computer models, that ozone will reach the level of the standard.

MWAQC approved several State Implementation Plans to meet the requirements for serious nonattainment areas, the 15 % Plan, and the Phase I and Phase II Plans. MWAQC approved the "15% Plan" in January 1994. [3] MWAQC approved revisions to this plan in February 1998.[4] MWAQC approved the Phase I Attainment Plan, which includes the 9% rate of progress requirements, in October 1997 and revised it in April 1999.[5] This plan outlined how the region would reduce pollutants by the additional 9% requirement from 1996–1999 and discussed efforts to identify attainment requirements.

MWAQC approved the Attainment Plan (Phase II) in April 1998 and revised it in January 2000.[6]The Phase II plan summarized the results of photochemical air quality modeling and provided information on trends in actual measured ozone levels. The plan showed that the Washington metropolitan region is likely to attain the federal one-hour standard for ozone in 2005 when the emission control measures currently proposed are fully implemented and after 'ozone transport' is reduced. In July 1998, EPA provided the States and MWAQC with additional modeling analysis performed as part of their efforts in support of the NOx SIP Call. This analysis evaluated the likelihood that the Washington Nonattainment area would reach the one-hour ozone standard after ozone transport is reduced. This evidence has been used to supplement the findings of the local modeling project and strengthens the conclusions of the original Phase II Plan approved by MWAQC.

Due to the use of MOBILE6, EPA's newest approved model for estimating mobile emissions in the Severe Area SIP, the Severe Area SIP inventories are not comparable to those of previous SIPs. The

Severe Area SIP builds on previous SIPs by using the attainment demonstration results and the control measures adopted in the previous SIPs. The Severe Area SIP emissions inventories and rate of progress calculations differ from previous plans' emissions inventories and target inventories for rate of progress because the mobile inventory portion is modeled differently. For a detailed explanation of the differences in the modeled mobile inventories, see Chapters 3 and 4.

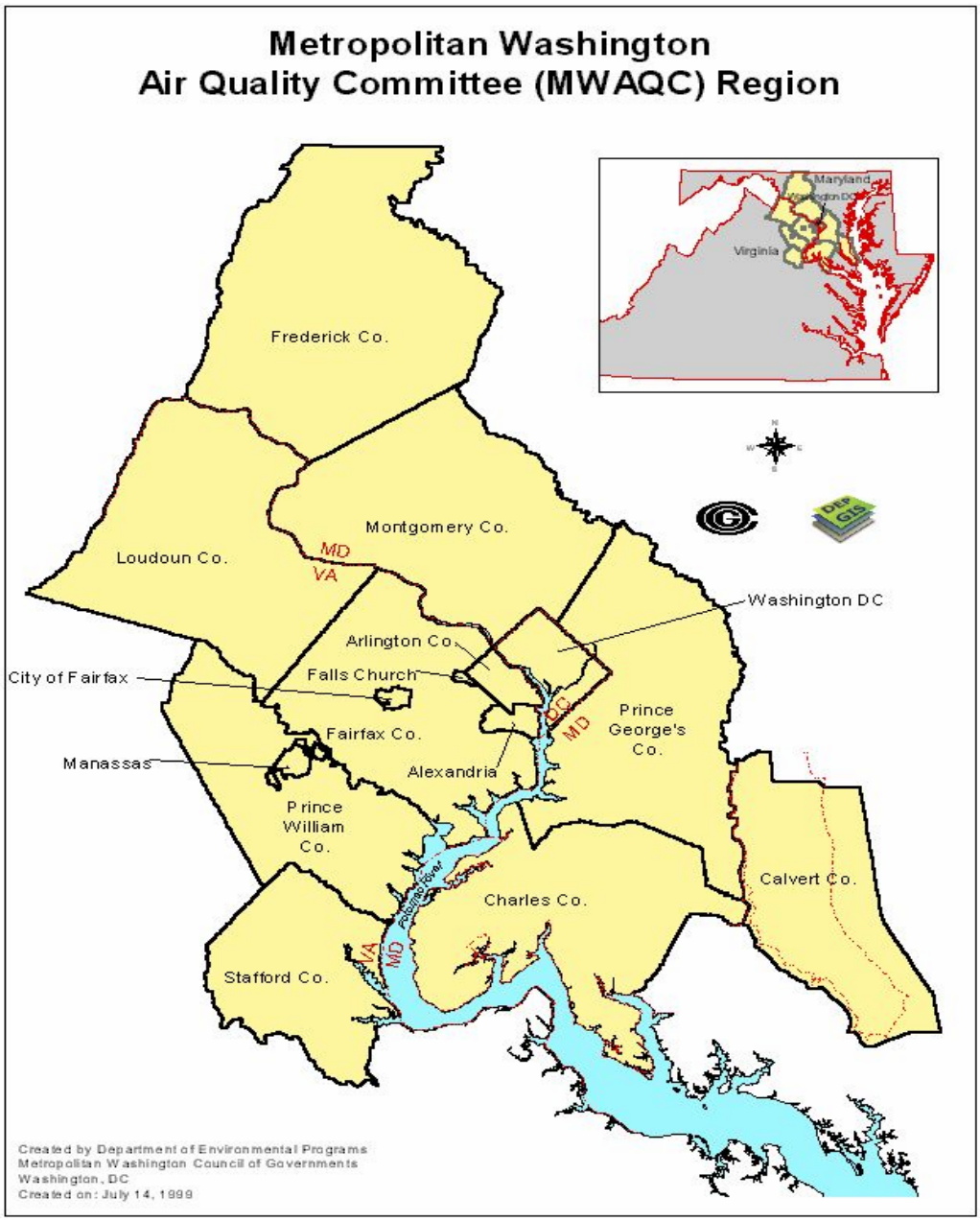

Figure 2-1: Map of Nonattainment Area

2.6 Sources of Ozone in the Metropolitan Washington Region

Ozone (O_3) is formed through a complex series of chemical reactions when oxygen molecules and atoms (O_2 + O) are combined. The process occurs when volatile organic compounds interact with nitrogen oxides in the presence of sunlight during hot, stagnant, summer days. VOCs are chemical compounds contained in gasoline, furniture polish, cleaning fluids, paint, inks, and other household and industrial products. VOCs also are a residue of combustion. Principal sources of NOx, which is produced by combustion, include motor vehicles, fossil fuel-fired power plants, and open burning. Ozone formation is favored under certain weather conditions, including high temperature, bright sunshine, and light winds. See Figure 2.

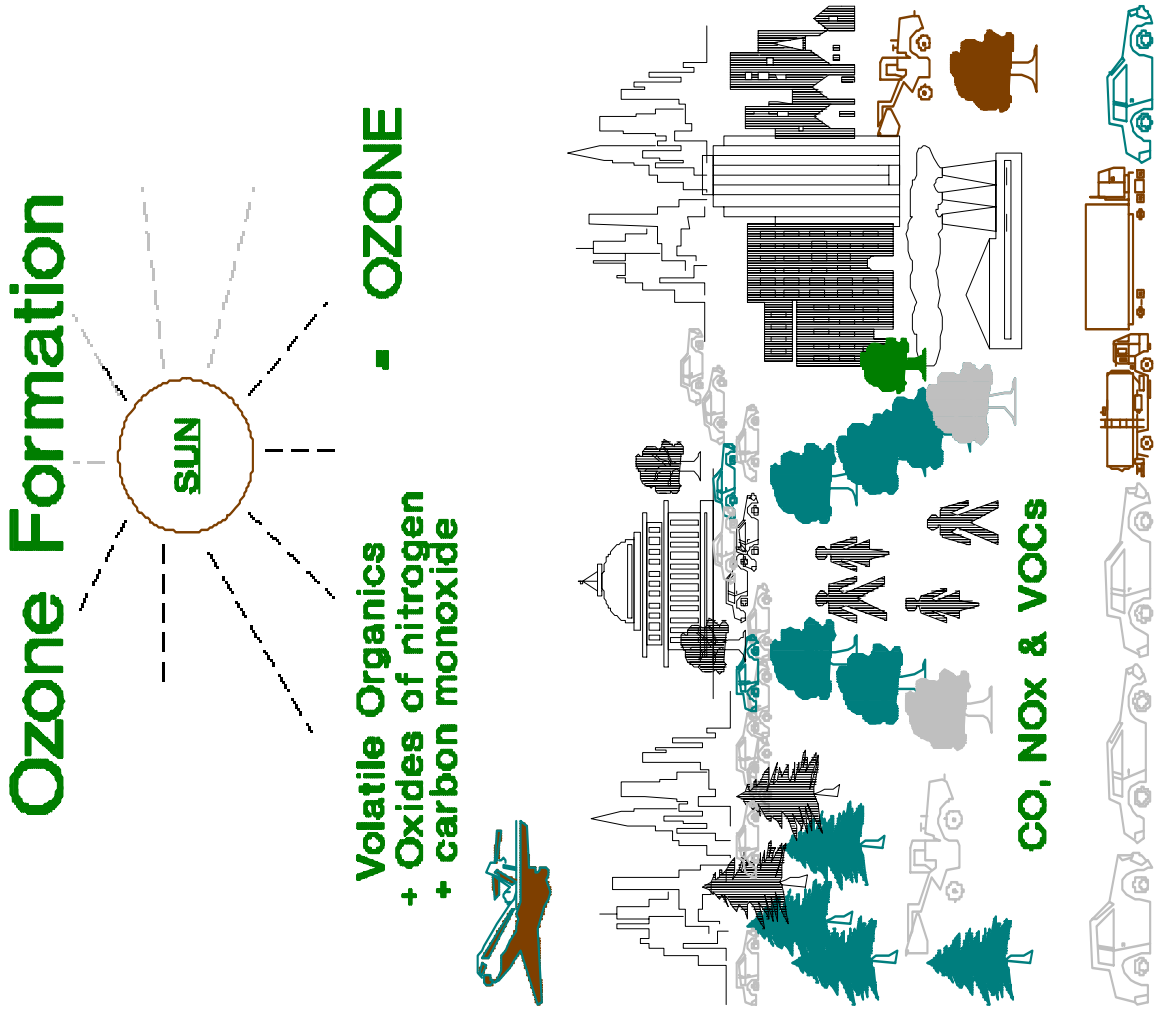

Figure 2-2: Conditions for Ozone Formation

Typically, ozone levels escalate rapidly before noontime, peak in the afternoon, and taper off when the sun goes down. Figure 3 shows hourly ozone concentrations for a typical 24-hour period in our region.

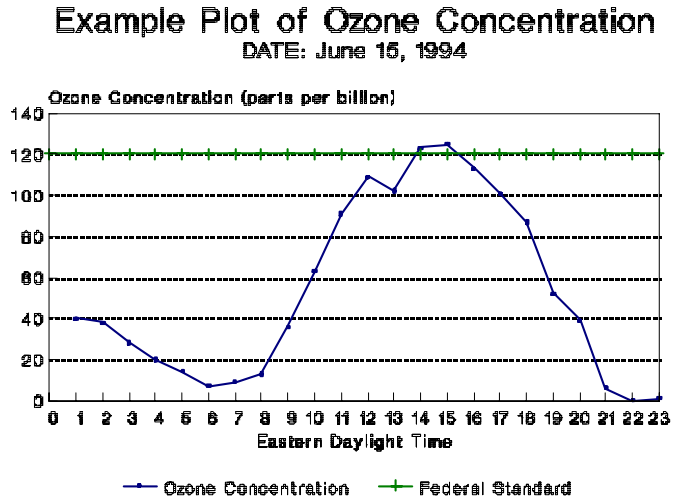

Figure 2-3: Gradual build-up of ozone levels on a typical summer day. Ozone peaks in the afternoon, then tapers off to lower levels in the evening.

Outer suburban and rural areas share this regional problem. Winds can move a cloud of ozone-containing smog for long distances. Regional data indicate that violations of the ozone standard can occur in either rural, inner suburban, outer suburban, or urban areas or combinations thereof.

While ozone within the region is caused mostly by emissions generated within the region, it also is carried into the metropolitan area by winds from elsewhere. Research conducted through the Ozone Transport Commission (OTC), and the Ozone Transport Assessment Group (OTAG) provides evidence that ozone formed in other parts of the country may drift into and affect air quality in the Washington region.

A number of diverse sources emit the ozone precursors VOC and NOx. Major sources of VOC emissions include, but are not limited to, gasoline storage facilities, bakeries, gasoline refueling stations, printing facilities, motor vehicles, lawnmowers, consumer products, and boats. Principal sources of NOx, which is produced by combustion, include motor vehicles (cars, trucks and buses), fossil fuel-fired power plants, and construction equipment.

In general the anthropogenic (man-made) sources of ozone precursors are grouped into four source categories: point (stationary), area, non-road, and mobile sources.

Point sources are stationary sources that emit more than 10 tons per year (tpy) of emissions. These

sources are individually inventoried. Actual emissions measurements are available for some sources from the states and the District of Columbia. Emissions from other sources are estimated using emission factors.

Area source emissions include small industries, such as bakeries and printers; off-highway mobile equipment; and commercial/consumer products and activities. Emissions are not measured directly but are estimated from engineering calculations and estimates of activity levels.

Non-road sources include construction and farming equipment, commercial and residential lawn and garden activities, and recreational boating.

On-road or "mobile source" emissions from transportation sources are estimated from regional transportation models, which provide estimates of the number of vehicle trips, and the distance, location and speed of the trips, combined with a detailed EPA-approved model of per-vehicle emission factors.

A fifth category, "biogenic" emissions, includes all naturally occurring sources of VOC emissions from trees, crops and other forms of vegetation.

The following tables list the top ten sources of VOCs and NOx in the Washington nonattainment area in 1990 and in 2005.

Table 2-1
TOP TEN SOURCES OF MAN-MADE VOLATILE ORGANIC COMPOUNDS (VOCs) IN THE WASHINGTON AREA IN 1990 and 2005 EMISSIONS LEVELS

#	SOURCE CATEGORY	SOURCE	VOCs* TONS/ DAY	
			1990	2005
1	On-Road Mobile	CARS, BUSES, TRUCKS	299	97
2	Non-Road	LAWN & GARDEN EQUIPMENT	40	34
3	Area	OTHER SURFACE COATINGS *(This category includes traffic markings, industrial coatings and special purpose)*	35	37
4	Area	COMMERCIAL CONSUMER SOLVENT USE	34	39
5	Area	ARCHITECTURAL COATINGS	32	33
6	Area	VEHICLE REFUELING	20	7
7	Area	AUTO BODY REFINISHING	15	11
8	Stationary	STATIONARY SOURCES	15	16
9	Non-Road	RECREATION, MARINE	10	12
10	Non-Road	CONSTRUCTION	10	13

**The emissions estimates above are rounded to the nearest whole number. They are MWAQC's best estimates. Total VOC emissions in the Washington area were 955 tons per day in 1990 and 732 tons per day in 2005. Biogenic emissions account for 377 tons of VOC emissions in the Washington region.*

Table 2-2
TOP TEN SOURCES OF NITROGEN OXIDES (NOx) IN THE WASHINGTON AREA

IN 1990 and 2005 EMISSIONS LEVELS

#	SOURCE CATEGORY	SOURCE	NOx* TONS/ DAY	
			1990	2005
1.	On-Road Mobile	CARS, BUSES, TRUCKS	381	235
2.	Stationary	UTILITIES AND OTHER SOURCES	361	110
3.	Non-Road	CONSTRUCTION	62	67
4.	Area	NATURAL GAS & LPG CONSUMPTION	12	15
5.	Non-Road	AGRICULTURE	11	8
6.	Area	FUEL OIL CONSUMPTION	10	13
7.	Area	RAILROAD LOCOMOTIVES	8	9
8.	Area	COAL CONSUMPTION	6	9
9.	Area	ON-SITE INCINERATION	5	7
10.	Area	COMMERCIAL AVIATION	5	8

**The emissions estimates above are rounded to the nearest whole number. They are MWAQC's best estimates. The total emission of NOx in the Washington area was 875 tons per day in 1990 and 491 tons per day in 2005. These categories account for 98% of the total in 1990. Note: the 1990 mobile number has been recalculated using MOBILE6.*

2.7 The Effects of Ozone

All of the 4.5 million residents of the Washington metropolitan region are likely to feel some of the adverse effects of ozone at one time or another, especially when they are working outdoors or exercising on a day when ozone levels are high.

But some people will feel symptoms at lower levels of exposure (even levels below the federal health standard), or experience more adverse effects at high levels. According to the American Lung Association, 2002, populations at increased risk in the Washington metropolitan region include

- 873,600 children 14 years of age and younger;
- 293,900 asthmatics, including 54,800 children with asthma and 239,100 adults;
- 180,700 residents with other chronic or persistent respiratory diseases, such as chronic bronchitis and emphysema;
- 401,600 residents over the age of 65

Figure 4 shows a breakdown of some of the categories of sensitive populations by sub-region.

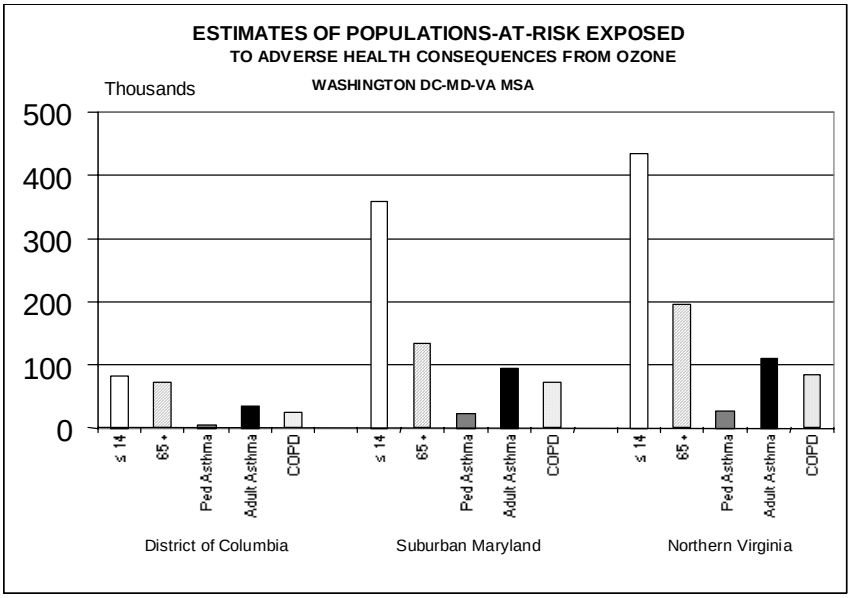

Figure 2-4: Approximately one-third of the residents of Metropolitan Washington area children, asthmatics over 65, have chronic respiratory diseases, and/or are especially sensitive to ozone. These individuals are more vulnerable to ill effects from air pollution. Source: American Lung Association

As mentioned earlier, ozone poses a threat not only to human health, but also to the health of natural ecosystems. Scientific evidence suggests that air pollution weakens the immune systems of many types of vegetation and can cause significant crop damage. In addition, rain and snow wash air pollution deposited on vegetation and architectural surfaces into the streams and rivers of the region and finally into the Chesapeake Bay.

2.8 Frequency of Violation of Federal Health Standard for Ozone

The Washington area has exceeded the federal health standard for ozone in all of the last 24 years. The number of ozone exceedance days in a season ranged from a low of 1 to a high of 35. Federal law allows only one violation of the standard a year (averaged over 3 years) in any one location in the region. In an average summer from 1992 - 2002, there have been 4.9 days when Washington's air exceeds the ozone standard.

The federal standard is 0.12 parts per million (124 parts per billion) of ozone averaged over one hour. Figure 5 shows the number of days that the Washington region has violated the ozone standard since 1979. Violations are related to the weather (hot stagnant summers are favorable for ozone formation) and the levels of ozone precursors present in the ambient air.

The Metropolitan Washington Council of Governments (COG) issues an air quality forecast prepared by a regional team of meteorologists each day during the summer. The daily forecast and air quality index (AQI) advise the public of the air quality conditions for the next 24 hours, so that those at risk can take adequate precautions and everyone can take action to reduce ozone-causing emissions.

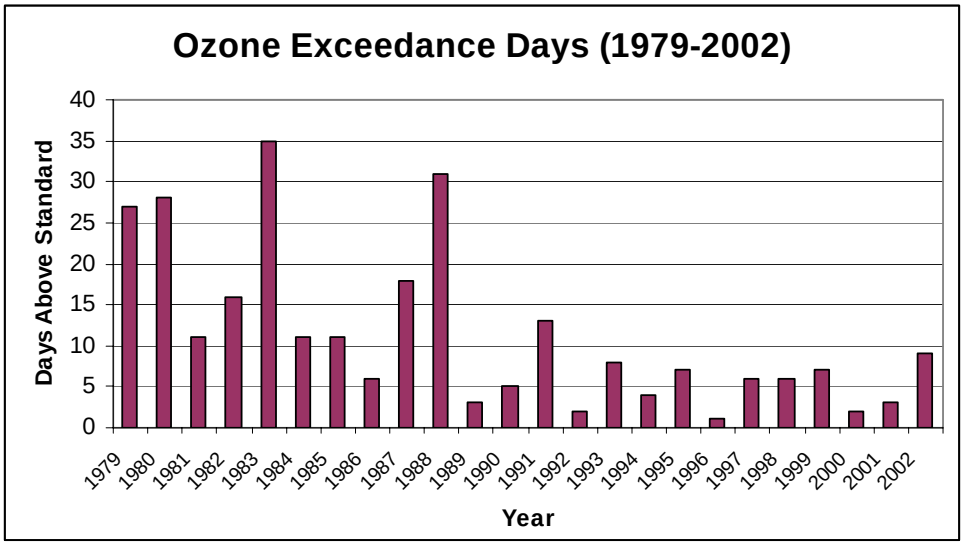

Figure 2-5: Ozone Exceedance Days in the Metropolitan Washington area

2.9 The Metropolitan Washington Air Quality Committee (MWAQC)

Under Section 174 of the Clean Air Act Amendments, the governors of Maryland and Virginia and the mayor of the District of Columbia certified the Metropolitan Washington Air Quality Committee (MWAQC) to develop specific recommendations for a regional air quality plan in the Washington, DC-MD-VA nonattainment area.

Members of MWAQC include elected officials from the Cities of Bowie, College Park, Frederick, Gaithersburg, Greenbelt, Rockville, and Takoma Park in Maryland, and Alexandria, Fairfax and Falls Church, Manassas and Manassas Park in Virginia; the Montgomery and Prince George's county councils; the Montgomery and Prince George's county executives; the mayor of the District of Columbia and representatives of the Council of the District of Columbia; and representatives of Calvert, Charles, and Frederick counties in Maryland, and Arlington, Fairfax, Loudoun, Prince William, and Stafford counties in Virginia.

Representatives of the general assemblies of Maryland and Virginia, the state air management directors, and the state transportation directors, and the chairman of the National Capital Region Transportation Planning Board also are members of MWAQC. The membership roster is contained in Appendix A.

The Metropolitan Washington Council of Governments, in close cooperation with state air quality and transportation agencies provides technical support to the Metropolitan Washington Air Quality Committee. Additional technical staff support is provided by county and city technical staffs and the Tri-County Council for Southern Maryland.

MWAQC also has established a public advisory committee to provide recommendations regarding public participation in the development of the air quality plans. The Air Quality Public Advisory Committee (AQPAC) works closely with staff and submits formal recommendations to MWAQC. AQPAC members represent academic, business, civic, and environmental groups. AQPAC members are listed in Appendix A.

2.10 Roles of the State Air Management Agencies and the Governors/Mayor

Representatives of the following state air management agencies are members of MWAQC: District of Columbia Department of Health, Environmental Health Administration; Air and Radiation Management Administration of the State of Maryland's Department of the Environment; and the Commonwealth of Virginia's Department of Environmental Quality.

Since the Washington metropolitan nonattainment area crosses state boundaries, the states and the

District of Columbia established MWAQC to prepare a regional control plan. MWAQC's recommendations are forwarded to the three state air agencies. In turn, each state will submit a SIP revision to EPA. In Maryland, the submittal is made by the governor or a designee; in the District of Columbia, by the mayor or a designee; and in Virginia by the Director of the Department of Environmental Quality on behalf of the governor.

2.11 State Commitment/Implementation Assurances

The measures in the SIP must be supported by any necessary legislative authority adopted by the states and the District of Columbia and adopted by the applicable governmental body responsible for their implementation.

Section 110 of the 1990 CAAA specifies the conditions under which EPA approves SIP submissions. These requirements are being followed by MWAQC and the states in developing this air quality plan or SIP. In order to develop effective control strategies, EPA has identified four fundamental principles that SIP control strategies must adhere to in order to achieve the desired emissions reductions. These four fundamental principles are outlined in the General Preamble to Title I of the Clean Air Act Amendments of 1990 at *Federal Register* 13567 (EPA, 1992a). The four fundamental principles are:

a. emissions reductions ascribed to the control measure must be quantifiable and measurable;
b. the control measures must be enforceable, in that the state must show that they have adopted legal means for ensuring that sources are in compliance with the control measure;
c. measures are replicable; and
d. the control strategy be accountable in that the SIP must contain provisions to track emissions changes at sources and to provide for corrective actions if the emissions reductions are not achieved according to the plan.

2.12 Submittal of the Plans

The governors and the mayor (or their designees) are required to submit to the EPA air quality State Implementation Plans to meet the requirements of the CAAA. After MWAQC approves the air quality attainment plan (SIP), each of the states and the District of Columbia will submit the document, along with specific commitments, schedules for adoption or adopted state regulations as appropriate, to EPA's Region III Office in Philadelphia.

2.13 Sanctions

EPA must impose various sanctions if the states or the District of Columbia do not submit a plan; or submit a plan that the EPA does not approve; or fail to implement the plan. These include: withholding federal highway funding; withholding air quality planning grants; and imposing a federal plan ("federal implementation plan."). Failure to submit or implement a plan will have

significant consequences for compliance with conformity requirements.

2.14 Rate of Progress Requirements

As a consequence of reclassification to a severe non-attainment area, the Washington region is required to demonstrate continued reductions of 3% per year in NOx or VOC from 1999 until 2002 and from 2002 until the region reaches attainment in 2005. The Severe Area Plan is designed to meet these new requirements. MWAQC has taken the following steps in development of the regional Severe Area Plan:

- Recalculation of 1990 base-year emissions inventory

In January 2002, EPA released a new version of the model used to calculate emissions from automobiles and other mobile sources. EPA requires all regions to adopt the new model, referred to as MOBILE6, for calculation of mobile emission inventories. Because MOBILE6 includes improved data and better methods for estimating the effect of certain control measures, the results of the model are not comparable to the results of MOBILE5b, the previous version. In order to use MOBILE6 to compare emissions from different years, regions must recalculate mobile emissions from each year using the new model. A small number of corrections were also made to emissions from other sectors. The recalculated 1990 base year inventory of man-made pollution sources is 578.7 tons per day (VOC) and 869.3 tons per day of nitrogen oxides (NOx). Chapter 3 provides complete documentation of the revised 1990 base year inventory.

- Recalculation of adjusted base-year inventories for 1996, 1999, 2002, 2005 with MOBILE6

The 1990 CAAA does not allow states to take credit for emissions reduction measures implemented before the Act's passage on November 15, 1990. Consequently, it is necessary to adjust the 1990 base-year inventory to eliminate reductions that would occur in 1996, 1999, 2002 and 2005 due to pre-1990 rules and regulations. Because of the requirement to use MOBILE6 for calculation of the mobile sector inventory, the adjusted base-year inventories for 1996, 1999, 2002 and 2005 were recalculated using MOBILE6.

- The 1990 base year inventory adjusted to 1996 is 455.5 tons per day VOC.
- The 1990 base year inventory adjusted to 1999 is 433.7 tons per day VOC and 778.5 tons per day NOx.
- The 1990 base year inventory adjusted to 2002 is 420.5 tons per day VOC and 756.7 tons per day NOx.
- The 1990 base year inventory adjusted to 2005 is 412.1 tons per day VOC and 735.6 tons per day NOx.

- Calculation of 2002, 2005 emissions reduction requirements

Many of the control measures included in previous air quality plans, including the Revised Phase II Plan, will yield emission reduction benefits during 1999-2005 that are creditable toward the 9% + 9% reduction requirement.

The Washington region provided for a 0% reduction in VOC emissions and a 9% reduction in NOx emissions to satisfy the 9% rate of progress requirement for 1999-2002. Growth in VOC that might otherwise occur from 1999-2002 was more than offset by reductions attributable to adopted control measures. Total reductions achieved from 1990-2002 will total 179.4 tons per day of VOC and 268.7 tons per day of NOx. These reductions will enable the region to meet its emissions targets of 347.7 tons per day of VOC and 626.3 tons per day of NOx.

The Washington region provided for a 0% reduction in VOC emissions and a 9% reduction in NOx emissions to satisfy the 9% rate of progress requirement for 2002-2005. Growth in VOC that might otherwise occur from 2002-2005 was more than offset by reductions attributable to adopted control measures. Total reductions achieved from 1990-2005 will total 214.7 tons per day of VOC and 393.3 tons per day of NOx. These reductions will enable the region to meet its emissions targets of 339.3 tons per day of VOC and 539.0 tons per day of NOx.

2.15 2005 Attainment Demonstration

The 2005 attainment demonstration analyzes the progress of the region towards attainment of the one-hour ozone standard. The states in the Metropolitan Washington region performed photochemical modeling in 1997 using the Urban Airshed Model (UAM-IV) to demonstrate attainment of the one-hour ozone standard. The modeling runs were performed for two episodes in 1991. Modeling future year scenarios, the results of the modeling demonstrated that the region would attain but for transported pollution from outside the region. Additional modeling such as EPA's photochemical modeling for Tier 2 and weight of evidence analysis using design values and projected future design values, provide further evidence that the region will attain in 2005. [7]

In addition, a comparison of the rates of reduction in emissions between the two mobile models, MOBILE5b and MOBILE6, indicates the rate of emissions reductions from the 1990 baseline emissions is greater with MOBILE6 than with MOBILE5b calculations. This is further evidence that the region will attain in 2005.

2.16 Analysis of Reasonably Available Control Measures (RACM)

An extensive list of potential control measures was analyzed and evaluated against criteria used for potential RACM measures. Individual measures must meet the following criteria: will reduce emissions by the beginning of the Washington region's 2004 ozone season (May 1, 2004); are

enforceable; are technically feasible; are economically feasible, defined as a cost of $10,000 to $20,000 per ton or less; would not create substantial or widespread adverse impacts within the region; and do the emissions from the source being controlled exceed a *de minimis* threshold, defined as 0.1 tons per day. A final short list of RACM measures that met most of the criteria was evaluated against two remaining criteria, the ability to reduce the region's ozone levels to 124 parts per billion by 2004 and the potential for intensive and costly implementation. The results show that if implemented collectively, the measures would reduce 5.1 tons per day VOC and 3.4 tons per day NOx. This does not meet the 34.0 tons per day VOC or 8.8 tons per day NOx required to reduce regional ozone levels to 124 parts per billion by May 1, 2004. Chapter 8 contains the list of measures considered.

2.17 Contingency Measures

In the event that the reductions anticipated in the 2002 or 2005 rate of progress demonstrations or the 2005 attainment demonstration are not realized within the timeframes specified, there must be contingency measures ready for implementation. EPA issued guidance says that contingency measures must provide for a 3% reduction in baseline emissions (12.6 tons per day VOC or 22.7 tons per day NOx for 2002).

Contingency measures identified for 2002 must deliver the required benefits in calendar year 2006. The District of Columbia, Maryland and Virginia have identified contingency measures that will exceed the required 12.6 tpd VOC and 22.7 tpd NOx calculated in Table 12-2.

Because the Washington region expects to fulfill the requirements of the 2002 rate-of-progress, the same contingency measures identified for the 2002 rate-of-progress can be used to fulfill the contingency measure requirement for the 2005 rate-of-progress and attainment demonstrations.

As detailed in Chapter 12, the contingency measures identified for the 2002 rate-of-progress will reduce more than 12.6 tons per day of VOC or 22.7 tpd of NOx. Therefore, the measures that are listed in Chapter 12 will fulfill the region's contingency measure requirements for 2005. The District of Columbia, Maryland and Virginia have identified contingency measures that will exceed the required 12.4 tpd VOC and 22.1 tpd NOx for 2005 contingency measures calculated in Table 12-4.

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[1] EPA 40 CFR Part 81, *Federal Register*, Vol.68, No. 16, , January 24, 2003, pp. 3410-3425.

[2] EPA 40 CFR Part 52, *Federal Register*, Vol.68, No. 75, April 17, 2003, pp.19106-19133.

[3] *Plan to Achieve A Fifteen Percent Reduction in Volatile Organic Compound Emissions for the Washington, DC-MD-VA Nonattainment Area*, MWAQC, January 14, 1994.

[4] *Revision to the SIP to Achieve a Fifteen Percent Reduction In VOC Emissions and Revision to the 1990 Base Year Emissions Inventory for Stationary, Anthropogenic, Biogenic Sources and Highway Vehicle Emissions of Ozone Precursors for the Washington DC-MD-VA Nonattainment Area*, MWAQC, February 17, 1998.

[5] *Revised State Implementation Plan (SIP) Revision, Phase I Attainment Plan, for the*

Washington DC-MD-VA Nonattainment Area, MWAQC, April 16, 1999.

[6] *State Implementation Plan (SIP) Revision Phase II Attainment Plan, for the Washington, DC-MD-VA Nonattainment Area*, MWAQC, February 3, 2000 and *Revision to State Implementation Plan (SIP) Revision, Phase II Attainment Plan, for the Washington DC-MD-VA Nonattainment Area, Establishing Out-Year Mobile Emissions Budgets for Transportation Conformity*, MWAQC, January 19, 2000.

[7] See Chapter 11 and Appendix D.

3.0 THE 1990 BASE-YEAR INVENTORY AND REVISIONS

3.1 Background and requirements

The full original 1990 Base-Year Inventory is published in a separate document, "1990 Base Year Emissions Inventory for Stationary Anthropogenic, Biogenic Sources and Highway Vehicle Emissions of Ozone Precursors in the Washington, DC-MD-VA Metropolitan Statistical Nonattainment Area," (Sept. 22, 1993). This document was prepared for the District of Columbia, Maryland and Virginia by COG under the auspices of MWAQC. It is available for inspection at the Council of Governments' Information Center and at the offices of the District of Columbia, Maryland and Virginia air management agencies.

The emissions inventory covers the Washington DC-MD-VA nonattainment area (identical to the Metropolitan Statistical Area, or MSA), which is classified as a severe nonattainment area for ozone by the U.S. Environmental Protection Agency (EPA). The 1990 emissions inventory is the starting point for calculating the emissions reduction requirement needed to meet the 15% VOC emissions reduction goal by 1996 *and* additional 3% per year reductions (for man-made sources of emissions) thereafter through 2005 to meet rate-of-progress requirements prescribed for severe nonattainment areas by the 1990 CAAA.

This separately published document addresses emissions of volatile organic compounds (VOCs), oxides of nitrogen (NOx), and carbon monoxide (CO) on a typical summer ozone season weekday. Included in the inventory are stationary anthropogenic (man-made), biogenic (naturally occurring), and non-road and on-road mobile sources of ozone precursors. It was used in the preparation of the 1994 15% Plan that was submitted to EPA. Revisions to the original 1990 inventory have been submitted to EPA as part of revisions to the 15% Plan (Final State Implementation Plan Revision to Achieve a Fifteen Percent Reduction in Volatile Organic Compounds Emissions for the Washington DC-MD-VA Nonattainment Area", February 17, 1998). This revised inventory served as the basis for calculating the 15% emissions reduction needed by 1996.

In 2002 and early 2003, MWAQC made changes to the methods for calculating emissions from mobile, stationary, area, and nonroad sources. These changes, described in succeeding sections, resulted in revisions to the 1990 base year inventory. The revised 1990 base-year inventories for VOC and NOx can be seen in Tables 3-1 and 3-2.

Table 3-1
1990 Base-Year VOC Inventory
(Tons/Day)

	District of Columbia	Maryland	Virginia	Total
Point	1.0	5.7	8.3	15.0
Area	20.1	94.0	77.0	191.1
Non-Road	5.8	33.8	33.8	73.4
On-Road	42.0	133.4	123.7	299.2
Biogenics	3.2	225.9	147.4	376.5
Total	72.1	492.8	390.2	955.2

* Small discrepancies may result due to rounding

Table 3-2
1990 Base-Year NOx Inventory
(Tons/Day)

	District of Columbia	Maryland	Virginia	Total
Point	7.8	292.4	61.2	361.4
Area	4.3	15.8	27.6	47.7
Non-Road	5.5	43.7	30.3	79.5
On-Road	41.9	181.7	157.3	380.8
Biogenics	NA	NA	NA	NA
Total	59.5	533.6	276.3	869.3

* Small discrepancies may result due to rounding

3.2 Total Emissions by Source

3.2.1 Point Sources

For emissions inventory purposes, point sources are defined as stationary, commercial, or industrial operations that emit more than 10 tons per year (tons/year) of VOCs or 25 tons/year or more of NOx or CO. Prior to being reclassified to a severe area, the threshold was 100 tons/year of NOx. The point source inventory consists of actual emissions for the base-year 1990 and includes sources within the geographical area of the Washington DC-MD-VA nonattainment area. The states of Maryland and Virginia and the District of Columbia are responsible for compiling and submitting point source emission estimates.

In 2002, the State of Maryland corrected its methodology for calculating average daily ozone seasons emissions for stationary sources. The change in Maryland's ozone season daily point source emission estimates is due to applying the summer seasonal throughput percentage to each piece of equipment. Estimating emissions using this calculation method results in a change to the 1990 base year inventory and ultimately all of the projection year inventories as well. In addition, the point source numbers for all jurisdictions have been modified to reflect the new 25 tons/year NOx definition of point sources under the severe nonattainment category. The state air agencies re-visited their 1990 point source inventories to determine if additional sources were to be included due to the lower NOx threshold. Appendix E contains a list of these new sources added to the inventory.

3.2.2 Area Sources

Area sources are sources of emissions too small to be inventoried individually and which collectively contribute significant emissions. Area sources include smaller stationary point sources not included in the states' point source inventories such as printing establishments, dry cleaners, and auto refinishing companies, as well as non-stationary sources.

Area source emissions typically are estimated by multiplying an emission factor by some known indicator of collective activity for each source category at the county (or county-equivalent) level. An activity level is any parameter associated with the activity of a source, such as production rate or fuel consumption that may be correlated with the air pollutant emissions from that source. For example, the total amount of VOC emissions emitted by commercial aircraft can be calculated by multiplying the number of landing and takeoff cycles (LTOs) by an EPA-approved emission factor per LTO cycle for each specific aircraft type.

Several approaches are available for estimating area source activity levels and emissions. These include apportioning statewide activity totals to the local inventory area and using emissions per employee (or other unit) factors. For example, solvent evaporation from consumer and commercial products such as waxes, aerosol products, and window cleaners cannot be routinely determined for many local sources. The per capita emission factor assumes that emissions in a given area can be reasonably associated with population. This assumption is valid over broad areas for certain activities such as dry cleaning and small degreasing operations. For some other sources an employment based factor is more appropriate as an activity surrogate.

For this SIP, the baseline area source inventory has been updated with the following information:

- The District requested that baseline emissions from locomotive activity within the District be revised to reflect more accurate data. The correction increases the 1990 nonroad VOC and NOx baseline.

- Vehicle refueling emissions are calculated using MOBILE6 emissions factors. The baseline Vehicle Refueling inventory was recalculated with MOBILE6 factors for Stage II refueling. The previous baseline inventory for refueling emissions was calculated with MOBILE5. The temperature inputs were changed to reflect the latest available data and

to be consistent with MOBILE6 modeling performed for on-road emissions. Minimum and maximum temperatures of 68.5 degrees and 95 degrees were used. The resulting emission factors were applied to gasoline sales consistent with the method documented in the 1990 Base Year Inventory.

Table 3-3
Refueling Loss Emission factors

County/Jurisdiction	Emission Factor (g/gallon)
Calvert	8.86
Charles	8.86
Frederick	8.87
Montgomery	8.86
Prince George's	8.85
Arlington	8.95
Fairfax	8.85
Loudoun	8.93
Prince William	8.92
Stafford	9.08
Alexandria	8.97

- Emissions from the commercial aircraft category were recalculated using the Emissions Dispersion Modeling Software (EDMS) model to reflect 1990 activity at Dulles and National Airports. This allowed a more accurate comparison between 2002 and 2005 airport emissions data. The area source category includes emissions from the commercial aircraft operating at Dulles and National airports. Emissions from ground service equipment and auxiliary power units are included in the nonroad inventory. These were also recalculated using EDMS.

3.2.3 Mobile Sources

Emissions from mobile sources were derived from the use of the National Capital Region Transportation Planning Board (TPB) travel demand forecasting procedure, which simulates vehicle travel across the region's transportation system. Travel was simulated on all highways in the region, including both volume and speed of travel for each hour of the day. An EPA emissions model, MOBILE6, was used to determine the emissions characteristics of the vehicle fleet in place in the year 1990. Input for this emissions model includes locally specific information such as age distribution of registered vehicles, evaporation characteristics of motor fuel, and temperature data. The general equation for the estimation of mobile sources is:

(Travel Component) x (Emission Factor) = Emissions

Emissions accounted for in the mobile source inventory include:

Origin:	Emissions include "cold start" and "hot start" emissions occurring during the first few minutes of vehicle operation.
Running:	Emissions occurring on local streets and on the region's network of arterial streets, freeways and non-ramp freeways.
Running Loss:	Emissions due to the heating of fuel and fuel lines.
Crankcase:	Emissions due to blow-by.
Destination:	Evaporative or "hot soak" emissions occurring at the conclusion of a vehicle trip after the engine is turned off.
Diurnal:	Evaporative emissions occurring when the vehicle is at rest due to temperature fluctuations.
Resting Loss:	Emissions due to the permeation of fuel through hoses and fittings.
Auto Access:	Emissions attributable to auto trips to Metrorail stations or to park-and-ride lots.
Bus:	Bus emissions, i.e., Metrobus, Ride-on, etc.

In 2002 and early 2003, MWAQC and TPB undertook a series of improvements and refinements to the methodology used to calculate mobile emissions in the Washington metropolitan area. These improvements included:

- Using the MOBILE6 model to estimate emissions factors;
- Updating the mobile emissions model inputs to reflect the inspections and maintenance programs described in the most recent submissions to EPA by Maryland, Virginia and the District of Columbia, to recognize changes in vehicle type and age reflected in the 2002 registration data, and to account for the Heavy-Duty Diesel Vehicle and National Low Emission Vehicle (NLEV) programs;
- Updating the Travel Demand Model (currently Version 2.1) to reflect changes in regional travel patterns and driving habits documented through household surveys, traffic data and transit ridership information

To ensure that the mobile emissions in the 1990 baseline are comparable to the 2002 and 2005 mobile emissions used in measuring rate of progress and attainment, MWAQC recalculated the 2002 and 2005 mobile emissions using the new model. A full description of the methodology for recalculating the 1990 mobile emissions inventory is included in Appendix B.

3.2.4 Non-Road Vehicle and Engine Sources

Emissions from this category were based on a 1991 EPA contractor's report titled, "Non-Road Engine and Vehicle Emission Inventories for CO and Ozone Nonattainment Boundaries, Washington, D.C. MSA."

To construct the EPA non-road inventory, several factors were estimated: (1) equipment populations in the nonattainment area; (2) annual hours for use of each type of equipment, adjusted for geographic region and for the season of interest for each pollutant studied; (3) average rated horsepower for each type of equipment; (4) typical load factor for each type of equipment; and (5) an emission factor for each of the 79 categories of equipment.

In developing emissions inventories for non-road engines and vehicles EPA used the following formula:

M = N x HRS x HP x LF x EF, where

M = mass of emissions of pollutant during inventory period
N = source population
HRS = annual hours of use
HP = average rated horsepower
LF = typical load factor
EF(i) = average emissions of pollutant per unit of use (e.g., emission factor grams per horsepower-hour)

The product of the annual hours of use, the average rated horsepower, and the load factor is referred to as the per-source usage rate. The product of the equipment population and the per-source usage rate is referred to as the activity level, and is estimated in units of horsepower-hours. By multiplying the seasonally adjusted activity levels by the appropriate emission factor, emission estimates for an ozone season day were developed for each category of non-road equipment and vehicles in the EPA-prepared inventories.

The EPA estimates as provided in the report did not accurately reflect either the 1990 summer Reid Vapor Pressure (RVP) of 8.3 psi or the proper activity split between the weekend and weekday use of recreational boating and lawn and garden equipment. The EPA document reported that an RVP of 10.5 psi was used in the analysis. The EPA estimates for the region were adjusted for the RVP and activity split by the Maryland Department of the Environment.

COG's Department of Environmental Programs improved the methodology for calculating the nonroad inventory during the process of developing the 1999 Periodic Emissions Inventory (PEI). As written in the documentation for the 1999 PEI (1999 Periodic Emissions Inventory of Ozone Precursors Emissions for the Washington, DC-MD-VA Ozone Nonattainment Area, dated November 12, 2001), EPA's NONROAD Model was used to generate ratios of emissions from commercial and residential non-road equipment categories. Those ratios were applied to the original 1991 EPA report of nonroad emissions for the Washington region.

For this purpose, NONROAD model runs were made for the metropolitan Washington region for weekday and weekend day. The ozone season day weighted ratios of the commercial and residential components for gasoline lawn and garden equipment category (2-stroke and 4-stroke) were estimated from the modeled emissions. These percent distributions were applied to the combined category for developing the emissions for the covered lawn and garden gasoline equipment categories. The resulting Nonroad inventory is the same as that reported in the 1990 Baseline Inventory report, but the level of detail is much greater, which allows for more accurate projections of future year inventories before and after emission controls are applied.
Ground service equipment and auxiliary power units operated at airports are considered nonroad sources and are included in the nonroad category. As mentioned above under the discussion of

area sources, these baseline emissions were recalculated using EDMS to allow a more accurate comparison between the baseline and the 2002 and 2005 emissions from these sources.

New updated 1990 baseline nonroad emissions incorporating updated 1990 baseline airport VOC and NOx emissions are as follows:
VOC: 73.4 tpd
NOx: 79.5 tpd

3.2.5 Biogenic Emissions

An important component of the modeling inventory is biogenic emissions. Biogenic emissions are those resulting from natural sources. Biogenic emissions are primarily VOCs that are released from vegetation throughout the day. Biogenic emissions of NOx include lightning and forest fires. A computer model has been used to estimate biogenic emissions in the modeling domain. Two versions of the model have been used - BEIS1 and BEIS2. EPA has recommended that states use BEIS1 with UAM-4 for attainment demonstrations. OTAG has applied BEIS2 for its modeling due to the fact that BEIS2 is an advanced version of the model. In order to be consistent with the modeling, the most of the modeling analysis is based on the results of the BEIS2 biogenics inventory.

Biogenic emissions are not included in the emission summary tables in this section of the report. The BEIS emission inventories for the Washington nonattainment area are shown in Table 3-3.

Table 3-4
Estimated Biogenic Emissions within the Washington Nonattainment Area
(tons per day)

	VOC	NOx
BEIS 1	376.0	NA
BEIS 2	720.0	7.4

Source: Virginia Department of the Environment, Biogenic Emissions Estimates (PC-BEIS2.2 Analyses) for July 16, 1991

4.0 The 2002 and 2005 Projected Inventories

The Act requires ozone nonattainment areas classified as moderate and above to achieve a 15 percent reduction in VOC emissions by 1996 and an additional three percent per year until the attainment date for the area. The reduction must be calculated from the anthropogenic emissions levels reported in the 1990 Base-Year Inventory after those levels have been adjusted to reflect the expected growth in emissions between 1990 and the projection year. The 1990 Base-Year Inventory is described in Chapter 3. This chapter presents the 2002 and 2005 Projection Inventories, the estimation of the levels of emissions to be expected in those years before the consideration of emission controls.

The 2002 and 2005 projected uncontrolled inventories are derived by applying the appropriate growth factors to the 1990 Base-Year Emissions Inventory. EPA guidance describes four typical indicators of growth. In order of priority, these are product output, value added, earnings, and employment. Surrogate indicators of activity, for example population growth, are also acceptable methods.

Round 6.3 Cooperative Forecasting results (population, household and employment projections), which are prepared and officially adopted by the Metropolitan Washington Council of Governments (COG), were used to project emissions from area and nonroad sources. The COG Board of Directors approved these forecasts on October 8, 2003. The Economic Growth Analysis System (EGAS) model was used by all three jurisdictions to project growth in point source emissions. Projections for onroad were developed using MOBILE6 and the Version 2.1c Travel Demand Model developed by the Transportation Planning Board.

4.1 Growth Projection Methodology

The following sections describe the method followed to determine the projected inventories for 2002 and 2005.

4.1.1 Growth Projection Methodology for Point Sources: EGAS

The growth in point source emissions is projected using EGAS version 3.0. Point source emissions for 1990 are provided from the state data sources and the model is run with the following options selected: projections are run by Source Classification Code; the Bureau of Labor Statistics national economic forecast; and the baseline regional economic forecast. Point source emission projection using EGAS are contained in Appendix E.

In 2002, the State of Maryland corrected its methodology for calculating average daily ozone seasons emissions for stationary sources. This correction to emissions from Maryland stationary sources is reflected in the new 2002 and 2005 NOx and VOC inventories and details are provided in Appendix E.

4.1.2 Growth Projection Methodology: Area and Non-Road Sources

Base-year area and nonroad source emissions for 1990 were calculated using 1990 population, household, and employment data. Thus, growth factors for the periods of 1990 to 2002 and 1990 to 2005 were derived by dividing Round 6.3 population, household, and employment forecasts for the analysis year by actual 1990 population, household, and employment values for the region. Area and non-road projection inventories are contained in Appendix C. The growth factors used for the 2002 and 2005 projection years are presented in Tables 4-1 and 4-2. The growth factors were applied to emissions categories by specific jurisdictions. The states supplied the gasoline sales growth factors.

In the previous SIP revision, COG used Round 6.2 and draft Round 6.3 Cooperative Forecasts to grow the baseline inventory to the 2002 and 2005 projection years and calculate emission reductions. Since the August 2003 SIP revision was submitted, COG approved final Round 6.3 cooperative forecasts for populations, employment, and households in all jurisdictions in the MWAQC region. Small corrections were made to the draft projections prior to final approval. The final Round 6.3 forecasts project higher growth in some jurisdictions and lower growth in other jurisdictions. Regionally, growth is forecasted to be higher in the final Round 6.3 numbers than in Round 6.2.

Table 4-1
1990-2002 Growth Factors, Final Round 6.3 Cooperative Forecasts

Jurisdiction	Employment	Population	Household	Gas Use
District of Columbia	0.971	1.000	1.046	1.165
Calvert County	1.498	1.455	1.486	1.165
Charles County	1.368	1.260	1.327	1.165
Frederick County	1.818	1.354	1.360	1.165
Montgomery County	1.218	1.176	1.185	1.165
Prince George's County	1.123	1.140	1.144	1.165
City of Alexandria	1.094	1.182	1.194	1.165
Arlington County	1.116	1.124	1.126	1.165
Fairfax County	1.367	1.220	1.242	1.165
Loudoun County	2.440	2.423	2.415	1.165
Prince William County	1.385	1.449	1.477	1.165
Stafford County	2.513	1.599	1.688	1.165
Maryland Aggregate	1.346	1.326	1.332	1.165

Virginia Aggregate	1.226	1.189	1.197	1.165
Nonattainment Aggregate	1.191	1.213	1.224	1.165

Source: Metropolitan Washington Council of Governments

Table 4-2
1990-2005 Growth Factors, Final Round 6.3 Cooperative Forecasts

Jurisdiction	Employment	Population	Household	Gas Use
District of Columbia	0.964	1.000	1.057	1.206
Calvert County	1.622	1.569	1.607	1.206
Charles County	1.460	1.325	1.409	1.206
Frederick County	2.022	1.442	1.449	1.206
Montgomery County	1.273	1.221	1.231	1.206
Prince George's County	1.153	1.175	1.180	1.206
City of Alexandria	1.117	1.228	1.242	1.206
Arlington County	1.145	1.155	1.158	1.206
Fairfax County	1.450	1.273	1.299	1.206
Loudoun County	2.800	2.778	2.769	1.206
Prince William County	1.481	1.561	1.596	1.206
Stafford County	2.891	1.749	1.859	1.206
Maryland Aggregate	1.432	1.408	1.415	1.206
Virginia Aggregate	1.283	1.237	1.247	1.206
Nonattainment Aggregate	1.238	1.267	1.280	1.206

Source: Metropolitan Washington Council of Governments

The 2002 and 2005 emissions for area and non-road sources are calculated by multiplying the 1990 base-year area and non-road emissions by the above growth factors for the appropriate year for each jurisdiction. Each area and non-road source category was matched to an appropriate growth surrogate based on the activity used to generate the base-year emission estimates. Surrogates were chosen as follows:

Surface Coating - population growth was chosen since the 1990 emissions are based on population-based emission factors.

Commercial/Consumer Solvent Use - population was chosen as the growth surrogate since 1990 emissions are based on per capita emission factors.

Vehicle Fueling and Underground Tank Breathing - all gasoline marketing categories were based on gasoline sales data since this is the activity level used to determine base-year emissions.

Open Burning - zero growth was applied since open burning emissions in the Washington region are predominately related to land clearing and the number of acres available for open burning is limited and will not increase between 1990 and 2002 0r 2005.

Dry Cleaning - population was chosen as the surrogate since base-year emissions are estimated using per capita emission factors.

Graphic Arts - population was used to estimate growth since emissions are based on per capita emission factors.

Surface Cleaning - employment growth was used as the surrogate since emissions are based on employment in auto repair, manufacturing, and electronic industries.

Tank Truck Unloading - growth in gasoline sales was applied to this category since base-year emissions are calculated using gasoline sales growth factors.

Municipal Landfills - Base-year emissions are estimated using data on total refuse deposited. Population was chosen as a surrogate since deposited waste is from the general population rather than industrial facilities.

Asphalt Paving - population was chosen as the surrogate since base-year emissions are calculated using per capita emission factors.

Bakeries - population was chosen as the surrogate.

Leaking Underground Storage Tanks - zero growth was applied to this category. The number of remediations during the ozone season, used to generate base-year emissions, does not directly correlate to population, households, or employment growth. The number of underground tanks is not expected to increase between 1990 and 1999.

Commercial Aviation and Airport Support Equipment - Emissions from commercial aircraft operations at Dulles and National Airports were provided by the Washington Metropolitan Airports Authority (MWAA). Emissions were calculated using FAA-approved activity data and the Emissions Dispersion Modeling system (EDMS) model.

Lawn and Garden Equipment - employment growth was chosen since the majority of lawn and garden emissions are the result of commercial lawn and garden activities.

Off-Highway Vehicles - population growth was chosen as the surrogate since projected estimates of future activity (e.g., number of motorcycle dealer establishments) are not available.

Recreational Boating - since forecasts of the future marine engine population are not available, population was chosen as the surrogate for projecting emissions.

Industrial Equipment - employment was chosen as the growth surrogate since emissions from this category are directly related to industrial activity.

Construction Equipment - emissions are related to total construction activity. Since reliable forecasts of construction equipment activity for 1999 are not readily available, total regional employment growth was chosen as the surrogate.

Agricultural Equipment - since the number of acres of land devoted to agricultural uses is not likely to increase between 1990 and 1999, a growth factor of 1.000 was applied.

Logging Activities - since the number of persons engaged in logging activities is not likely to increase between 1990 and 1999, a growth factor of 1.000 was applied.

4.1.3 Growth Projection Methodology: Mobile Sources

The 2002 and 2005 mobile source inventories were created through use of transportation and emissions modeling techniques. This involved use of the MOBILE6 emissions factor model and the Version 2.1c Travel Demand Model with a 2002 actual and 2005 planned highway network. Full documentation of the development of the 2002 and 2005 mobile inventories is included in Appendix B. Appropriate population, household, and employment growth are input through the Round 6.3 Cooperative Forecasting techniques.

4.1.4 Biogenic Emission Projections

Biogenic emission inventories for 2005 are the same as those used for the base-case for the entire domain. These were derived from BEIS1 and BEIS2 processors. No biogenic inventory is available for 2002. The biogenic inventory is not used to determine rate of progress.

4.2 Offset Provisions and Point Source Growth

The Act requires that emission growth from major stationary sources in nonattainment areas be offset by reductions that would not otherwise be achieved by other mandated controls. The offset requirement applies to all new major stationary sources and existing major stationary sources that have undergone major modifications. Increases in emissions from existing sources resulting from increases in capacity utilization are not subject to the offset requirement. For the purposes of the offset requirement, major stationary sources include all stationary sources exceeding an applicable size cutoff. In

the Washington region these provisions apply to sources with emissions equal to or greater than 25 tons per year.

4.3 Actual vs. Allowable Emissions in Development of the 2005 Projected Emissions Inventory

For the purposes of calculating 2005 projection emissions inventories, EPA guidance specifically outlines the circumstances under which emissions projections are to be based on actual or allowable emissions. For sources or source categories that are subject to a pre-1990 regulation and the state does not anticipate subjecting the source to additional regulation, emissions projections should be based on actual emissions levels. Actual emissions levels should also be used to project for sources or source categories that were unregulated as of 1990. For sources that are expected to be subject to post-1990 regulation, projections should be based on new allowable emissions.

To simplify comparisons between the base-year and the projected year, EPA guidance states that comparison should be made only between like emissions: actual to actual, or allowable to allowable, not actual to allowable. Therefore, all base-year and all projection-year emissions estimates are based on actual emissions.

The term "actual emissions" means the average rate, in tons per year, at which a source discharged a pollutant during a two year period, which preceded the date or other specified date, and which is representative of normal source operation. Actual emissions are calculated using the source's operating hours, production rates, and types of material processed, stored, or combusted during the selected time period.

"Allowable emissions" are defined as the maximum emissions a source or installation is capable of discharging after consideration of any physical, operations, or emissions limitations required by state regulations or by federally enforceable conditions, which restrict operations and which are included in an applicable air quality permit to construct or permit to operate, secretarial order, plan for compliance, consent agreement, court order, or applicable federal requirement.

4.4 Projection Inventory Results

The 2002 and 2005 VOC and NOx projection-year emission inventory results with no control measures applied are summarized by component of the inventory in Tables 4-3 through and 4-6 below.

Table 4-3
2002 Projected Uncontrolled VOC Inventory (tons/day)
Washington Nonattainment Area

Emission Source	Maryland	Virginia	District of Columbia	Total
Point	7.0	10.8	0.9	18.7
Area	111.3	99.0	20.1	230.5
Non-road	41.9	48.1	5.7	95.6
Mobile	84.7	78.0	18.8	181.5
Total	244.9	235.9	45.5	526.3

Source: COG and state air agencies, 2003, based on Round 6.3 Cooperative Forecasts
* Small discrepancies may result due to rounding

Table 4-4
2002 Projected Uncontrolled NOx Inventory (tons/day)
Washington Nonattainment Area

Emission Source	Maryland	Virginia	District of Columbia	Total
Point	310.3	66.8	7.6	384.8
Area	19.2	36.3	4.3	59.8
Non-road	52.2	42.3	5.3	99.9
Mobile	159.4	147.5	28.8	335.7
Total	541.2	293.0	46.0	880.1

Source: COG and state air agencies, 2003, based on Round 6.3 Cooperative Forecasts
* Small discrepancies may result due to rounding

Table 4-5
2005 Projected Uncontrolled VOC Inventory (tons/day)
Washington Nonattainment Area

Emission Source	Maryland	Virginia	District of Columbia	Total
Point	7.4	11.6	0.9	19.9
Area	115.7	105.1	20.2	240.9
Non-road	43.9	52.0	5.6	101.5
Mobile	82.0	78.2	18.0	178.2
Total	249.0	246.9	44.7	540.5

Source: COG and state air agencies, 2003, based on Round 6.3 Cooperative Forecasts
* Small discrepancies may result due to rounding

Table 4-6
2005 Projected Uncontrolled NOx Inventory (tons/day)
Washington Nonattainment Area

Emission Source	Maryland	Virginia	District of Columbia	Total
Point	313.8	67.8	7.59	389.2
Area	20.0	40.8	4.3	65.1
Non-road	54.4	45.7	5.3	105.3
Mobile	152.2	141.8	27.2	321.2
Total	540.4	296.1	44.3	880.8

Source: COG and state air agencies, 2003, based on Round 6.3 Cooperative Forecasts
* Small discrepancies may result due to rounding

4.5 Emission Reductions from Control Measures

Chapter 7 of this SIP describes the control measures that have been or will be implemented by 2005 that will reduce emissions. Most control measures are required by federal or state regulations. Local governments and state agencies have voluntarily committed to other measures, as described in Section 7.6. Deducting the benefits of the control measures from the uncontrolled inventory yields 2002 and 2005 projected inventories assuming control measures are in place.

Tables 4-7 through 4-10 present the projected emission reductions for the 2002 rate-of-progress and 2005 rate-of-progress and attainment demonstrations resulting from implementation of the control measures. Below is a list of the measures implemented in the Washington region. Chapter 7 presents detailed information on the measures and the projected reductions from each.

Point Source Controls
Non-CTG VOC RACT to 50 tons per year
State NOx RACT and regional NOx transport requirements
Expanded State VOC source regulations to 25 tons per year

Area Source Controls
Stage II vapor recovery
Reformulated gasoline refueling benefits
Reformulated surface coatings
Reformulated consumer products
Surface cleaning/degreasing for machinery/auto repair
Landfill regulations
Seasonal open burning restrictions
Stage I expansion (Tank truck unloading)
Graphic arts controls
Autobody refinishing
Reformulated Industrial Cleaning Solvents
Emission Standards for Locomotives
Ozone Transport Commission (OTC) Portable Fuel Containers Rule
OTC Architectural and Industrial Maintenance Coatings
OTC Solvent Cleaning Operations Rule
Voluntary Measures Bundle

Nonroad Source Controls
Non-road gasoline engines rule
Non-road diesel engines rule
Non-road marine engines rule
Large non-road spark ignition engines rule
Reformulated gasoline (off-road)

Onroad Source Controls
High-tech Inspection/Maintenance
National Low Emission Vehicle Program
Tier I vehicle standards
Tier II Vehicle Emission and Fuel Program
Reformulated gasoline (on-road)
Transportation control measures
Heavy–Duty Diesel Engine Rule

4.6 2002 and 2005 Controlled Emissions for Rate-of-Progress

The projection of 2002 and 2005 controlled emissions is simply the 2002 or 2005 uncontrolled emissions minus the emission reductions achieved from the rate-of-progress control measures implemented by the Severe Area Plan. This information is presented in Tables 4-7 through 4-10. Point source controlled inventories are contained in Appendix E, while area and non-road controlled inventories are in Appendix C. Details on mobile source controlled inventories can be found in Appendices B and G.

Table 4-7
2002 Projected Controlled VOC Emissions (tons/day)
Washington Nonattainment Area

Emission Source	Maryland	Virginia	District of Columbia	Total**
Point	5.0	9.6	0.6	15.2
Area	67.7	57.0	15.6	140.3
Non-road	29.8	35.4	4.2	69.4
Mobile	58.9	53.8	12.8	125.2
Total	161.4	155.8	33.2	346.9

* Small discrepancies may result due to rounding
** Mobile total includes a reduction of 0.3 tpd due to regional TCMs.
Regional total includes a reduction of 3.2 tpd from 7.6 Voluntary Measures Bundle.

Table 4-8
2002 Projected Controlled NOx Emissions (tons/day)
Washington Nonattainment Area

Emission Source	Maryland	Virginia	District of Columbia	Total**
Point	135.6	40.8	4.6	181.0
Area	17.0	34.2	4.2	55.3
Non-road	44.3	36.2	4.5	85.0
Mobile	138.5	127.4	24.9	290.3
Total	335.3	238.6	38.2	611.4

* Small discrepancies may result due to rounding
** Mobile total includes a reduction of 0.5 tpd due to regional TCMs.
Regional total includes a reduction of 0.2 tpd from 7.6 Voluntary Measures Bundle

Table 4-9
2005 Projected Controlled VOC Emissions (tons/day)
Washington Nonattainment Area

Emission Source	Maryland	Virginia	District of Columbia	Total**
Point	5.2	10.4	0.5	16.2
Area	70.4	61.5	15.4	147.3
Non-road	29.3	35.0	3.8	68.2
Mobile	45.2	42.4	10.1	97.4
Total	150.1	149.3	29.9	325.8

* Small discrepancies may result due to rounding
** Mobile total includes a reduction of 0.3 tpd due to regional TCMs.
Regional total includes a reduction of 3.2 tpd from 7.6 Voluntary Measures Bundle.

Table 4-10
2005 Projected Controlled NOx Emissions (tons/day)
Washington Nonattainment Area

Emission Source	Maryland	Virginia	District of Columbia	Total**
Point	83.9	22.5	3.4	109.8
Area	17.8	38.5	4.1	60.4
Non-road	42.4	36.2	4.2	82.8
Mobile	112.2	103.0	20.2	234.7
Total	256.2	200.2	31.9	487.5

* Small discrepancies may result due to rounding
** Mobile total includes a reduction of 0.7 tpd due to regional TCMs.
Regional total includes a reduction of 0.2 tpd from 7.6 Voluntary Measures Bundle.

5.0 2002 RATE-OF-PROGRESS REQUIREMENTS

5.1 Introduction

Since 1990, the Clean Air Act has required ozone nonattainment areas to demonstrate progress towards attaining the 1-hour ozone standard. This requirement is referred to as the rate-of-progress (ROP) requirement. Between 1990-1996, nonattainment areas were required to reduce VOC emissions by 15%. Since 1996, regions have been required to demonstrate a 9% rate of progress every three years until the region's attainment date. As discussed in Chapter 2, the Metropolitan Washington region was originally classified as a serious nonattainment area with an attainment date of November 15, 1999. On January 24, 2003, EPA promulgated a Final Nonattainment Determination and Reclassification for the Metropolitan Washington area. This document reclassified the region as a severe nonattainment area, with an attainment date of November 15, 2005. Under severe area requirements, the Washington region is required to submit rate-of-progress demonstrations for the periods 1999-2002 and 2002-2005. However, the reclassification did not occur until after the November 15, 2002 deadline for demonstrating 1999-2002 rate-of-progress. In its Final Reclassification Notice, EPA extended until November 15, 2005 the deadline for the Washington region to meet the 2002 rate-of-progress requirements:

> *The required post-1999 ROP nine percent reduction originally was required by November 15, 2002 under the [Clean Air Act]. However, that date has elapsed. Therefore, in this action EPA is allowing the District, Maryland, and Virginia to demonstrate that the first required post-1999 nine percent ROP is achieved as expeditiously as practicable after November 15, 2002, but in any case no later than November 15, 2005.* (68 FR 3412)

This chapter contains the Washington region's rate of progress demonstration for the years 1999-2002. The region will fulfill the 1999-2002 rate-of-progress requirements by January 2005, as discussed in Section 5.7.

In order to demonstrate rate-of-progress, a region must show that its expected emissions, termed controlled inventories, of NOx and VOC will be less than or equal to the target levels set for the end of the rate-of-progress period, or "milestone year". For the rate-of-progress period 1999-2002, the "target inventories" of emissions are the maximum quantity of anthropogenic emissions permissible during the 2002 milestone year.

This section describes the methodology used to establish the regional target inventories and controlled inventories for 2002. Because the expected NOx and VOC emissions will be less than or equal to the target levels, the Washington region will meet the rate-of-progress requirements for 2002.

5.2 Guidance for Calculating Emission Target Levels

The Clean Air Act Amendments (CAAA) of 1990 provide the primary guidance for calculating the VOC and NOx target levels used in a region's rate-of-progress (ROP) plans. In addition, EPA has issued various guidance documents to assist states in ROP development. This section briefly summarizes the requirements and procedures for calculating the target emission levels required for a ROP demonstration. Rate of progress demonstrations build upon each other, starting from the base year of 1990. Because the Washington region has updated its mobile inventories using MOBILE6, the base year and milestone year inventories have been revised from those submitted in prior SIPs. The intermediate milestones needed to be recalculated in order to develop 2002 target levels.

5.2.1 Guidance Relating to the 15% Plan

The first demonstration, known as the 15% Plan, required nonattainment areas to reduce VOC emissions by 15% from 1990 base year levels during the years 1990-1996. The CAAA included restrictions on the use of control measures to meet the 15% requirements. Reductions in ozone precursors resulting from four types of federal and state regulations could not be used to meet rate of progress. These four types of programs are: Federal Motor Vehicle Control Program (FMVCP) tailpipe and evaporative standards issued by January 1, 1990, federal regulations limiting the Reid Vapor Pressure (RVP) of gasoline in ozone nonattainment areas issued by June 15, 1990, state regulations correcting deficiencies in reasonably available control technology (RACT) rules, and state regulations establishing or correcting inspection and maintenance (I/M) programs for on-road vehicles. The basic procedures for developing target levels for the 15% Plan are described in EPA's *Guidance on the Adjusted Base Year Emissions Inventory and the 1996 Target for the 15% Rate of Progress Plans*.

5.2.2 Guidance Relating to the Post-1996 Rate of Progress Plans and NOx Substitution

The post-1996 rate-of-progress requirements mandate that nonattainment areas reduce regional VOC emissions by an average of 3% per year, for a total of 9%, during each rate-of-progress period. Section 182(c)(2)(C) of the Clean Air Act allows use of NOx reductions occurring after 1990 when demonstrating a post-1996 rate-of-progress. Procedures for developing target levels for post-1996 rate-of-progress demonstrations are described in EPA's *Guidance on the Post-1996 Rate-of-Progress Plan and the Attainment Demonstration*. NOx emissions reductions may be substituted for VOC emissions reductions at a rate of 1 percent of the adjusted base year VOC inventory for 1 percent of the adjusted base year NOx inventory. If a region chooses to substitute reductions in NOx for reductions in VOC, the substitution must be made in accordance with EPA's *NOx Substitution Guidance*. This guidance states that the sum of all NOx and VOC reductions must average 3% per year over each 3-year ROP period, and that the use of NOx emission reductions must be consistent with the photochemical modeling used in the region's attainment demonstration. As photochemical attainment modeling performed for the Metropolitan Washington region shows that NOx reductions significantly reduce ozone formation, the region can substitute NOx reductions for VOC reductions. Based on this modeling, the Washington region can substitute NOx reductions for some or all (0-9%) of the

required VOC reductions for the 2002 rate-of-progress. Further details are contained in Appendix F.

5.3 Recalculation of Target Levels for Previous Milestone Years

5.3.1 1996 VOC Target Level

The 1996 VOC target level is calculated according to EPA's *Guidance on the Adjusted Base Year Emissions Inventory and the 1996 Target for the 15% Rate of Progress Plans*. The formula for calculation of the 1996 VOC target level is as follows:

1996 Target Level = (1990 base year inventory) – (reductions required to meet the rate-of-progress requirement) – (fleet turnover correction term) – (RACT rule correction term) [Eq. 5-1]

There are six steps in calculating a target level. These steps are described below.

Steps 1-2 Develop 1990 Base Year and 1990 Rate-of-Progress Base Year Inventories

The revised 1990 base year inventory is an inventory of actual anthropogenic and biogenic VOC emissions on a typical weekday during peak ozone season. The inventory was calculated as described in Chapter 3 and is presented in Table 3-1. The rate-of-progress base-year inventory includes only anthropogenic emissions generated within the Metropolitan Washington nonattainment area. As the 1990 base-year inventory included no emissions generated outside the Metropolitan Washington area, the only difference between the base year inventory and the rate-of-progress base year inventory is the removal of biogenic emissions. The rate-of-progress base year VOC inventory is presented in Table 5-1.

Table 5-1
1990 VOC Rate-of-Progress Base-Year Inventory
(Ozone Season tons per day)

Source	Tons Per Day	Reference
Point	15.0	
Area	191.1	
Non-Road	73.4	
On-Road	299.2	
TOTAL	578.7	(V1)

Note: Small discrepancies may result due to rounding

Step 3 Develop Adjusted Base Year Inventory (1990 Inventory Adjusted to 1996)

According to the 1990 CAAA, reductions necessary to meet the rate-of-progress requirement must be calculated from an emission baseline that excludes the effects of the non-creditable FMVCP and RVP programs described in Section 5.2.1. Therefore the 1990 baseline must be adjusted by subtracting the VOC reductions that will result from these two programs between 1990 and 1996. The resulting inventory is referred to as the "1990 Baseline Inventory Adjusted to 1996", or the "1996 Adjusted Inventory".

As the FMVCP and RVP programs affect the mobile inventory, the first step in deriving the adjusted inventory is recalculating the mobile portion of the inventory to eliminate reductions due to these programs. The FMVCP and RVP emission reductions that occurred between 1990 and 1996 are calculated using MOBILE6, EPA's most recent mobile emissions model. Two changes were made to the MOBILE6 input files in order to calculate the 1996 adjusted inventory. To eliminate the effect of the RVP adjustment, the model must exclude emission reductions resulting from the use of lower volatility gasoline in 1996. This is accomplished by changing the RVP input from 8.2 to 7.8 psi in the base-year MOBILE6 input files.[1]

The effect of fleet turnover due to the FMVCP regulations is eliminated by calculating 1990 mobile emissions as if those emissions were produced by 1996 vehicles. The adjusted inventory uses actual 1990 vehicle miles traveled (VMT), but multiplies the VMT by the emission factors associated with the fleet of vehicles on the road in 1996. The following equations illustrate this difference between the base year and adjusted inventories:

Actual mobile emissions in the base year inventory are given by

E_{act} = (1990 VMT) x (MOBILE6 EMISSIONS FACTORS FOR CALENDAR YEAR 1990) [Eq. 5-2]

Adjusted emissions are given by

E_{adj} = (1990 VMT) x (MOBILE6 EMISSIONS FACTORS FOR CALENDAR YEAR 1996) [Eq. 5-3]

Therefore in calculating the 1990 adjusted emissions, MOBILE6 was run under the same assumptions as used in calculating actual 1990 emission factors except that 1996 was used as the evaluation year and RVP was set to 7.8 psi. The MOBILE6 input files are included in Appendix B. Table 5-2 displays the 1990 VOC Inventory Adjusted to 1996.

Table 5-2
1990 VOC Base-Year Inventory Adjusted to 1996
(Ozone Season tons per day)

Source	Tons Per Day	Reference
Point	15.0	
Area	191.1	
Non-Road	73.4	
On-Road	176.0	
TOTAL	455.5	(V2)

Note: Small discrepancies may result due to rounding

Step 4 Reductions Required to Meet Rate-of-Progress Requirement

The CAAA require nonattainment areas to demonstrate reductions totaling 15% of the 1990 Base Year Inventory Adjusted to 1996. These reductions are calculated as:

Required reductions = 0.15 * (1990 Inventory Adjusted to 1996) [Eq. 5-4]

Description	Tons/day VOC	Reference
1990 Inventory Adjusted to 1996	455.5	(V2)
15% Reduction for Rate-of-Progress Requirement	0.15	(V3)
Reduction Required for Rate-of-Progress	68.3	(V4) = (V2) * (V3)

Step 5 Fleet Turnover and RACT Rule Corrections

Even in the absence of new emission controls on vehicles, vehicle emissions would continue to decrease from year to year as a result of drivers purchasing new cars compliant with the 1990 FMVCP requirements. The effects of fleet turnover are eliminated during calculation of the 1996 adjusted inventory. Therefore fleet turnover can be calculated as:

Fleet Turnover Correction = 1990 Base Year Inventory – 1990 Inventory Adjusted to 1996 [Eq. 5-5]

Description	Tons/day VOC	Reference
1990 Base Year Inventory	578.7	(V1)
1990 Inventory Adjusted to 1996	455.5	(V2)
Fleet Turnover Correction	123.2	(V5) = (V1) - (V2)

As mentioned in Section 5.2.1, EPA guidance does not permit regions to take credit for emission reductions resulting from correction of RACT rule deficiencies. One RACT rule correction was required in the Washington region. The rule affected tank truck emissions in Loudoun County, Virginia. Appendix B of *Guidance on the Adjusted Base Year Emissions Inventory and the 1996 Target for the 15 Percent Rate-of-Progress Plans* describes the methodology for calculating RACT rule corrections. The RACT rule correction totals 0.059 tpd VOC, which rounds to 0.1 tpd VOC. Calculations are given in Appendix F.

Description	Tons/day VOC	Reference
RACT Rule Correction	0.1	(V6)

Step 6 Calculation of 1996 VOC Target Level

Following Equation 5-1, the VOC target level for 1996 is calculated in Table 5-3 below:

Table 5-3
Calculation of 1996 VOC Target Level
(Ozone Season tons per day)

Description	Tons/day VOC	Reference
1990 Base Year Inventory	578.7	(V1)
Reduction Required for Rate-of-Progress	68.3	(V4)
Fleet Turnover Correction	123.2	(V5)
RACT Rule Correction	0.1	(V6)
1996 Target Level	387.1	(V7) = (V1)-(V4)-(V5)-(V6)

Note: Small discrepancies may result due to rounding

5.3.2 1999 VOC and NOx Target Levels

The post-1996 rate-of-progress requirements mandate that nonattainment areas reduce regional VOC emissions by an average of 3% per year, for a total of 9%, during each rate-of-progress period. As explained in Section 5.2.2, the Washington region can choose to substitute NOx for some or all of the 9% VOC reduction. In the Revised Phase I Attainment Plan submitted in May 1999, the Washington region demonstrated rate-of-progress for the years 1996-1999 using

reductions of 1% VOC and 8% NOx.[2] Therefore these same percentage reductions will be used in recalculation of the 1999 VOC and NOx target levels.

The target levels for post-1996 rate-of-progress plans are calculated according to EPA's *Guidance on the Post-1996 Rate-of-Progress Plan and the Attainment Demonstration*. The general formula for calculation of post-1996 target levels is as follows:

Target Level = (previous milestone's target level) - (reductions required to meet the rate-of-progress requirement) - (fleet turnover correction term) [Eq. 5-6]

For the 1999 VOC target level, this becomes:

1999 VOC Target Level = (1996 VOC Target Level) – (1% VOC reduction) – (fleet turnover correction term) [Eq. 5-7]

Because EPA did not permit NOx substitution to meet the requirements of the 15% Plan, a 1996 NOx target level does not exist. Therefore the 1999 NOx target level is calculated as:

1999 NOx Target Level = (1990 NOx Base Year inventory) – (8% NOx reduction) – (fleet turnover correction term) [Eq. 6-8]

Steps 1-2 Develop 1990 Base Year and 1990 Rate-of-Progress Base Year Inventories

The revised 1990 NOx base year and base year rate-of-progress inventories are inventories of actual anthropogenic and biogenic VOC emissions on a typical weekday during peak ozone season. The inventory was calculated as described in Chapter 3 and is presented in Table 3-2. The base year rate-of-progress inventory includes only anthropogenic emissions generated within the Metropolitan Washington nonattainment area. As the 1990 base-year inventory included no emissions generated outside the Metropolitan Washington area, the only difference between the base year inventory and the rate-of-progress base year inventory is the removal of biogenic emissions. The rate-of-progress base year NOx inventory is presented in Table 5-4.

Table 5-4
1990 NOx Rate-of-Progress Base-Year Inventory
(Ozone Season tons per day)

Source	Tons Per Day	Reference
Point	361.4	
Area	47.7	
Non-Road	79.5	
On-Road	380.8	
TOTAL	869.3	(N1)

Note: Small discrepancies may result due to rounding

Step 3 Develop Adjusted Base Year Inventories (1990 Inventories Adjusted to 1999)

The 1990 base year inventories adjusted to 1999 estimate what 1990 VOC and NOx emissions would have been if they were produced by the fleet mix on the road in the Washington region in 1999. The inventories are calculated as described in Step 3 of Section 5.3.1, except the MOBILE6 emission factors are for calendar year 1999 instead of 1996. The MOBILE6 input files are included in Appendix B. Table 5-5 displays the 1999 Adjusted Inventories for VOC and NOx.

Table 5-5
1990 Base-Year Inventories Adjusted to 1999
(Ozone Season tons per day)

Source	VOC	NOx	Reference
Point	15.0	361.4	
Area	191.1	47.7	
Non-Road	73.4	79.5	
On-Road	154.2	290.0	
TOTAL	433.7	778.5	(V8), (N8)

Note: Small discrepancies may result due to rounding

Step 4 Reductions Required to Meet Rate-of-Progress Requirement

The Washington region chose to fulfill its 1996-1999 rate-of-progress requirement using an 8% reduction in NOx and a 1% reduction in VOC. These reductions are calculated as a percentage of the 1990 Base Year Inventory Adjusted to 1999:

Description	Tons/day VOC	Tons/day NOx	Reference
1990 Inventory Adjusted to 1999	433.7	778.5	(V8), (N8)
% Reduction for Rate-of-Progress Requirement	0.01	0.08	(V9), (N9)
Reduction Required for Rate-of-Progress	4.3	62.3	(V10) = (V8) * (V9) (N10) = (N8) * (N9)

Step 5 Fleet Turnover Correction

As discussed in Section 5.3.1, an adjusted inventory predicts how base year emissions would change if the benefits of fleet turnover and RVP adjustments in a given year were credited to the baseline inventory. Therefore the benefits of fleet turnover in a rate-of-progress period can be determined by taking the difference between the adjusted inventories for the relevant milestone years. For VOC, the relevant milestone years are 1996 and 1999. Because NOx reductions could not be used to fulfill the requirements of the 15% Plan, NOx reductions during the entire period

1990-1999 are creditable toward the 1996-1999 rate of progress. Therefore, the NOx fleet turnover correction is also calculated for the period 1990-1999:

VOC Fleet Turnover Correction = 1990 Inventory Adjusted to 1996– 1990 Inventory Adjusted to 1999 [Eq. 5-9]

NOx Fleet Turnover Correction = 1990 Base Year Inventory– 1990 Inventory Adjusted to 1999 [Eq. 5-10]

Description	Tons/day VOC	Tons/day NOx	Reference
1990 Base Year Inventory	N/A	869.3	(N1)
1990 Inventory Adjusted to 1996	455.5	N/A	(V2)
1990 Inventory Adjusted to 1999	433.7	778.5	(V8), (N8)
Fleet Turnover Correction	21.8	90.8	(V11) = (V2)-(V8) (N11) = (N1)-(N8)

Step 6 Calculation of 1999 Target Levels

Following Equations 5-7 and 5-8, the VOC and NOx target levels for 1999 are calculated in Table 5-6 below:

Table 5-6
Calculation of VOC and NOx Target Levels for 1999
(Ozone Season tons per day)

Description	**VOC**	**NOx**	**Reference**
1990 Base Year Inventory		869.3	(N1)
1996 Target Level	387.1		(V7)
Reduction Required for Rate-of-Progress	4.3	62.3	(V10), (N10)
Fleet Turnover Correction	21.8	90.8	(V11), (N11)
1999 Target Levels	360.9	716.2	(V12) = (V7)-(V10)-(V11) (N12) = (N1)-(N10)-(N11)

Note: Small discrepancies may result due to rounding

5.4 2002 VOC and NOx Target Levels

5.4.1 Emission Reduction Strategy for the 2002 Rate of Progress

As mentioned in Section 5.2.2, the photochemical modeling performed for the Washington region validates the use of either NOx or VOC reductions to fulfill the 9% emission reduction requirement for the 2002 and 2005 rates of progress. See Appendix F for further details. The region is not obligated to use the same VOC and NOx percentages used in any prior rate of progress plan. The ability to substitute NOx for VOC creates an array of VOC and NOx control strategy combinations that fulfill the 9% reduction requirement for the 1999-2002 rate-of-progress. The target levels of emissions and reduction requirements will vary depending on the VOC/NOx strategy chosen. Because the Washington region expects to see large NOx reductions by 2005 due to the NOx SIP call and the new Tier 2 vehicle regulations, among other measures, the region has chosen to demonstrate the 2002 rate-of-progress using reductions of 9% NOx and 0% VOC.

5.4.2 Calculation of 2002 Target Levels

Equation 5-6 gives the general formula for calculating post-1996 target levels. From Section 5.4.1, the region has chosen to demonstrate the 2002 rate-of-progress using 0% VOC reductions and 9% NOx reductions. Therefore the 2002 VOC target level becomes:

2002 VOC Target level = (1999 VOC Target Level) – (0% VOC reduction) – (fleet turnover correction term) [Eq. 5-11]

The 2002 NOx target level becomes:

2002 NOx Target level = (1999 NOx Target Level) – (9% NOx reduction) – (fleet turnover correction term) [Eq. 5-12]

Steps 1-2 Develop 1990 Base Year and 1990 Rate-of-Progress Base Year Inventories

The base year rate of progress inventories for VOC and NOx are the same inventories referenced in Sections 5.2.2 and 5.3.2 during calculation of the 1990-1996 and 1996-1999 target levels.

Step 3 Develop Adjusted Base Year Inventories (1990 Inventories Adjusted to 2002)

The 1990 base year inventories adjusted to 2002 estimate what 1990 VOC and NOx emissions would have been if they were produced by the fleet mix on the road in the Washington region in 2002. The inventories are calculated as described in Step 3 of Section 5.3.1, except the MOBILE6 emission factors are for calendar year 2002 instead of 1996. The MOBILE6 input files are included in Appendix B. Table 5-7 displays the 2002 Adjusted Inventories for VOC and NOx.

Table 5-7
1990 VOC Base-Year Inventories Adjusted to 2002
(Ozone Season tons per day)

Source	VOC	NOx	Reference
Point	15.0	361.4	
Area	191.1	47.7	
Non-Road	73.4	79.5	
On-Road	141.0	268.2	
TOTAL	420.5	756.7	(V13), (N13)

Note: Small discrepancies may result due to rounding.

Step 4 Reductions Required to Meet Rate-of-Progress Requirement

The Washington region is choosing to fulfill the 1999-2002 rate-of-progress requirements using a 9% reduction in NOx and a 0% reduction in VOC. These reductions are calculated as a percentage of the 1990 Base Year Inventory Adjusted to 2002:

Description	Tons/day VOC	Tons/day NOx	Reference
1990 Inventory Adjusted to 2002	420.5	756.7	(V13), (N13)
% Reduction for Rate-of-Progress Requirement	0	0.09	(V14), (N14)
Reduction Required for Rate-of-Progress	0	68.1	(V15) = (V13) * (V14) (N15) = (N13) * (N14)

Step 5 Fleet Turnover Correction

As discussed in Section 5.3.1, calculation of an adjusted inventory predicts how base year emissions would change if the benefits of fleet turnover and RVP adjustments in a given year were credited to the baseline inventory. Therefore the benefits due to fleet turnover during a rate-of-progress period can be determined by taking the difference between the adjusted inventories for the relevant milestone years. For VOC and NOx, the relevant milestone years are 1999 and 2002.

Fleet Turnover Correction = 1990 Inventory Adjusted to 1999– 1990 Inventory Adjusted to 2002

[Eq. 5-13]

Description	Tons/day VOC	Tons/day NOx	Reference
1990 Inventory Adjusted to 1999	433.7	778.5	(V8), (N8)
1990 Inventory Adjusted to 2002	420.5	756.7	(V13), (N13)
Fleet Turnover Correction	13.2	21.8	(V16) = (V8)-(V13) (N16) = (N8)-(N13)

Step 6 Calculation of 2002 Target Levels

Following Equations 5-11 and 5-12, the VOC and NOx target levels for 2002 are calculated in Table 5-8 below:

Table 5-8
Calculation of VOC and NOx Target Levels for 2002
(Ozone Season tons per day)

Description	**Tons/day VOC**	**Tons/day NOx**	**Reference**
1999 Target Level	360.9	716.2	(V12), (N12)
Reduction Required for Rate-of-Progress	0	68.1	(V15), (N15)
Fleet Turnover Correction	13.2	21.8	(V16), (N16)
2002 Target Levels	347.7	626.3	(V17) = (V12)-(V15)-(V16) (N17) = (N12)-(N15)-(N16)

5.5 Required Emission Reductions for 2002 Rate of Progress

5.5.1 2002 Uncontrolled Inventories

The CAAA require nonattainment areas to prove that the average 3% per year required emission reductions are achieved after offsetting growth in emissions. To determine the total emission reductions required for the 2002 rate-of-progress plan and prove that emissions growth has been offset, emissions levels during the 2002 milestone year must be estimated. The first part of this estimation is development of a 2002 uncontrolled inventory. The uncontrolled inventory includes VOC and NOx emissions that would have occurred in 2002 if no new control measures had been implemented since 1990. The inventory was calculated as described in Chapter 4 and is presented in Tables 4-3 and 4-4.

5.5.2 Requirement to Offset Growth in Emissions

The growth in emissions from 1990-2002 can be calculated by subtracting the 1990 base year inventory from the 2002 uncontrolled inventory. Table 5-9 shows emissions growth in VOC and NOx between 1990 and 2002.

Table 5-9
Washington Nonattainment Area
Summary of Emissions Growth Between 1990 and 2002
Ozone Season Daily Emissions (tons per day)

Description	VOC	NOx	Reference
2002 Uncontrolled Emissions	526.3	880.2	(V18), (N18)
1990 Inventory Adjusted to 2002[3]	420.5	756.7	(V13), (N13)
1990-2002 Emissions Growth	105.8	123.4	(V19) = (V18)-(V13) (N19) = (N18)-(N13)

VOC and NOx reductions excluding growth are calculated by taking the difference between the 1990 base year inventory and the 2002 target inventory. Table 5-10 displays the necessary VOC and NOx reductions.

Table 5-10
Washington Nonattainment Area
VOC and NOx Emission Reductions Required Between 1990 and 2002, Excluding Growth
Ozone Season Daily Emissions (tons per day)

Description	VOC	NOx	Reference
1990 Inventory Adjusted to 2002	420.5	756.7	(V13), (N13)
2002 Target Levels	347.7	626.3	(V17), (N17)
1990-2002 Reductions Required, Excluding Growth	72.8	130.4	(V20) = (V13)-(V17) (N20) = (N13)-(N17)

Total emission reductions including growth are calculated by summing the emissions growth, shown in Table 5-9, and the reductions required excluding growth, shown in Table 5-10. Table 5-11 summarizes the VOC and NOx reductions necessary for the 2002 rate-of-progress demonstration.

Table 5-11
Washington Nonattainment Area
VOC and NOx Emissions Reductions Required to Offset Growth Between 1990 and 2002
Ozone Season Daily Emissions (tons per day)

Description	VOC	NOx	Reference
1990-2002 Emissions Growth	105.8	123.4	(V19), (N19)
Reductions Without Growth	72.8	130.4	(V20), (N20)
Total Reductions Required, Including Growth	178.6	253.8	(V21) = (V19)+(V20) (N21) = (N19)+(N20)

5.6 Control Strategy for Demonstrating 2002 Rate-of-Progress

In order to demonstrate rate-of-progress for the years 1999-2002, the Washington region must show that expected emissions in 2002 are equal to or less than the 2002 target levels presented in Table 5-8. The region must also show that the total reductions achieved from 1990-2002 are greater than or equal to the required reductions calculated in Table 5-11.

The 2002 controlled inventories are inventories of all anthropogenic VOC and NOx emissions expected to occur in the Washington nonattainment area during 2002. The inventories were developed as described in Chapter 4 and are displayed in Tables 4-7 and 4-8. As summarized in Table 5-12, the 2002 controlled VOC and NOx inventories are less than the 2002 target inventories. The controlled inventories include the benefits of the control measures described in Chapter 7. As shown in Table A, the reductions from these control measures will exceed the 178.6 tpd VOC and 253.8 tpd NOx required. Table 5-13 summarizes the emission reductions from control measures. These two tables demonstrate that the Washington region fulfills the 1999-2002 rate-of-progress requirements.

Table 5-12
Washington Nonattainment Area
Comparison of 2002 Controlled and Target Inventories
Ozone Season Daily Emissions (tons per day)

Description	VOC	NOx	Reference
2002 Target Levels	347.7	626.3	(V17), (N17)
2002 Controlled Emissions	346.9	611.4	(V22), (N22)

Table 5-13
Washington Nonattainment Area
2002 Control Strategy Projection
Ozone Season Daily Emissions (tons per day)

Description	VOC	NOx	Reference
2002 Uncontrolled Emissions	526.3	880.1	(V18), (N18)
2002 Controlled Emissions, Including Round 6.3 Growth	346.9	611.4	(V23), (N23)
Emission Reductions from Control Measures	179.4	268.7	(V24) = (V18)-(V23) ≥ (V21) (N24) = (N18)-(N23) ≥ (N21)

5.7 Date for Fulfilling 2002 Rate-of-Progress Requirements

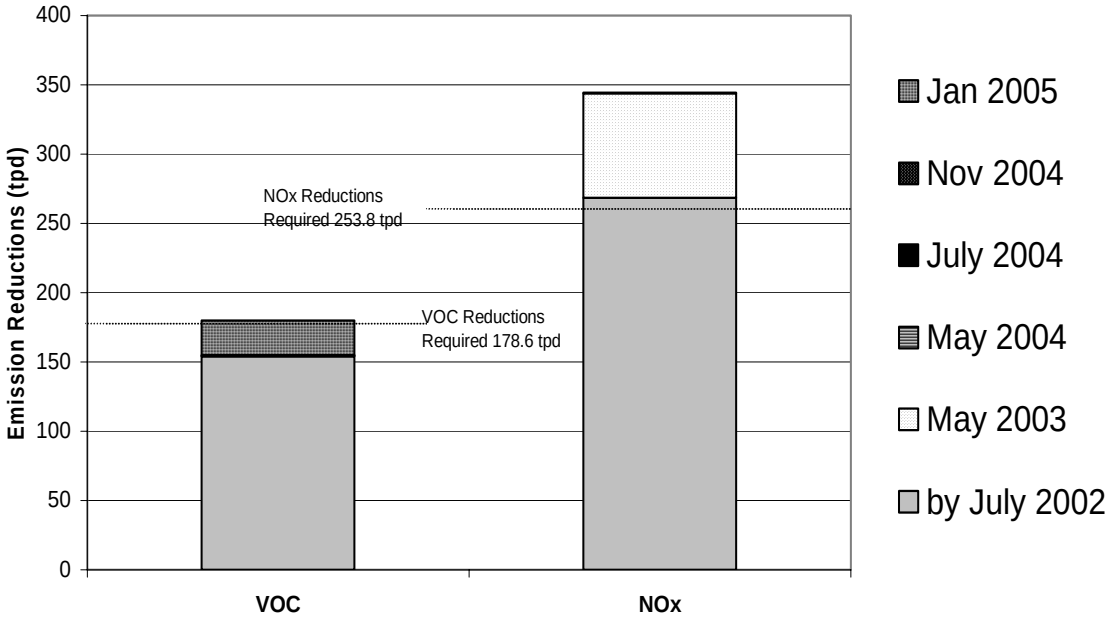
As discussed in Section 5.1, EPA's January 2003 reclassification notice ordered the region to achieve the 1999-2002 ROP as expeditiously as practicable after November 15, 2002, but no later than November 15, 2005. Table A in Chapter 7 quantifies the benefits of control measures used to fulfill the 2002 ROP requirements. Many of the reductions shown in Table A result from recent state and local commitments to implement control measures for the purpose of demonstrating the 2002 rate-of-progress. Of the measures listed in Table A, area source measures 7.4.11, 7.4.11, 7.4.14, 7.6 and part of measure 7.5 were not committed to as of November 15, 2002. As Table 5-14 shows, the reductions associated with these measures will total 25.6 tons per day VOC. These benefits could not be expediently or cost-effectively achieved through local reduction programs, such as vehicle replacement or transportation demand management. Therefore state regulations were required. As of November 2002, states had already begun rule development for many of regulations listed in Table 5-14. However, the regulatory comment and approval processes are lengthy, especially in the Commonwealth of Virginia.

Table 5-14
Washington Nonattainment Area
Reductions from Control Measures Not Committed to as of November 15, 2002
Ozone Season Daily NOx Emissions (tons per day)

Reference No.	Measure	VOC
7.4.11	Ozone Transport Commission (OTC) Portable Fuel Containers	0.9
7.4.12	Ozone Transport Commission (OTC) Architectural and Industrial Maintenance Coatings	12.3
7.4.14	Ozone Transport Commission (OTC) Solvent Cleaning	9.0
7.5	Transportation Control Measures (partial)	0.2
7.6	Voluntary Measures Bundle	3.2
	Reductions from Control Measures Not Committed to as of November 15, 2002	25.6

The District of Columbia, State of Maryland and Commonwealth of Virginia are implementing emission reductions contained in Table 5-14 as expeditiously as practicable, given the time required for completion of state regulatory processes. As Figure 5-1 shows, the region expects to credit all reductions necessary to demonstrate the 1999-2002 rate of progress by January 2005. Therefore, the Washington region expects to fulfill the 2002 ROP requirements before the statutory deadline of November 15, 2005. Appendix H contains more detailed information regarding the date on which the region will achieve rate of progress.

Figure 5-1
Date of Implementation for Future Emission Reductions
Used to Achieve 2002 Rate-of-Progress



References

U.S. EPA, "Guidance on the Adjusted Base Year Emissions Inventory and the 1996 Target for the 15% Rate of Progress Plans"

U.S. EPA, "Guidance on the Post-1996 Rate-of-Progress Plan and the Attainment Demonstration", February 18, 1994.

U.S. EPA, "NOx Substitution Guidance", December 1993.

[1] The 1990 Phase II regulations specify 7.8 psi as the maximum RVP of gasoline being sold in the Washington, DC-MD-VA ozone nonattainment area in 1992.

[2] See MWAQC Phase I Plan Revisions, Chapter 5.

6.0 2005 RATE-OF-PROGRESS REQUIREMENTS

In addition to the 1999-2002 rate-of-progress (ROP) demonstration contained in Chapter 5, the Washington region must also demonstrate rate-of-progress for the period 2002-2005. In order to demonstrate rate-of-progress, a region must show that its expected emissions, termed controlled inventories, of NOx and VOC will be less than or equal to the target levels set for the end of the rate-of-progress period, or "milestone year". For the rate-of-progress period 2002-2005, the target levels of emissions are the maximum quantity of anthropogenic emissions permissible during the 2005 milestone year. This section describes the methodology used to establish the regional target inventories and controlled inventories for 2005. Because the expected NOx and VOC emissions will be less than the target levels, the Washington region will meet the rate-of-progress requirements by the November 15, 2005 deadline.

6.1 2005 VOC and NOx Target Levels

6.1.1 Emission Reduction Strategy for the 2005 Rate of Progress

As mentioned in Section 5.2.2, the photochemical modeling performed for the Washington region validates the use of either NOx or VOC reductions to fulfill the 9% emission reduction requirement for the 2002 and 2005 rates of progress. See Appendix F for further details. The region is not obligated to use the same VOC and NOx percentages used in any prior rate of progress plan. The ability to substitute NOx for VOC creates an array of VOC and NOx control strategy combinations that fulfill the 9% reduction requirement for the 2002-2005 rate-of-progress. The target levels of emissions and reduction requirements will vary depending on the VOC/NOx strategy chosen. Because the Washington region expects to see large NOx reductions by 2005 due to the NOx SIP call and the new Tier 2 vehicle regulations, among other measures, the region has chosen to demonstrate the 2005 rate-of-progress using reductions of 9% NOx and 0% VOC.

6.1.2 Calculation of 2005 Target Levels

Equation 5-6 gives the general formula for calculating post-1996 target levels. From Section 6.1.1, the region has chosen to demonstrate the 2005 rate-of-progress using 0% VOC reductions and 9% NOx reductions. Therefore the 2005 VOC target level becomes:

2005 VOC Target level = (2002 VOC Target Level) – (0% VOC reduction) – (fleet turnover correction term) [Eq. 6-1]

The 2005 NOx target level becomes:

2005 NOx Target level = (2002 NOx Target Level) – (9% NOx reduction) – (fleet turnover correction term) [Eq. 6-2]

Steps 1-2 Develop 1990 Base Year and 1990 Rate-of-Progress Base Year Inventories

The base year rate of progress inventories for VOC and NOx are the same inventories presented in Tables 5-1 and 5-4 during calculation of the 1990-1996 and 1996-1999 target levels.

Step 3 Develop Adjusted Base Year Inventories (1990 Inventories Adjusted to 2005)

The 1990 base year inventories adjusted to 2005 estimate what 1990 VOC and NOx emissions would have been if they were produced by the fleet mix on the road in the Washington region in 2002. The inventories are calculated as described in Step 3 of Section 5.3.1, except the MOBILE6 emission factors are for calendar year 2005 instead of 1996. The MOBILE6 input files are included in Appendix B. Table 6-1 displays the 2005 Adjusted Inventories for VOC and NOx.

Table 6-1
1990 Base-Year Inventories Adjusted to 2005
(Ozone Season tons per day)

Source	VOC	NOx	Reference
Point	15.0	361.4	
Area	191.1	47.7	
Non-Road	73.4	79.5	
On-Road	132.6	247.0	
TOTAL	412.1	735.6	(V25), (N25)

Step 4 Reductions Required to Meet Rate-of-Progress Requirement

The Washington region is choosing to fulfill the 2002-2005 rate-of-progress requirement using a 9% reduction in NOx and a 0% reduction in VOC. These reductions are calculated as a percentage of the 1990 Base Year Inventory Adjusted to 2005:

Description	Tons/day VOC	Tons/day NOx	Reference
1990 Inventory Adjusted to 2005	412.1	735.6	(V25), (N25)
% Reduction for Rate-of-Progress Requirement	0	0.09	(V26), (N26)
Reduction Required for Rate-of-Progress	0	66.2	(V27) = (V25) * (V26) (N27) = (N25) * (V26)

Step 5 Fleet Turnover Correction

As discussed in Section 5.3.1, calculation of an adjusted inventory predicts how base year emissions would change if the benefits of fleet turnover and RVP adjustments in a given year were credited to the baseline inventory. Therefore the benefits due to fleet turnover during a rate-

of-progress period can be determined by taking the difference between the adjusted inventories for the relevant milestone years. For VOC and NOx, the relevant milestone years are 2002 and 2005.

Fleet Turnover Correction = 1990 Inventory Adjusted to 2002– 1990 Inventory Adjusted to 2005

[Eq. 6-3]

Description	Tons/day VOC	Tons/day NOx	Reference
1990 Inventory Adjusted to 2002	420.5	756.7	(V13), (N13)
1990 Inventory Adjusted to 2005	412.1	735.6	(V25), (N25)
Fleet Turnover Correction	8.4	21.1	(V28) = (V13)-(V25) (N28) = (N13)-(N25)

Step 6 Calculation of 2005 Target Levels

Following the equations 5-11 and 5-12, the VOC and NOx target levels for 2005 are calculated in Table 6-2 below:

Table 6-2
Calculation of VOC and NOx Target Levels for 2005
(Ozone Season tons per day)

Description	**VOC**	**NOx**	**Reference**
2002 Target Levels	347.7	626.3	(V17), (N17)
Reductions Required for Rate-of-Progress	0	66.2	(V27), (N27)
Fleet Turnover Correction	8.4	21.1	(V28), (N28)
2005 Target Levels	339.3	539.0	(V29) = (V17)-(V27)-(V28) (N29) = (N17)-(N27)-(N28)

6.2 Required Emission Reductions for 2005 Rate of Progress

6.2.1 2005 Uncontrolled Inventories

The CAAA require nonattainment areas to prove that the average 3% per year required emission reductions are achieved after offsetting growth in emissions. To determine the total emission reductions required for the 2005 rate-of-progress plan and prove that emissions growth has been offset, emissions levels during the 2005 milestone year must be estimated. The first part of this estimation is development of a 2005 uncontrolled inventory. The uncontrolled inventory includes VOC and NOx emissions that would have occurred in 2005 if no new control measures had been implemented since 1990. The inventory was calculated as described in Chapter 4 and is presented in Tables 4-5 and 4-6.

6.2.2 Requirement to Offset Growth in Emissions

The growth in emissions from 1990-2005 can be calculated by subtracting the 1990 base year inventory from the 2005 uncontrolled inventory. Table 6-3 shows emissions growth in VOC and NOx between 1990 and 2005.

Table 6-3
Washington Nonattainment Area
Summary of Emissions Growth Between 1990 and 2005
Ozone Season Daily Emissions (tons per day)

Description	VOC	NOx	Reference
2005 Uncontrolled Emissions	540.5	880.8	(V30), (N30)
1990 Inventory Adjusted to 2005[1]	412.1	735.6	(V25), (N25)
1990-2005 Emissions Growth	128.4	145.2	(V31) = (V30)-(V25) (N31) = (N30)-(N25)

VOC and NOx reductions excluding growth are calculated by taking the difference between the 1990 base year inventory and the 2005 target inventory. Table 6-4 displays the necessary VOC and NOx reductions.

Table 6-4
Washington Nonattainment Area
VOC and NOx Emissions Reductions Required Between 1990 and 2005
Ozone Season Daily Emissions (tons per day)

Description	VOC	NOx	Reference
1990 Inventory Adjusted to 2005	412.1	735.6	(V25), (N25)
2005 Target Levels	339.3	539.0	(V29), (N29)
1990-2005 Reductions Required, Excluding Growth	72.8	196.6	(V32) = (V25)-(V29) (N32) = (N25)-(N29)

Total emission reductions including growth are calculated by summing the emissions growth, shown in Table 6-3, and the reductions required excluding growth, shown in Table 6-4. Table 6-5 summarizes the VOC and NOx reductions necessary for the 2005 rate-of-progress demonstration.

Table 6-5
Washington Nonattainment Area
VOC and NOx Emissions Reductions Required To Offset Growth Between 1990 and 2005
Ozone Season Daily Emissions (tons per day)

Description	VOC	NOx	Reference
1990-2005 Emissions Growth	128.4	145.2	(V31), (N31)
Reductions Without Growth	72.8	196.6	(V32), (N32)
Total Reductions Required, Including Growth	201.2	341.8	(V33) = (V31)+(V32) (N33) = (N31)+(N32)

6.3 Control Strategy for Demonstrating 2005 Rate-of-Progress

In order to demonstrate rate-of-progress for the years 1999-2005, the Washington region must show that expected emissions in 2005 are equal to or less than the 2005 target levels presented in Table 6-2. The region must also show that the total reductions achieved from 1990-2005 are greater than or equal to the required reductions calculated in Table 6-5.

The 2005 controlled inventories are inventories of all anthropogenic VOC and NOx emissions expected to occur in the Washington nonattainment area during 2005. The inventories were developed as described in Chapter 4 and are displayed in Tables 4-9 and 4-10. As is summarized in Table 6-6, the 2005 controlled VOC and NOx inventories are less than the 2005 target inventories. The controlled inventories include the benefits of the control measures described in Chapter 7. As shown in Table A of Chapter 7, these reductions will exceed the 201.2 tpd VOC and 341.8 tpd NOx required. Table 6-7 summarizes the emission reductions from control measures. These two tables demonstrate that the Washington region fulfills the 1999-2005 rate-of-progress requirements.

Table 6-6
Washington Nonattainment Area
2005 Controlled and Target Inventories
Ozone Season Daily Emissions (tons per day)

Description	VOC	NOx	Reference
2005 Target Levels	339.3	539.0	(V29), (N29)
2005 Controlled Emissions	325.8	487.5	(V34), (N34)

Table 6-7
Washington Nonattainment Area
2005 Control Strategy Projection
Ozone Season Daily Emissions (tons per day)

Description	VOC	NOx	Reference
2005 Uncontrolled Emissions	540.5	880.8	(V30), (N30)
2005 Controlled Emissions	325.8	487.5	(V34), (N34)
Emission Reductions from Control Measures	214.7	393.3	(V35) = (V30)-(V34) > (V33) (N35) = (N30)-(N34) > (N33)

References

U.S. EPA, "Guidance on the Adjusted Base Year Emissions Inventory and the 1996 Target for the 15% Rate of Progress Plans"

U.S. EPA, "Guidance on the Post-1996 Rate-of-Progress Plan and the Attainment Demonstration", February 18, 1994.

U.S. EPA, "NOx Substitution Guidance", December 1993.

7.0 CONTROL MEASURES

Chapters 5 and 6 present the emission reduction estimates and target levels of emissions for the 2002 and 2005 Rate of Progress demonstrations. Table A is an overall summary table of emission reductions from each control measure that will be in effect for the rate of progress and attainment demonstrations. The remainder of this chapter documents the methodologies used and provides example calculations for the emission reduction estimates for each control measure listed in Table A.

When the Washington DC-MD-VA Nonattainment Area SIP was first developed and submitted, the first section of the control measures chapter contained Table A, a summary of emission control measures. The second through fifth sections of the chapter contained detailed descriptions of the measures listed in Table A. The second section of the chapter contained federally mandated measures that had already been implemented, and the third section contained federally mandated measures that would be implemented in the future. The fourth section contained state and local government measures, and the fifth section included Transportation Control Measures (TCMs). As time has passed and the original "future" measures have been implemented, the numbering of the control measures is no longer as logical as it once was. However, the original numbering of the control measures has been retained to enable readers to easily track control measures between SIP revisions. Both Sections 7.2 and 7.3 of this SIP contain implemented federal measures. Section 7.4 contains state and local measures. Section 7.5 contains TCMs, while Section 7.6 discusses the region's voluntary measures package.

7.1 Reductions For Control Measures

TABLE A
SUMMARY OF CONTROL STRATEGIES
VOC and NOx Benefits of Control Measures
(1990-2005)

		VOC Reductions tons/day		NOx Reductions tons/day	
Ref No.	***Control Measure***	***2002****	***2005*****	***2002****	***2005*****
POINT SOURCE MEASURES					
7.2.5	Non-CTG VOC RACT to 50 tpy	1.2	1.2	0	0
7.2.9	State NOx RACT and Regional NOx Transport Requirement	0	0	203.8	279.4
7.4.7	Expanded Non-CTG VOC RACT and State Point Source Regulations to 25 tons/yr	2.4	2.5	0	0
SUBTOTAL		**3.5**	**3.7**	**203.8**	**279.4**
AREA SOURCE MEASURES					
7.2.2	Stage II Vapor Recovery Nozzles	15.1	15.1	0	0
7.2.6	Phase II Gasoline Volatility Controls	2.6	2.3	0	0
7.3.1	Reformulated Surface Coatings	16.7	17.5	0	0
7.3.2	Reformulated Consumer Products	4.1	4.3	0	0
7.3.4	Reformulated Industrial Cleaning Solvents	0.9	1.0	0	0
7.3.5	Standards for Locomotive	0.0	0.0	2.9	3.1
7.4.3	Surface Cleaning/Degreasing for Machinery/Automotive Repair	4.1	4.4	0	0
7.4.4	Landfill Regulations	2.4	2.5	0	0
7.4.5	Seasonal Open Burning Restrictions	7.4	7.4	1.6	1.6
7.4.6	Stage I Expansion (Tank Truck Unloading)	1.5	1.6	0	0
7.4.8	Graphic Arts Controls	3.8	4.0	0	0
7.4.9	Auto body Refinishing	9.3	9.8	0	0
7.4.10	RESERVED				
7.4.11	Ozone Transport Commission (OTC) Portable Fuel Containers Rule	0.9	2.6	0	0
7.4.12	Ozone Transport Commission (OTC) Architectural and Industrial Maintenance Coatings Rule	12.3	12.3	0	0
7.4.13	RESERVED				
7.4.14	Ozone Transport Commission (OTC) Solvent Cleaning Operations Rule	9.0	9.0	0	0
SUBTOTAL		**90.2**	**93.6**	**4.5**	**4.7**
ON-ROAD MEASURES					
7.2.1	High-Tech Inspection/Maintenance				
7.4.1	Reformulated Gasoline (on-road)				
7.2.3	Federal "Tier I" Vehicle Standards and New Car Evaporative Standards	56.0	80.5	44.9	85.8
7.3.6	Heavy-Duty Diesel Engine Rule				
7.2.4	Tier 2 Motor Vehicle Emission Standards				
7.3.3	National Low Emission Vehicle Program				
7.5	Transportation Control Measures	0.3	0.3	0.5	0.7
SUBTOTAL		**56.3**	**80.8**	**45.4**	**86.5**

NON-ROAD MEASURES

7.2.7	EPA Non-Road Gasoline Engines Rule	22.2	26.6	0	0
7.2.8	EPA Non-Road Diesel Engines Rule	0	0	14.9	22.1
7.2.10	Emissions standards for spark ignition marine engines	1.3	3.1	0	0
7.2.11	Emissions standards for large spark ignition engines	0	0.6	0	0.5
7.4.2	Reformulated Gasoline (off-road)	2.7	2.9	0	0
SUBTOTAL		**26.2**	**33.3**	**14.9**	**22.6**

VOLUNTARY MEASURES (Multiple Source Sectors)

7.6	Voluntary Bundle	3.2	3.2	0.2	0.2

TOTAL REDUCTIONS	**179.4**	**214.7**	**268.7**	**393.3**

* Reductions included in the 2002 Rate of Progress demonstration, occurring between 1990 and January 2004.
** Reductions included in the 2005 Rate-of-Progress and attainment demonstrations, occurring between 1990 and November 15, 2005.

7.2 Detailed Descriptions of Emission Control Measures

This section describes each of the control measures appearing in Table A. Each control measure is described and emission reduction calculations are presented in the remainder of this chapter. Actual implementation dates and regulation names were supplied by the states and are included in Chapter 10. Actual emission reductions may vary slightly from the estimates appearing in this chapter since these estimates are based on EPA guidance, and not necessarily actual data from the in-situ emission control measures.

The following onroad emission reduction measures that are discussed in this section are calculated using the MOBILE6 emission factor model:

- Enhanced I/M, 7.2.1
- Federal Tier 1 Vehicle Standards, 7.2.3
- Federal Tier 2 Vehicle Standards, 7.2.4
- National Low Emission Vehicle Standards, 7.3.3
- Reformulated Gasoline, 7.4.1
- Heavy Duty Diesel Engine Rule, 7.3.6

Past SIP documents for the Washington region have presented the emission reductions from each of the above measures individually, and then summed the reductions to create a controlled on road inventory for each milestone year. MOBILE5b, the mobile emissions model used in previous SIPs, was designed to calculate the benefits of each of the above control measures individually. In the update to MOBILE6, changes were made to the model, creating create synergistic effects between the six mobile control measures listed above. These effects do not lend themselves to isolating credit from one control program, and make it very difficult to calculate incremental benefits from implementation of individual control measures. As a result, this and future SIP revisions will not enumerate the benefits of individual mobile control measures, with the exception of the transportation control measures (TCMs), which are quantified outside of the MOBILE6 model. The table below summarizes the combined benefits from the above control measures by jurisdiction.

	VOC Emission Reductions (tons per day)			
	District of Columbia	**Maryland**	**Virginia**	**Total**
2002 VOC Reductions	6.0	25.8	24.2	56.0
2005 VOC Reductions	7.9	36.8	35.8	80.5

	NOx Emission Reductions (tons per day)			
	District of Columbia	**Maryland**	**Virginia**	**Total**
2002 NOx Reductions	3.9	20.9	20.1	44.9
2005 NOx Reductions	7.0	40.0	38.8	85.8

7.2.1 Enhanced Vehicle Emissions Inspection and Maintenance (Enhanced I/M)

This measure involves requiring a regional vehicle emissions inspection and maintenance (I/M) program with requirements stricter than "basic" programs, as required under 42 U.S.C. §§ 7511a(c)(3) and 7521. Before 1994, "basic" automobile emissions testing checked only tailpipe emissions while idling and sometimes at 2,500 rpm. The new procedures include a dynamometer (treadmill) test checks the car's emissions under driving conditions. In addition, evaporative emissions and the on-board diagnostic computer are checked.

Source Type Affected

This measure affects light-duty gasoline vehicles and light-duty gasoline trucks.

Control Strategy

Maryland, the District of Columbia, and Virginia committed to EPA Performance Standard Enhanced I/M programs in the 15% VOC Emissions Reduction Plan. Each affected vehicle in the region is given a high tech emissions test every two years. In Maryland and the District of Columbia emissions tests are performed at test-only stations. Virginia tests vehicles in stations that may also perform repairs.

Implementation

District of Columbia - Department of Public Works, Dept. of Consumer and Regulatory Affairs
Maryland - Motor Vehicles Administration
Virginia - Department of Environmental Quality

Appendix B contains detailed information regarding implementation of I/M programs in the District, Maryland, and Virginia.

Projected Reductions and Emission Benefit Calculations

Changes made to the mobile model during the development of MOBILE6 create synergistic effects between the different mobile control measures, making it difficult to isolate credit from one control program or calculate incremental benefits from implementation of individual control measures. As a result, this document does not enumerate the benefits of individual mobile control measures. See Appendix B for documentation of the MOBILE 6 modeling process.

References

U.S. Environmental Protection Agency, "Inspection/ Maintenance Program Requirements," Final Rule, 57 *Federal Register* 52950 (November 5, 1992).
U.S. Environmental Protection Agency, "I/M Costs, Benefits, and Impacts Analysis," Draft, February 1992.

7.2.2 Stage II Vapor Recovery

As a serious ozone nonattainment area, Washington is required, under 42 U.S.C. § 7511a(b)(3) and 7511a(c), to install stage II vapor recovery systems at gasoline pumps.

Source Type Affected

This measure affects gasoline service stations and will reduce vehicle refueling emissions. Refueling emissions are attributed to the evaporation of gasoline-rich vapors displaced from the storage tank during refueling. The system is composed of a nozzle covering the fill-pipe and a vapor line returning from the fill-pipe to the storage tank. The stage II system captures the fuel rich vapors from the vehicle fill-pipe and returns them to the storage tank. Returning saturated vapors to the storage tank reduces emissions by maintaining liquid/vapor equilibrium in the storage tank, thereby decreasing the evaporation potential.

Control Strategy

Stage II nozzles have been in place in the District of Columbia since 1977. Implementation of stage II is required in the Washington nonattainment regions of Maryland and Virginia by operation of the Clean Air Act Amendments of 1990, 42 U.S.C. § 7511a(b)(3) and 7511a(c). Those sections require adherence to a schedule of implementation, and set forth a standard for applicability (i.e., to stations of what size or what amount of gasoline sold per month). Maryland and Virginia adopted stage II regulations as a part of their November 15, 1992 SIP revisions.

Projected Reductions

	VOC Emission Reductions (tons per day)			
	District of Columbia	Maryland	Virginia	Total
2002 VOC Reductions	0	8.1	7.1	15.1
2005 VOC Reductions	0	8.0	7.0	15.1

Emission Benefit Calculations

Vehicle refueling emissions are estimated using MOBILE6 emission factors in combination with gasoline throughput estimates as delineated in the 1990 base-year inventory documentation. Stage II benefits were measured for 2002 and 2005 projection years by subtracting the emissions calculated with stage II emission factors from the emissions calculated without stage II.

The Reformulated Gasoline (RFG) Program default RVP values were used in 2002 and 2005 MOBILE6 modeling (the emission reduction associated with lowering the RVP from 8.2 psi to 7.8 psi is not creditable). Minimum and maximum temperatures of 68.5^{o} and 95^{o} F were used. Stage II was assumed to be fully implemented in 1996 at an overall control effectiveness of 77% in Virginia and 70% in Maryland and based on annual inspections and size cutoffs of 10,000/50,000 gallons per

month for dependents/ independents (EPA, 1991). (Control effectiveness is an input to the MOBILE model.) Refueling rates (see below) were determined for each jurisdiction with and without Stage II and weighted using gasoline sales data to obtain weighted refueling factor for each jurisdiction.

County/Jurisdiction	Refueling Loss Emission Factor (g/gallon)
Calvert	8.86
Charles	8.86
Frederick	8.87
Montgomery	8.86
Prince George's	8.85
Arlington	8.95
Fairfax	8.85
Loudoun	8.93
Prince William	8.92
Stafford	9.08
Alexandria	8.97

References

U.S. Environmental Protection Agency, *Technical Guidance -- Stage II Vapor Recovery Systems for Control of Vehicle Refueling Emissions at Gasoline Dispersing Facilities*, Volume 1, EPA-450/3-91-022a, November 1991.

1990 Base Year Emissions Inventory for Stationary, Anthropogenic, Biogenic Sources and Highway Vehicle Emissions of Ozone Precursors in the Washington, DC-MD-VA Metropolitan Statistical Nonattainment Area, Prepared for The District of Columbia, Maryland, and Virginia by the Metropolitan Washington Council of Governments, September 22, 1993.

7.2.3 Federal "Tier I" New Vehicle Emission and New Federal Evaporative Emissions Standards

Under 42 U.S.C. §7521, EPA issued a new and cleaner set of federal motor vehicle emission standards (Tier I standards), which were phased in beginning with model year 1994.

Source Type Affected

These federally implemented programs affected light-duty vehicles and trucks.

Control Strategy

The Federal Motor Vehicle Control Program requires more stringent exhaust emission standards as well as a uniform level of evaporative emission controls, demonstrated through the new federal evaporative test procedures. Under 42 U.S.C. §7521(g), all post-1995 model year cars must achieve the Tier I (or Phase I) exhaust standards, which are as follows. ***Emissions are in grams per mile, and are related to durability timeframes of 5 yrs/50,000 miles and 10 yrs/100,000 miles.***

Vehicle Type	*5 yrs/50,000 mi*			*10 yrs/100,000 mi*		
	VOCs	CO	NOx	VOCs	CO	NOx
Light-duty vehicles; light-duty trucks (loaded weight #3,750 lbs)	0.25	3.4	0.4*	0.31	4.2	0.6*
Light-duty trucks (loaded weight of 3,751 to 5,750 lbs)	0.32	4.4	0.7**	0.40	5.5	0.97

*For diesel-fueled light-duty vehicles and for LDTs at #3,750 lbs, before model year 2004, the applicable NOx standards shall be 1.0 at 5 yrs/50,000 mi and 1.25 at 10 yrs/100,000.
**This NOx standard does not apply to diesel-fueled trucks of 3,751 to 5,750 lbs.

Implementation

This program is implemented by the EPA under 42 U.S.C. §7521.

Projected Reductions and Emission Benefit Calculations

On average, Tier I cars will emit 0.077 fewer grams of VOCs per mile than their predecessors. Changes made to the mobile model during the development of MOBILE6 create synergistic effects between the different mobile control measures, making it difficult to isolate credit from one control program or calculate incremental benefits from implementation of individual control measures. As a result, this and future SIP revisions do not enumerate the benefits of individual mobile control measures. See Appendix B for documentation detailing emission reductions for mobile source controls.

References

U.S. Environmental Protection Agency, Office of Mobile Sources, *User's Guide to MOBILE5*, Chapter 2, March 1993.

7.2.4 Tier 2 Motor Vehicle Emission Regulations

The U.S. EPA promulgated a rule on February 10, 2000 requiring more stringent tailpipe emissions standards for all passenger vehicles, including sport utility vehicles (SUVs), minivans, vans and pick-up trucks. These regulations also require lower levels of sulfur in gasoline, which will ensure the effectiveness of low emission-control technologies in vehicles and reduce harmful air pollution.

Source Type Affected
These federally implemented programs affect light-duty vehicles and trucks.

Control Strategy

The new tailpipe and sulfur standards require passenger vehicles to be 77 to 95 percent cleaner than those built before the rule was promulgated and will reduce the sulfur content of gasoline by up to 90 percent. The new tailpipe standards are set at an average standard of 0.07 grams per mile for NOx for all classes of passenger vehicles beginning in 2004. This includes all light-duty trucks, as well as the largest SUVs. Vehicles weighing less than 6000 pounds will be phased-in to this standard between 2004 and 2007.

Beginning in 2004, the refiners and importers of gasoline will have the flexibility to manufacture gasoline with a range of sulfur levels as long as all of their production is capped at 300 parts per million (ppm) and their annual corporate average sulfur levels are 120 ppm. In 2005, the refinery average will be set at 30 ppm, with a corporate average of 90 ppm and a cap of 300 ppm. Finally, in 2006, refiners will meet a 30 ppm average sulfur level with a maximum cap of 80 ppm.

As newer, cleaner cars enter the national fleet, the new tailpipe standards will significantly reduce emissions of nitrogen oxides from vehicles by about 74 percent by 2030.

Implementation
EPA implements this program under 40 CFR Parts 80, 85, and 86.

Projected Reductions and Emission Benefit Calculations

Changes made to the mobile model during the development of MOBILE6 create synergistic effects between the different mobile control measures, making it difficult to isolate credit from one control program or calculate incremental benefits from implementation of individual control measures. As a result, this and future SIP revisions do not enumerate the benefits of individual mobile control measures. See Appendix B for documentation of the MOBILE6 modeling process.

References

U.S. Environmental Protection Agency, “Control of Air Pollution From New Motor Vehicles: Tier 2 Motor Vehicle Emissions Standards and Gasoline Sulfur Control Requirements,” Final Rule, 65 *Federal Register 6697,* February 10, 2000.

7.2.5 Non-CTG VOCs RACT Greater Than 50 Tons Per Year

This measure involves extending the required Reasonably Available Control Technology (RACT) standards to point sources emitting in excess of 50 tons per year (tpy) of VOCs. The Washington, D.C. metropolitan area, when designated as serious nonattainment for ozone, was obligated under the CAAA to implement RACT for major sources (50 tpy) not covered by EPA's Control Technique Guidance (CTG) documents. Under this measure, "reasonably available" control technologies were determined and implemented for industry sources with the potential to emit greater than 50 tpy.

Source Type Affected

RACT consists of a variety of control techniques that are generally available and cost-effective. Usually the EPA will issue a CTG, which documents the cost per ton of the control method and the size of the source that can best benefit from the control based on cost and technological feasibility. A CTG can include add-on equipment as well as emissions limits. If a CTG is not issued for a category that contains a major source, the state must develop a RACT regulation for that category.

This measure affects point sources with the potential to emit 50 tpy or more of VOCs.

Control Strategy

Point sources are regulated through a state permit process in Maryland, Virginia and D.C. The states were required to develop and implement new RACT regulations for all non-CTG point sources emitting more than 50 tpy, which had not been previously regulated.

Maryland already required RACT on major sources with the potential to emit 100 tpy of VOCs or more in Montgomery and Prince George's counties. In 1993, Maryland revised its existing RACT regulations, COMAR 26.11.19, .11, and .13, to lower the major source threshold to include sources with allowable emissions of 50 tpy or more, and to extend the geographic applicability of the regulation statewide. This required RACT for the first time in Calvert, Charles, and Frederick counties. These counties were previously not included in the Washington DC-MD-VA nonattainment area.

Specifically, Maryland requires the use of RACT coatings with emission limits of 3.5 pounds per gallon for miscellaneous metal coatings. Bakeries are subject to the requirements of COMAR 26.11.19.21. This regulation became effective on July 3, 1995. Auto body refinishing activities are subject to COMAR 26.11.19.23, which was approved as a SIP submittal on August 4, 1997. CanAm Steel has agreed to voluntarily make reductions. COMAR 26.11.19.13-3 makes these enforceable.

Virginia has adopted a generic rule for major non-CTG sources. Virginia has identified sources that will be affected by this rule and has determined the potential control effectiveness for these sources.

In November 1993, the District of Columbia enacted regulations requiring RACT for non-CTG sources with potential to emit 50 or more tons per year of VOCs [20 DCMR §715.4]. Additional regulations were published in 1998 for offset-lithography and were effective October 2, 1998. Currently there are two non-CTG point sources in the District of Columbia emitting 50 tpy or more, U.S. Government Printing Office and Bureau of Engraving and Printing.

Implementation

District of Columbia – Environmental Health Administration
Maryland - Air and Radiation Management Administration
Virginia - Department of Environmental Quality

Projected Reductions

	VOC Emission Reductions (tons per day)			
	District of Columbia	**Maryland**	**Virginia**	**Total**
2002 VOC Reductions	0.32	0.29	0.57	1.18
2005 VOC Reductions	0.34	0.31	0.59	1.24

Emission Benefit Calculations

Emission benefits were calculated by identifying point sources emitting greater than 50 tpy, and applying a reduction potential to the base-year emissions. Table 7-1 lists the applicable point sources, the estimated reduction potential, and the expected reductions for sources in Virginia. Tables 7-2 and 7-3 present similar information for Maryland and the District, respectively.

Table 7-1
Non-CTG VOC RACT Greater than 50 tpy (VA) and
Sources no Longer Subject to RACT

Source Name	Uncontrolled Emissions (tpd)	Reduction Potential (%)	Reductions (tpd)
2002			
Tuscarora Plastics[c]	0.355	39	0.138
Insulated Building Systems [a]	0.247	100	0.247
Treasure Chest Ad.[b]	0.309	60	0.185
2002 Totals	**0.911**		**0.570**
2005			
Tuscarora Plastics[c]	0.373	39	0.145
Insulated Building Systems [a]	0.247	100	0.247
Treasure Chest Ad.[b]	0.333	60	0.200
2005 TOTALS	**0.953**		**0.592**

[a] Insulated Business Systems is a shutdown, effective January, 1991
[b] Treasure Chest Ad. is no longer subject to RACT. It is subject to a permit. See Appendix F for further documentation.
[C] Case-by-case RACT determination.
*Virginia reductions from VOC sources emitting more than 25 tpy are assumed in this table.

Table 7-2
Non-CTG VOC RACT greater than 50 tpy (MD)

Source Name	Uncontrolled Emissions (tpd)	Reduction Potential (%)	Reductions (tpd)
2002			
Giant Food – Silver Spring	0.220	63	0.140
CanAm Steel	1.157	13	0.150
2002 Totals	**1.377**		**0.290**
2005			
Giant Food – Silver Spring	0.225	63	0.143
CanAm Steel	1.293	13	0.168
2005 TOTALS	**1.158**		**0.311**

Table 7-3
Non-CTG VOC RACT to 50 tpy (DC)

Source Name	Uncontrolled Emissions (tpd)	Reductions (tpd)
2002		
Bureau of Engraving and Printing	0.476	0.215
Government Printing Office	0.233	0.105
2002 Totals	**0.709**	**0.320**
2005		
Bureau of Engraving and Printing	0.476	0.228
Government Printing Office	0.233	0.109
2005 TOTALS	**0.709**	**0.337**

References

Staff engineers at the Virginia Department of Environmental Quality, the Maryland Department of the Environment, and the District of Columbia Environmental Health Administration supplied reduction potential estimates.

7.2.6 Phase II Gasoline Volatility Controls

This measure takes credit for lower refueling emissions resulting from the effects of federally mandated reductions in gasoline volatility, as required under 42 U.S.C. §§7545 (h) and (k). The measure affects emissions from light-duty gasoline vehicles and light-duty gasoline trucks.

Control Strategy

The volatility reductions under §7545 (h) became effective in summer 1992. Further volatility reductions required under §7545 (k) are associated with the reformulated gasoline (see measures 6.4.1 and 6.4.2) that began selling in the Washington nonattainment area on January 1, 1995.

Implementation

This program is implemented by the EPA under 42 U.S.C. §§7545 (h) and (k).

Projected Reductions and Emission Benefit Calculations

Changes made to the mobile model during the development of MOBILE6 create synergistic effects between the different mobile control measures, making it difficult to isolate credit from one control program or calculate incremental benefits from implementation of individual control measures. As a result, this and future SIP revisions do not enumerate the benefits of individual mobile control measures. See Appendix B for documentation of the MOBILE6 modeling process.

References

1990 Clean Air Act Amendments, 42 U.S.C. §§7545 (h) and (k).

7.2.7 Phase I and Phase II Emissions standards for gasoline-powered non-road utility engines

This measure takes credit for VOC emissions reductions attributable to emissions standards promulgated by the EPA for small non-road, spark-ignition (i.e., gasoline-powered) utility engines, as authorized under 42 U.S.C. §7547. The measure affects gasoline-powered (or other spark-ignition) lawn and garden equipment, construction equipment, chain saws, and other such utility equipment as chippers and stump grinders, wood splitters, etc., rated at or below 19 kilowatts (an equivalent of 25 or fewer horsepower). Phase 2 of the rule applied further controls on handheld and non-handheld outdoor equipment.

Control Strategy

Federal emissions standards promulgated under §7547 (a) apply to spark-ignition non-road utility engines. The EPA's Phase 1 Spark Ignition Nonroad final rule on such emissions standards was published in 60 *Federal Register 34581* (July 3, 1995), and was effective beginning August 2, 1995. Compliance was required by the 1997 model year. The Phase 2 final rule for handheld nonroad equipment was published in 65 *Federal Register* 24267 (April 25, 2000). The Phase 2 final rule for non-handheld equipment was published in 64 *Federal Register* 36423 (July 6, 1999.

Implementation

This program was implemented by the EPA, under 42 U.S.C. §7547 (a).

Projected Reductions

	VOC Emission Reductions (tons per day)			
	District of Columbia	Maryland	Virginia	Total
2002 VOC Reductions	1.1	10.8	10.2	22.2
2005 VOC Reductions	1.3	12.8	12.5	26.6

	NOx Emission Reductions (tons per day)			
	District of Columbia	Maryland	Virginia	Total
2002 NOx Reductions	0	0	0	0
2005 NOx Reductions	0	-0.01	0	-0.01

Emission Benefit Calculations

The emission reductions associated with the new federal small engines rule are calculated according to methods detailed in the regulatory impact analysis (RIA) document for the EPA's proposed rule. The controls engineered to reduce VOC emissions from these small engines increase NOx emissions slightly.

For the gasoline equipment covered by Phase 1 of the rule, the RIA calculates for 2002 a 29.35% VOC reduction and a NOx disbenefit of 46.3%. For 2005, the VOC reduction is 30.5% and the NOx disbenefit is 50.7%.

The second phase of the rule will result in the following reductions:

- Handheld engines 2002: 4% reduction in HC, no change in NOx
- Nonhandheld engines 2002: 9% reduction in HC, 9% reduction NOx
- Handheld engines 2005: 12% reduction in HC, no change in NOx
- Nonhandheld engines 2005: 14% reduction in HC, 14% reduction NOx.

A detailed nonroad inventory is contained in Appendix C.

References

EPA Guidance Memorandum, "Future Nonroad Emission Reduction Credits for Court-Ordered Nonroad Standards" from Emission Planning and Strategies Division, Memorandum from Phil Lorang, Director, Emission Planning and Strategies Division, November 28, 1994.

U.S. Environmental Protection Agency, "Emission Standards for New Nonroad Spark-Ignition Engines at or Below 19 Kilowatts", Final Rule, 60 *Federal Register* 34581 (July 3, 1996).

U.S. Environmental Protection Agency, “Phase 2 Emission Standards for New Nonroad Spark-Ignition Nonhandheld Engines At or Below 19 Kilowatts”, Final Rule, 64 *Federal Register* 36423, (July 6, 1999)

U.S. Environmental Protection Agency, “Phase 2 Emission Standards for New Nonroad Spark-Ignition Handheld Engines at or Below 19 Kilowatts”, Final Rule, 65 Federal Register 24267 (April 25, 2000)

1990 Clean Air Act Amendments, 42 U.S.C. §7547 (a).

7.2.8 Emissions standards for diesel-powered non-road utility engines of 50 or more horsepower

This measure takes credit for NOx emissions reductions attributable to emissions standards promulgated by the EPA for non-road, compression-ignition (i.e., diesel-powered) utility engines, as authorized under 42 U.S.C. § 7547. The measure affects diesel-powered (or other compression-ignition) construction equipment, industrial equipment, etc., rated at or above 37 kilowatts (37 kilowatts is approximately equal to 50 horsepower).

Control Strategy

Federal emissions standards applicable to compression-ignition non-road utility engines were promulgated under §7547 (a). The EPA's final rule on such emissions standards was published in 59 *Federal Register* 31306 (June 17, 1994), and was effective on July 18, 1994.

Implementation

This program will be implemented by the EPA under 42 U.S.C. § 7547 (a).

Projected Reductions

	VOC Emission Reductions (tons per day)			
	District of Columbia	**Maryland**	**Virginia**	**Total**
2002 VOC Reductions	0	0	0	0
2005 VOC Reductions	0	0	0	0

	NOx Emission Reductions (tons per day)			
	District of Columbia	**Maryland**	**Virginia**	**Total**
2002 NOx Reductions	0.8	8.0	6.2	14.9
2005 NOx Reductions	1.1	11.8	9.3	22.1

Emission Benefit Calculations

The emission reductions associated with the new federal compression-ignition engines rule are calculated according to methods detailed in the regulatory impact analysis (RIA) document for the EPA's final rule. The RIA estimates NOx reductions in the year 2002 of: 15.7% for engines in the 50-100 HP range, 16.4% for engines in the 100-175 HP range, and 17.4% for engines greater than 75

HP. In 2005, the percentage reductions are: 23.8% for engines of 0-100 HP; 23.1% for engines of 100-175 HP, and 23.1% for engines greater than 175 HP.

A detailed nonroad inventory is contained in Appendix C.

References

1990 Clean Air Act Amendments, 42 U.S.C. §7547 (a).

EPA Guidance Memorandum, "Future Nonroad Emission Reduction Credits for Court-Ordered Nonroad Standards" from Emission Planning and Strategies Division, Memorandum from Phil Lorang, Director, Emission Planning and Strategies Division, November 28, 1994.

U.S. Environmental Protection Agency," Determination of Significance for Nonroad Sources and Emission Standards for New Nonroad Compression-Ignition Engines At or Above 37 Kilowatts", Final Rule, 59 *Federal Register* 31306 (June 17, 1994).

7.2.9 NOx RACT and Regional NOx Transport Requirements

This section documents credit for NOx emissions reductions attributable to federal and regional NOx requirements on point sources. These credits include Reasonably Available Control Technology ("RACT"), as required under 42 U.S.C. § 7511a (f) (read in conjunction with §§ 7511a (b)(2) and (c)); "NOx Budget" rules that require a second phase of stationary source NOx reductions as part of a coordinated regulatory initiative by the Ozone Transport Region (OTR) states to further reduce NOx emissions in the Northeast; and the "NOx SIP Call" to reduce ozone transport in the Eastern United States.

Control Strategy

RACT
Major point sources of NOx are subject to RACT requirements created by D.C., Maryland and Virginia in response to §7511a (f).

The region's reclassification to "severe" nonattainment for ozone requires that NOx reduction controls be applied to sources that have the potential to emit 25 tons per year or more of NOx, rather than 50 tons under the previous "serious" classification. The jurisdictions are in the process of developing and implementing new rules that meet the standards for "severe" nonattainment. In the District, the Washington Hospital Center and Walter Reed Army Medical Center are the only additional sources. The additional expected benefits from this measure are insignificant for 2005 projections. Virginia has determined which sources are affected and has determined that small emission reductions will result from implementation of this rule. However, because the exact quantity of reductions is still uncertain, reductions resulting from the measure are not included at this time. These reductions will be included in the next SIP revision.

NOx OTC Phase II Budget Rules
Maryland and the District adopted "NOx Budget" rules to require a second phase of stationary source NOx reductions as part of a coordinated regulatory initiative by the OTR states to further reduce NOx emissions in the Northeast. The rules require large stationary sources to reduce summertime NOx emissions by approximately 65% from 1990 levels. The regulation also includes provisions allowing sources to comply by trading "allowances." This regulation requires affected sources to reduce their emissions to meet these requirements by May 2001.

NOx SIP Call
In late 1998, the U.S. EPA adopted a rule called the "NOx SIP Call" to reduce ozone transport in the Eastern United States. This regional NOx reduction program requires 22 states, including Maryland and Virginia, and the District of Columbia, to submit regulations and a revision to State Implementation Plans (SIPs) to further reduce NOx emissions to fully meet state emission budget levels by 2007. The SIP Call will take effect in the jurisdictions in the Washington, DC nonattainment area in 2003, resulting in approximately 23% additional NOx reductions by that time frame. The SIP Call takes effect across all other states in the SIP Call region beginning in 2004.

The controls are a phased approach to controlling emissions of NOx from power plants and other large fuel combustion sources, with the RACT rules taking effect first, followed by the NOx Budget rules by the 2002 timeframe, and finally the NOx SIP Call rules by the 2003 timeframe.

NOx reductions resulting from these controls are presented by source for Maryland in Tables 7-4 and 7-5, for Virginia in Tables 7-6 and 7-7, and for the District in Tables 7-8 and 7-9. Table 7-10 summarizes emission reductions by jurisdiction and for the region for each of the NOx point source controls listed in Tables 7-4 through 7-9.

In Maryland, the expected emission reductions for 2002 and 2005 were calculated using the listed allowances within MDE's NOx Budget Rule or NOx SIP Call regulations. Because the program allows trading under a NOx "cap" the expected emissions reductions are not allocated to a particular source but are listed in Tables 7-4 and 7-5 as a total reduction for the affected sources.

Tables 7-6 and 7-7 for Virginia contain sources that were originally identified for NOx RACT and underwent New Source Review (NSR) for the replacement of equipment which were RACT, prior to the deadline for implementing RACT. In each case, the NOx emission limit was at least as stringent as the presumptive NOx RACT limit. BACT was also applied to emission units that were not required to meet the presumptive RACT. The permits were issued via SIP approved Minor New Source Permit regulations. The tables also contain emissions reductions from two Covanta sources subject to the Municipal Waste Combustion (MWC) rule. To meet the NOx SIP Call requirements, Virginia has issued state operating permits to the two facilities in the Virginia portion of the area, thereby controlling their emissions to 0.15 lbs/million BTU by 2003. This is reflected in Table 7-7.

See Appendix E for further point source documentation.

Table 7-4
2002 NOx Point Source Reductions for Maryland

Facility	Uncontrolled Emissions	Reductions			Total Emission Red.
		RACT	NOx Budget Rule	NOx SIP Call	
Potomac Electric Dickerson	38.49	-	-	na	-
Potomac Electric Chalk Point	120.73	-	-	na	-
Potomac Electric Morgantown	131.50	-	-	na	-
Total 2002 Reductions	**290.72**	**2.12**	**172.62**	**na**	**174.74***

* Reductions achieved under cap and trade program and are not allocated to individual point sources.

Table 7-5
2005 NOx Point Source Reductions for Maryland

Facility	Uncontrolled Emissions	Reductions			Total Emission Red.
		RACT	NOx Budget Rule	NOx SIP Call	
Potomac Electric Dickerson	39.38	-	na	-	-
Potomac Electric Chalk Point	122.98	-	na	-	-
Potomac Electric Morgantown	131.50	-	na	-	-
Total 2002 Reductions	**293.86**	**2.04**	**na**	**227.88**	**229.92***

* Reductions achieved under cap and trade program and are not allocated to individual point sources.

Table 7-6
2002 NOx Point Source Reductions for Virginia (tpd)

Facility	Uncontrolled Emissions	Reductions			Total Emission Red.
		RACT/ Shutdown	MWC Rule	NSR Permit	
Dominion Virginia Power – Possum Point	23.73	8.98	0	0	8.98
Mirant-Potomac River	26.39	9.11[a]	0	0	9.11
Covanta (Fairfax)	4.99	0	1.69	0	1.69
Covanta (Alexandria)	1.87	0	0.55	0	0.55
Transcontinental Gas Pipeline	5.64	4.85	0	0	4.85
Washington Gas Light	1.43	0.64	0	0	0.64
DC Corrections - Lorton[b]	0.17	0.17	0	0	0.17
National Airport	0.05	0	0	0.02	0.02
USMC-Quantico	0.42	0	0	0.02	0.02
Total 2002 Reductions	**64.69**	**23.75**	**2.24**	**0.04**	**26.03**

[a] Emission reductions result of combining regional MD and VA Mirant emissions into a "bubble".
[b] Facility has permanently closed.

Table 7-7
2005 NOx Point Source Reductions for Virginia (tpd)

Facility	Uncont. Emissions	Reductions				Total Emission Red.
		RACT/ Shutdown	MWC Rule	NSR Permit	NOx SIP Call	
Dominion Virginia Power – Possum Point	24.15	8.98	0	0	8.06	17.04
Mirant-Potomac River	27.01	9.11[a]	0	0	11.24	20.35
Covanta (Fairfax)	4.99	0	1.69	0	0	1.69
Covanta (Alexandria)	1.87	0	0.55	0	0	0.55
Transcontinental Gas Pipeline	5.67	4.88	0	0	0	4.88
Washington Gas Light	1.44	0.65	0	0	0	0.65
DC Corrections - Lorton[b]	0.17	0.17	0	0	0	0.17
National Airport	0.05	0	0	0.02	0	0.02
Total 2005 Reduct.	**64.7**	**23.8**	**2.2**	**0.02**	**19.3**	**45.34**

[a] Emission reductions result of combining regional MD and VA Mirant emissions into a "bubble".
[b] Facility has permanently closed.

Table 7-8
2002 NOx Point Source Reductions for the District of Columbia

Facility	Uncontrolled Emissions	Reductions			Total Emission Red.
		RACT	NOx Budget Rule	NOx SIP Call	
Pepco - Benning	4.41	-[a]	-[a]	na	2.12[a]
Capitol Power Plant	0.67	0.23	0	na	0.23
GSA West & Central Heating	0.67	-[a]	-[a]	na	0.34[a]
Georgetown Univ Power Plant	0.63	0.11	0	na	0.11
Pepco - Buzzard	0.73	0	0.21	na	0.21
US Soldiers Home	0.05	0.01	0	na	0.01
Total 2002 Reduct.	**7.16**	**2.01[a]**	**1.01[a]**	**na**	**3.02**

[a] Reductions for Pepco Benning and GSA sources result from a combination of RACT and NOx Budget Rule.

Table 7-9
2005 NOx Point Source Reductions for the District of Columbia

Facility	Uncontrolled Emissions	Reductions			Total Emission Red.
		RACT	NOx Budget Rule	NOx SIP Call	
Pepco - Benning	4.41	-[a]	-[a]	-[a]	3.12[a]
Capitol Power Plant	0.68	0.23	0	0	0.23
GSA West & Central Heating	0.64	-[a]	-[a]	-[a]	0.48[a]
Georgetown Univ Power Plant	0.61	0.11	0	0	0.11
Pepco - Buzzard	0.73	0	0.21	0	0.21
US Soldiers Home	0.04	0.01	0	0	0.01
Total 2005 Reductions	**7.11**	**2.01[a]**	**1.01[a]**	**1.14**	**4.16**

[a] Reductions for Pepco Benning and GSA sources result from a combination of RACT, NOx Budget Rule, and NOx SIP Call Rule.

Table 7-10
Point Source NOx Reductions Summary (tpd)

Control	District of Columbia	Maryland	Virginia	Total
2002				
NOx RACT*	2.01	2.12	23.75	27.88
NOx Budget Rules	1.01	172.62	0	173.63
NOx SIP Call	na	na	na	na
MWC Rule	0	0	2.24	2.24
NSR Permits	0	0	0.04	0.04
Total 2002 Reductions	**3.02**	**174.74**	**26.03**	**203.79**
2005				
NOx RACT*	2.01	2.04	24.38	28.43
NOx Budget Rules	1.01	na	na	1.01
NOx SIP Call	1.14	227.88	19.30	248.32
MWC Rule	0	0	2.24	2.24
NSR Permits	0	0	0.02	0.02
Total 2005 Reductions	**4.16**	**229.92**	**45.94**	**280.02**

*RACT Reductions include 0.17 tpd from shutdown of Lorton facility in VA.

Implementation

District of Columbia - Environmental Health Administration
Maryland - Air and Radiation Management Administration
Virginia - Department of Environmental Quality

Projected Reductions

	NOx Emission Reductions (tons per day)			
	District of Columbia	**Maryland**	**Virginia**	**Total**
2002 NOx Reductions	3.0	174.7	26.0	203.8
2005 NOx Reductions	4.2	229.9	45.3	279.4

Emission Benefit Calculations

The emission reductions associated with the state NOx requirements on point sources were supplied by the staffs of the Maryland Air and Radiation Management Administration, the District of Columbia Environmental Health Administration, and the Virginia Department of Environmental Quality Air Division.

References

1990 Clean Air Act Amendments, 42 U.S.C. §§7511a (f), (b)(2), and (c).

7.2.10 Emissions standards for spark ignition marine engines

This EPA measure controls exhaust VOC emissions from new spark-ignition (SI) gasoline marine engines, including outboard engines, personal watercraft engines, and jet boat engines. Of nonroad sources studied by EPA, gasoline marine engines were found to be one of the largest contributors of hydrocarbon (HC) emissions (30% of the nationwide nonroad total).

Control Strategy

EPA is imposing emission standards for 2 – stroke technology, outboard and personal watercraft engines. This will involve increasingly stringent HC control over the course of a nine-year phase-in period beginning in model year 1998. By the end of the phase-in, each manufacturer must meet an HC and NOx emission standard that represents a 75% reduction in HC compared to unregulated levels. These standards do not apply to any currently owned engines or boats.

Implementation

This program will be implemented by the EPA under 42 U.S.C. § 7547 (a).

Projected Reductions

	VOC Emission Reductions (tons per day)			
	District of Columbia	**Maryland**	**Virginia**	**Total**
2002 VOC Reductions	0.1	0.1	1.0	1.3
2005 VOC Reductions	0.3	0.2	2.6	3.1

	NOx Emission Reductions (tons per day)			
	District of Columbia	**Maryland**	**Virginia**	**Total**
2002 NOx Reductions	0	0	0	0
2005 NOx Reductions	0	0	0	0

Emission Benefit Calculations

The Code of Federal Register (40 CFR Parts 89, 90 and 91) rule entitled Control of Air Pollution; Final Rule for New Gasoline Spark-Ignition Marine Engines; Exemptions for New Nonroad Compression-Ignition Engines at or Above 37 Kilowatts and New Nonroad Spark-Ignition Engines at or Below 19 Kilowatts lists the projected inventory reductions for outboard/personal watercraft (OB/PWC) engines. These reduction percentages are reproduced

below.

PROJECTED INVENTORY REDUCTIONS	
Year	Percent reduction in OB/PWC HC inventory
2000	4
2005	26
2010	52
2015	68
2020	73
2030	75

The regulatory impact assessment for the rule presents data showing the percent reduction for each year beyond 2000. For 2002, the HC percentage reductions from the affected marine engine fleet is 10.99%, with a NOx disbenefit of 10.99%. The NOx disbenefit in 2005 is 20.6%. It should be noted that NOx emissions from these engines are minor.

References

1990 Clean Air Act Amendments, 42 U.S.C. §7547 (a).

Code of Federal Register (40 CFR Parts 89, 90 and 91) rule entitled Control of Air Pollution; Final Rule for New Gasoline Spark-Ignition Marine Engines; Exemptions for New Nonroad Compression-Ignition Engines at or Above 37 Kilowatts and New Nonroad Spark-Ignition Engines at or Below 19 Kilowatts

Regulatory Impact Analysis "Control of Air Pollution Emission Standards for New Nonroad Spark-Ignition Marine Engines", U.S. EPA, June 1996

7.2.11 Emissions standards for large spark ignition engines

This EPA measure controls VOC and NOx emissions from several groups of previously unregulated nonroad engines, including large industrial spark-ignition engines, recreational vehicles, and diesel marine engines.

Control Strategy

The new EPA requirements vary depending upon the type of engine or vehicle, taking into account environmental impacts, usage rates, the need for high performance models, costs and other factors. The emission standards apply to all new engines sold in the United States and any imported engines manufactured after these standards begin.

Controls on the category of large industrial spark-ignition engines are first required in 2004. Controls on the other engine categories is required beginning in years after 2005. Large industrial spark-ignition engines are those rated over 19 kW used in a variety of commercial applications; most use liquefied petroleum gas, with others operating on gasoline or natural gas.

EPA adopted two tiers of emission standards for Large SI engines. The first tier of standards, scheduled to start in 2004, are based on a simple laboratory measurement using steady-state procedures. The Tier 1 standards are the same as those adopted earlier by the California Air Resources Board for engines used in California. As Tier 2 standards will not become effective until 2007, they are not included in this document.

Implementation

This program will be implemented by the EPA under 42 U.S.C. § 7547 (a).

Projected Reductions

	VOC Emission Reductions (tons per day)			
	District of Columbia	**Maryland**	**Virginia**	**Total**
2002 VOC Reductions	0	0	0	0
2005 VOC Reductions	0	0.3	0.3	0.6

	NOx Emission Reductions (tons per day)			
	District of Columbia	**Maryland**	**Virginia**	**Total**
2002 NOx Reductions	0	0	0	0
2005 NOx Reductions	0	0.2	0.2	0.5

Emission Benefit Calculations

EPA's "Final Regulatory Support Document: Control of Emissions from Unregulated Nonroad Engines," (EPA420-R-02-022, September 2002), presents the emission reductions to be expected from the large industrial spark-ignition engine category in 2005. HC emissions will be reduced 24% and NOx emissions reduced 21% in 2005. These reductions were applied to the appropriate category types in the nonroad inventory.

References

1990 Clean Air Act Amendments, 42 U.S.C. §7547 (a).

U.S. Environmental Protection Agency, "Control of Emissions From Nonroad Large Spark-Ignition Engines, and Recreational Engines (Marine and Land-Based)," Final Rule, 67 Federal Register 68241 (November 8, 2002).

U.S. Environmental Protection Agency, Final Regulatory Support Document: Control of Emissions from Unregulated Nonroad Engines," EPA420-R-02-022, September 2002.

7.3 Federal programs

7.3.1 Reformulated surface coatings

This measure involves adopting the federal rule resulting from the National Regulatory Negotiation for Architectural and Industrial Maintenance (AIM) Coatings, which restricts the VOC content of architectural, industrial maintenance, special industrial, and highway markings surface coatings sold and used in the Washington, D.C. ozone nonattainment area. This rule was adopted on September 11, 1998 (63 FR 48819), corrected on. June 30, 1999 (64 FR 34997) and amended on February 16, 2000 (65 FR 7736). Compliance is required by September 13, 1999, or March 10, 2000.

Source Type Affected

This measure affects makers of architectural, industrial maintenance, special industrial, and highway markings surface coatings.

Control Strategy

The proposed measure is based on the national regulatory negotiation for AIM coatings. According to the most recent EPA guidance the final rule is expected to yield a 20% reduction in VOC emissions from AIM coating sources. This estimate includes consideration of rule effectiveness and rule penetration.

Reductions for AIM coatings are achievable through product reformulations, product substitution, and consumer education. Reformulations include altering the components of the coating to achieve a lower VOC content, replacing VOC solvents with water or alternative non-VOC solvents, and increasing the solids content of the coating thereby reducing the volume applied. Product substitution is accomplished by replacing higher-VOC coatings with currently available lower-VOC coatings. Consumer education will provide information on the relative cost of lower-VOC coatings and encourage careful, efficient use of such products. Specific VOC content limits included in the regulatory negotiations are not yet published.

In a memorandum from John S. Seitz, director of EPA's Office of Air Quality Planning and Standards, EPA has given permission for states to take VOC emissions reduction credits for applying the pending federal rule to the architectural and industrial maintenance coatings emissions.

Implementation

This program is implemented by the EPA under 42 U.S.C. §7511 (b).

Projected Reductions

	VOC Emission Reductions (tons per day)			
	District of Columbia	Maryland	Virginia	Total
2002 VOC Reductions	1.7	8.5	6.4	16.7
2005 VOC Reductions	1.7	8.9	6.9	17.5

Emission Benefit Calculations

Staff applied a 20% reduction factor to the 2002 and 2005 projection of VOC emissions from architectural, industrial maintenance, special industrial, and highway markings coatings.

The VOC emission reduction is calculated as:

	Architect Coatings	Traffic Markings	Industrial Products	Special Purpose	Total	Reduction (20%)
	2002 Uncontrolled Emissions by Source					
DC	4.97	0.58	0.63	2.49	8.67	1.73
MD	17.43	2.04	19.64	3.43	42.54	8.51
VA	16.61	1.95	4.40	9.23	32.19	6.44
Total	39.01	4.58	24.67	15.15	83.41	16.68
	2005 Uncontrolled Emissions by Source					
DC	4.97	0.58	0.62	2.48	8.65	1.73
MD	18.12	2.13	20.67	3.60	44.52	8.90
VA	17.62	2.07	4.78	9.89	34.36	6.87
Total	40.71	4.78	26.07	15.97	87.53	17.51

References

National Volatile Organic Compound Emission Standards for Architectural, Preamble Section IV.A.1 (63 FR 48819), September 11, 1998.

U.S. Environmental Protection Agency, "Credit for the 15% rate-of-progress Plans for Reductions from Architectural and Industrial Maintenance Coating Rule ", Memorandum from John S. Seitz, Director, to directors of Air Divisions of EPA Regional Offices, March 22, 1995.

U.S. Environmental Protection Agency, "Credit for the 15% rate-of-progress Plans for Reductions from Architectural and Industrial Maintenance Coating Rule and the Autobody Refinishing Rule", Memorandum from John S. Seitz, Director, to directors of Air Divisions of EPA Regional Offices, November 21, 1994.

Meeting the 15-Percent Rate-of-Progress Requirement Under the Clean Air Act: A Menu of Options, STAPPA/ALAPCO, September 1993.

7.3.2 Reformulated consumer products

This measure requires that certain consumer products sold in the Washington, D.C. ozone nonattainment area be reformulated to reduce their VOC content. The measure is based upon regulations that, under 42 U.S.C. 7511b(e)(3), EPA was required to publish by November 15, 1995. The final regulation was adopted on September 11, 1998 (63 FR 48848).

Source Type Affected

The measure affects manufacturers of the various specialty chemicals that EPA will select, after conducting a study consistent with 42 U.S.C. 7511b(e)(2).

Control Strategy

The proposed measure relies upon federal implementation of a rule mandating reformulation of certain "consumer or commercial products" (as that term is defined under 42 U.S.C. 7511b(e)(1)(B)). Under §7511b(e)(3), EPA must create by November 15, 1995, regulations to require reformulation of one-fourth of the "consumer or commercial products" that are responsible for at least 80% of photochemically reactive VOC emissions from such products.

Recent EPA guidance from John Seitz specifies a 10% total reduction of emissions from a regulated subset of consumer products. EPA estimated the regulated subset to be approximately 3.9 pounds per capita annually. Consequently, a total of 10% of the "commercial or consumer products" are expected to be subject to reformulation requirements by November 15, 1999. EPA guidance also allows states to retain emission reduction estimates for consumer and commercial product reformulations in their 15% Plans.

Implementation

This measure will be federally implemented under a federal regulatory calendar initially issued in *60 Federal Register 15264*, finalized in *63 Federal Register 48791* and amended in *64 Federal Register 13422* (March 18, 1999). This program is implemented by the EPA under 42 U.S.C. §7511 (b).

Projected Reductions

	VOC Emission Reductions (tons per day)			
	District of Columbia	Maryland	Virginia	Total
2002 VOC Reductions	0.5	1.8	1.7	4.1
2005 VOC Reductions	0.5	1.9	1.8	4.3

Emissions Benefit Calculations

The calculation based on the most recent EPA guidance for emission reductions in 2005 follows:

	2002 Uncontrolled	10% Reduction
DC	5.24	0.47
MD	18.34	1.83
VA	17.49	1.75
	2005 Uncontrolled	**10% Reduction**
DC	5.24	0.52
MD	19.09	1.90
VA	18.46	1.85

Note: slight discrepancies may occur due to rounding.

References

National Volatile Organic Compound Emission Standards for Consumer Products, Preamble Section III.A. (63 FR 48848), September 11, 1998.

1990 Clean Air Act Amendments, 42 U.S.C. 7511b(e).

U.S. Environmental Protection Agency, "Regulatory Schedule for Consumer and Commercial Products under Section 183 (e) of the Clean Air Act", Memorandum from John S. Seitz, Director, to directors of Air Divisions of EPA Regional Offices, June 21, 1995.

Commercial and Consumer Products: Schedule for Regulation (64 FR 13422), March 18, 1999.

7.3.3 National Low Emission Vehicle Program

Under the National LEV program, auto manufacturers have agreed to comply with tailpipe standards that are more stringent than EPA can mandate prior to model year (MY) 2004. Once manufacturers committed to the program, the standards became enforceable in the same manner that other federal motor vehicle emissions control requirements are enforceable. The program went into effect throughout the Ozone Transport Region (OTR), including Maryland, Virginia, and the District of Columbia, in model year 1999 and will be nationwide in model year 2001.

Source Type Affected

These federally implemented programs affect light-duty vehicles and trucks.

Control Strategy

The National Low Emission Vehicle Program requires more stringent exhaust emission standards than the Federal Motor Vehicle Control Program Tier I (or Phase I) exhaust standards.

Implementation

This program is implemented by the EPA, under 40 CFR Part 86 Subpart R. Nine states within the OTR, including the MWAQC states, have opted-in to the program as have all the auto manufacturers. EPA found the program to be in effect on March 2, 1998.

Projected Reductions and Emission Benefit Calculations

Changes made to the mobile model during the development of MOBILE6 create synergistic effects between the different mobile control measures, making it difficult to isolate credit from one control program or calculate incremental benefits from implementation of individual control measures. As a result, this and future SIP revisions do not enumerate the benefits of individual mobile control measures. See Appendix B for documentation of the MOBILE6 modeling process.

References

U.S. Environmental Protection Agency, Office of Mobile Sources, *User's Guide to MOBILE5*, Chapter 2, March 1993.

7.3.4 Reformulation of Industrial Cleaning Solvents

This measure requires that certain industrial cleaning solvents sold in the Washington, D.C. ozone nonattainment area be reformulated to reduce their VOC content. The measure is based upon regulations that, under 42 U.S.C. 7511b(e)(3), EPA was required to publish by November 15, 1995. The industrial cleaning solvent standards were adopted in 2001.

Source Type Affected

The measure affects manufacturers of the various specialty chemicals that EPA will select, after conducting a study consistent with 42 U.S.C. § 7511b(e)(2).

Control Strategy

The proposed measure relies upon federal implementation of a rule mandating reformulation of certain "consumer or commercial products" (as that term is defined under 42 U.S.C. § 7511b(e)(1)(B)). Under § 7511b(e)(3), EPA must create by November 15, 1995, regulations to require reformulation of one-fourth of the "consumer or commercial products" that are responsible for at least 80% of photochemically reactive VOC emissions from such products.

EPA guidance from John Seitz specifies a 10% total reduction of emissions from a regulated subset of consumer products. This is used as a benchmark for estimating reductions in industrial cleaning solvents.

Implementation

This program was implemented by the EPA in 2001 under a schedule adopted on March 18, 1999. The program is implemented under 42 U.S.C. §7511 (b).

Projected Reductions

	VOC Emission Reductions (tons per day)			
	District of Columbia	Maryland	Virginia	Total
2002 VOC Reductions	0.03	0.4	0.5	0.9
2005 VOC Reductions	0.03	0.4	0.5	1.0

Emission Benefit Calculations

2002

DC (0.259 tons per day) x (0.1 emission reduction) = 0.03 tons per day
MD (4.182 tons per day) x (0.1 emission reduction) = 0.42 tons per day
VA (4.954 tons per day) x (0.1 emission reduction) = 0.50 tons per day

2005

DC (0.257 tons per day) x (0.1 emission reduction) = 0.03 tons per day
MD (4.389 tons per day) x (0.1 emission reduction) = 0.44 tons per day
VA (5.303 tons per day) x (0.1 emission reduction) = 0.53 tons per day

References

1990 Clean Air Act Amendments, 42 U.S.C. 7511b(e).

U.S. Environmental Protection Agency, "Regulatory Schedule for Consumer and Commercial Products under Section 183 (e) of the Clean Air Act" , Memorandum from John S. Seitz, Director, to directors of Air Divisions of EPA Regional Offices, June 21, 1995.

Federal Register Vol. 64 No. 52, Thursday, March 18, 1999 (AD FLR-6311-9) p. 13422 – 13424

7.3.5 Emissions Controls for Locomotives

This sets NOx standards for locomotive engines remanufactured and manufactured after 2001.

Source Type Affected

This program includes all locomotives originally manufactured from 2002 through 2004. It also applies to the remanufacture of all engines built since 1973. Regulation of the remanufacturing process is critical because locomotives are generally remanufactured 5 to 10 times during their total service lives, which are typically 40 years or more.

Control Strategy

Three separate sets of emissions standards have been adopted, with the applicability of the standards dependent on the date a locomotive is first manufactured. The first set of standards (Tier 0) applies to locomotives and locomotive engines originally manufactured from 1973 through 2001, any time they are manufactured or remanufactured. The second set of standards (Tier 1) apply to locomotives and locomotive engines originally manufactured from 2002 through 2004. These locomotives will be required to meet the Tier 1 standards at the time of manufacture and at each subsequent remanufacture. The final set of standards (Tier 2) apply to locomotives and locomotive engines originally manufactured in 2005 and later. Electric locomotives, historic steam-powered locomotives and locomotives manufactured before 1973 do not significantly contribute to the emissions problem and, therefore, are not included in the regulation.

The District of Columbia reports that majority of the switching yard locomotives in the District may not be subjected to the new locomotive standards in 2005. This is mainly due to the engine re-build/re-manufacture schedule, which triggers such requirement. As a result, only one third of the available credit from EPA's locomotives regulation was assumed when calculating the locomotive emission reductions in the District.

Implementation

This program is implemented by the EPA under the *Final Emissions Standards for Locomotives* (EPA420-F-97-048) published in December 1997.

Projected Reductions

	NOx Emission Reductions (tons per day)			
	District of Columbia	Maryland	Virginia	Total
2002 NOx Reductions	0.1	1.3	1.5	2.9
2005 NOx Reductions	0.1	1.3	1.6	3.1

Emission Benefit Calculations

2005 VOC

	Uncontrolled	Reduction (3.3%)
DC	0.110	0.001 (one-third of credit)
MD	0.207	0.007
VA	0.257	0.008
Total	0.574	0.019

2005 NOx

	Uncontrolled	Reduction (27.8%)
DC	1.391	0.129 (one-third of credit)
MD	4.831	1.342
VA	5.928	1.648
Total	12.151	3.1198

References

Regulatory Update, EPA's Nonroad Engine Emissions Control Programs, EPA, Air and Radiation, EPA420-F-99-001, January 1999

Final Emissions Standards for Locomotives, EPA420-F-97-048, December 1997

7.3.6 Heavy-Duty Diesel Engine Rule

Under the Heavy-Duty Diesel Engine Rule, truck manufacturers must comply with tailpipe standards that are more stringent by 2004. The standards are enforceable in the same manner that other federal motor vehicle emissions control requirements are enforceable.

Source Type Affected

These federally implemented programs affect heavy-duty diesel engines used in trucks.

Control Strategy

The Heavy-Duty Diesel Engine Rule requires more stringent exhaust emission standards.

Implementation

This program is implemented by the EPA, under 40 CFR Parts 9 and 86 Control of Emissions of Air Pollution From Highway Heavy-Duty Engines; Final Rule.

Projected Reductions and Emission Benefit Calculations

Changes made to the mobile model during the development of MOBILE6 create synergistic effects between the different mobile control measures, making it difficult to isolate credit from one control program or calculate incremental benefits from implementation of individual control measures. As a result, this and future SIP revisions do not enumerate the benefits of individual mobile control measures. See Appendix B for documentation of the MOBILE6 modeling process.

References

U.S. Environmental Protection Agency, Office of Mobile Sources, *User's Guide to MOBILE5*, Chapter 2, March 1993.

40 CFR Parts 9 and 86 Control of Emissions of Air Pollution From Highway Heavy-Duty Engines; Final Rule (62 FR 54694), October 21, 1997.

7.4 State and local measures

7.4.1 Reformulated gasoline use in on-road vehicles

This measure requires the use of federal reformulated gasoline in the Washington nonattainment area. This is accomplished through an opt-in to the federal program, which is mandatory in more severe ozone nonattainment areas.

Source Type Affected

All gasoline-powered vehicles (non-road source benefits are documented under Section 7.4.2) are affected by this measure. Vehicle refueling emissions at service stations are also reduced.

Control Strategy

Federal reformulated gasoline has been sold in the Washington, DC-MD-VA ozone nonattainment area since January 1, 1995.

Implementation

Implementation occurs through a state "opt-in" process. The governors of Maryland and Virginia and the mayor of the District of Columbia have "opted in" for, and EPA has approved, delivery of reformulated gasoline in their respective portions of the Washington, DC-MD-VA ozone nonattainment area. All gasoline sold in the nonattainment area on or after January 1, 1995, must be reformulated gasoline.

Projected Reductions and Emission Benefit Calculations

Changes made to the mobile model during the development of MOBILE6 create synergistic effects between the different mobile control measures, making it difficult to isolate credit from one control program or calculate incremental benefits from implementation of individual control measures. As a result, this document does not enumerate the benefits of individual mobile control measures, nor will future SIP revisions. See Appendix B for documentation detailing emission reductions for mobile source controls.

References

U.S. Environmental Protection Agency, Office of Mobile Sources, *User's Guide to MOBILE6.0*, Chapter 2, January 2002.

7.4.2 Reformulated gasoline use in non-road motor vehicles and equipment

This measure involves taking credit for reductions due to the use of federally reformulated gasoline in non-road mobile sources. The reformulated gasoline will be available as a result of Virginia's, Maryland's, and the District of Columbia's "opting-in" on delivery of reformulated gasoline in the Washington, D.C. ozone nonattainment area. Areas that opt-in on delivery of reformulated gasoline receive such gasoline beginning in 1995.

Source Types Affected

This measure affects the various non-road mobile sources that burn gasoline.

Control Strategy

Federal reformulated gasoline has been sold in the Washington, DC-MD-VA ozone nonattainment area since January 1, 1995.

Projected Reductions

	VOC Emission Reductions (tons per day)			
	District of Columbia	Maryland	Virginia	Total
2002 VOC Reductions	0.2	1.2	1.4	2.7
2005 VOC Reductions	0.2	1.2	1.5	2.9

Emissions Benefit Calculations

Refueling emissions for on-road sources are already calculated in the Washington, D.C. ozone nonattainment area's mobile source inventory.

In an August 18, 1993, memorandum, EPA's Office of Mobile Sources lists several factors for use in computing reduction credits for the use of reformulated gasoline in non-road equipment. Using the EPA memorandum, the emissions reduction factor is 3.324%, and the calculated emissions reductions therefore are as follows:

(Uncontrolled 2002 non-road mobile source emissions) x (0.03324 reduction factor) x (gasoline component of non-road mobile sources inventory) = tons/day reduction.

(101.6 tons VOC/day) * (0.03324 reduction factor) * [87.62 tpd gasoline VOC/101.6 tpd total VOC] = 2.91 tons VOC/day reduction.

Implementation

District of Columbia - Implemented by EPA via mayor's formal request to opt-in to federal program.
Maryland - Implemented by EPA via governor's formal request to opt-in to federal program.
Virginia - Implemented by EPA via governor's formal request to opt-in to federal program.

References

U.S. Environmental Protection Agency, "Regulation of Fuels and Fuel Additives: Standards for Reformulated Gasoline", Proposed Rule, 58 *Federal Register* 11722, February 26, 1993.

"VOC Emission Benefits for Non-Road Equipment with the Use of Federal Phase I Reformulated Gasoline", memorandum from Phil Lorang, U.S. EPA Office of Mobile Sources to Air Directors, EPA Regions 1-10, August 18, 1993.

7.4.3 Surface cleaning and degreasing for machinery and automobiles repair

This measure amended regulations for surface cleaning (often called "cold cleaning and degreasing") devices and operations, to require more stringent emissions control techniques, and to require, where possible, the use of low- or no-VOC solvents.

Source Type Affected

All cold cleaning and degreasing equipment and operations.

Control Strategy

Maryland has regulations on cold cleaning and degreasing equipment and operations (COMAR 26.11.19.09). The regulations require a decrease in vapor pressure of degreasing material for cold degreasers, installation of a condenser or air pollution control device, and good operating practices to minimize VOC losses.

The District of Columbia and Virginia have adopted regulations on cold cleaning and degreasing equipment and operations. Credit is taken for two types of control measures: (1) The first measure proposes following equipment controls: solvent tank evaporation controls, carry-out emission controls, and enclosure/add-on controls; and the following operational controls: proper equipment use, and reduced disturbance of solvent-air interface. (2) The second measure will require the use, where feasible, of alternative solvents.

Implementation

District of Columbia - Environmental Health Administration
Maryland - Air and Radiation Management Administration
Virginia - Department of Environmental Quality

Projected Reductions

	VOC Emission Reductions (tons per day)			
	District of Columbia	**Maryland**	**Virginia**	**Total**
2002 VOC Reductions	0.1	2.5	1.6	4.1
2005 VOC Reductions	0.01	2.6	1.7	4.4

Emissions Benefits Calculations

The calculation based on the most recent EPA guidance for emission reductions in 2005 follows:

	2002 Uncontrolled	Reduction
DC (32% reduction)	0.259	0.083
MD (59% reduction)	4.182	2.467
VA (32% reduction)	4.954	1.585
	2005 Uncontrolled	**Reduction**
DC (32% reduction)	0.257	0.082
MD (59% reduction)	4.389	2.590
VA (32% reduction)	5.303	1.670

7.4.4 Landfill regulations

Landfills emit gases as a result of decomposition of materials buried in them. While most of these gases are methane, which is not photochemically reactive, landfills do contribute to VOC emissions, and, thus, ozone formation. A federal rule for the control of new landfills and guidelines for existing landfills has been proposed under Section 111 of the Clean Air Act Amendments.

Source Type Affected

Municipal landfills are those that receive primarily household and/or commercial waste.

Control Strategy

The 15% VOC Reduction Plan required adoption of the federal guidelines for municipal landfills (see 56 *Federal Register* 24468). The proposed guidelines require installation of gas collection systems followed by flares, to either destroy the VOCs or burn them for fuel. The rule would require capture and control systems to capture at least 80% of the VOC emissions and rout them to a 98% destruction efficiency control device.

Implementation

Federal standards for existing landfills will be promulgated under Section 111 of the Clean Air Act Amendments. The following state agencies will have to independently adopt regulations consistent with the federal standards:

Maryland - Air and Radiation Management Administration - MD 26.11.19.20, 3/9/98
Virginia - Department of Environmental Quality – 9 VAC 5-40-5800, 4/1/96

Projected Reductions

	VOC Emission Reductions (tons per day)			
	District of Columbia	Maryland	Virginia	Total
2002 VOC Reductions	0	1.2	1.1	2.4
2005 VOC Reductions	0	1.3	1.2	2.5

Emission Benefit Calculations

Following the EPA guidance on this measure, a 98% emissions reduction factor was used, with a default capture efficiency of 80% and a default rule effectiveness factor of 80%. These figures were applied to emissions to determine reductions.

2002 MD: (1.989 tpd) x (0.98) x (0.8) x (0.8) = 1.25 tpd
2005 MD: (2.072 tpd) x (0.98) x (0.8) x (0.8) = 1.30 tpd

2002 VA: (1.796 tpd) x (0.98) x (0.8) x (0.8) = 1.13 tpd
2005 VA: (1.901 tpd) x (0.98) x (0.8) x (0.8) = 1.19 tpd

References

U.S. Environmental Protection Agency, *Standards of Performance for New Stationary Sources and Guidelines for Existing Sources: Municipal Solid Waste Landfills*, 56 *Federal Register* 24468, May 30, 1991.

U.S. Environmental Protection Agency, *Air Emissions From Municipal Solid Waste Landfills - Background Information for Proposed Standards and Guidelines*, EPA-450/3-90-011a, March 1991.

7.4.5 Seasonal open burning restrictions

This measure involves amending and/or adopting state regulations to ban the open burning of such items as trees, shrubs, and brush from land clearing, trimmings from landscaping, and household or business trash, during the peak ozone season. The measure is authorized by state regulations, but is enforced by the local governments.

Source Type Affected

The measure affects all citizens and businesses that burn solid waste.

Control Strategy

Under the 15% VOC Reduction Plan, Maryland and Virginia adopted state regulations to prohibit open burning during peak ozone season in the Washington, D.C. ozone nonattainment area. The emissions benefits will remain constant throughout 2005.

Implementation

District of Columbia - Environmental Health Administration.
Maryland - Air and Radiation Management Administration; local government enforcement.
Virginia - Department of Environmental Quality; local government enforcement.

Projected Reductions

	VOC Emission Reductions (tons per day)			
	District of Columbia	Maryland	Virginia	Total
2002 VOC Reductions	0	4.4	3.0	7.4
2005 VOC Reductions	0	4.4	3.0	7.4

	NOx Emission Reductions (tons per day)			
	District of Columbia	Maryland	Virginia	Total
2002 NOx Reductions	0	0.9	0.6	1.6
2005 NOx Reductions	0	0.9	0.6	1.6

Emissions Benefit Calculations

For emissions reductions, the calculation is as follows:

(Projected uncontrolled emissions) x (emissions reduction factor) x (rule compliance factor) = tons NOx/day benefit

MD

A rule effectiveness factor of 96.8% is used. This factor was obtained from a study prepared by Mid-Atlantic Regional Air Management Association/Mid-Atlantic Northeast Visibility Union (MARAMA/MANE-VU) regarding emission factors and rule effectiveness for open burning.

(4.587 tons VOC/day) x (1.0 reduction factor) x (0.968 rule compliance) = 4.440 tons/day VOC reduction

VA

A rule effectiveness factor of 90% is used. This factor was obtained from a study prepared by E.H. Pechan for Fairfax County regarding rule effectiveness for open burning in the Northern Virginia area. A copy of this study is included in Appendix C.

(3.323 tons VOC/day) x (1.0 reduction factor) x (0.90 rule compliance) = 2.991 tons/day VOC reduction

DC

No open burning is assumed in the 1990 baseline inventory or the 2002 or 2005 projection inventories.

References:

"Open Burning in Residential Areas, Emissions Inventory Development Report," E.H. Pechan & Associates, Inc., January 31, 2003. Prepared for the Mid-Atlantic/Northeast Visibility Union.

"Northern Virginia Open Burning Rule Effectiveness Evaluation," E.H. Pechan & Associates, Inc., December 8, 2003. Prepared for the County of Fairfax.

7.4.6 Stage I vapor recovery system expansion

This measure involves applying the federal Control Technique Guideline's "balanced submerged" underground storage tank refilling method at gas stations located in newly designated nonattainment counties.

Source Type Affected
All filling of underground storage tanks not currently controlled will be affected.

Control Strategy

In the 15% VOC Reduction Plan, balanced submerged fill requirements were extended to Calvert, Charles and Frederick counties in Maryland and Stafford counties in Virginia. All other counties in the nonattainment area already were required to use balanced submerged fills.

Implementation

Maryland - Air and Radiation Management Administration
Virginia - Department of Environmental Quality

Projected Reductions

	VOC Emission Reductions (tons per day)			
	District of Columbia	Maryland	Virginia	Total
2002 VOC Reductions	0	0.9	0.6	1.5
2005 VOC Reductions	0	1.0	0.6	1.6

Emission Benefit Calculations

For Maryland, projected 2002 and 2005 emissions for Frederick, Charles, and Calvert counties were multiplied by a 90% emissions reduction factor and a 91% rule effectiveness factor. For the Virginia portion of this source, projected 2002 and 2005 emissions for Stafford County were multiplied by a 90% emissions reduction factor and an 80% rule effectiveness factor.

MD 2002: (1.144) x (0.9) x (0.91) = 0.937 tpd
VA 2002: (0.782) x (0.9) x (0.80) = 0.563 tpd
MD 2005: (1.184) x (0.9) x (0.91) = 0.970 tpd
VA 2005: (0.809) x (0.9) x (0.80) = 0.582 tpd

References

Maryland Department of the Environment, Air Management Administration, *Stage I Vapor Recovery Inspection Program,* (Beth Murray, September 30, 1991).

7.4.7 Extend Non-CTG RACT and state point source regulations to sources of 25 tons VOC per year

This measure involves extending emission standards to point sources with the potential to emit in excess of 25 tons per year (tpy) of VOCs. Because of its designation as a severe nonattainment area, the Washington D.C. metropolitan area is obligated by law under the CAAA to implement regulations for major sources (greater than 25 tpy) not covered by EPA's Control Technique Guidance (CTG) documents. Under this measure, "reasonably available" control technologies would need to be determined and implemented for industry sources emitting between 25 and 50 tpy.

Source Type Affected

Point sources with the potential to emit between 25 and 50 tpy.

Control Strategy

Under the 15% VOC Reduction Plan, Maryland and the District of Columbia agreed to develop and implement new regulations for point sources with the potential to emit between 25 and 50 tpy not already regulated or required to be regulated under the previous major source definition (50 tpy). The Commonwealth of Virginia is now implementing this control measure as well, as required under the Clean Air Act. This control measure includes two parts: extension of non-CTG RACT rules to point sources emitting over 25 tpy, and extension of other state regulations applicable to major sources. The latter reductions are found only in Maryland.

Implementation

District of Columbia - Environmental Health Administration (no applicable sources)
Maryland - Air and Radiation Management Administration
Virginia – Department of Environmental Quality

Projected Reductions

	VOC Emission Reductions (tons per day)*			
	District of Columbia	Maryland	Virginia	Total
2002 VOC Reductions	0	1.73	0.63	2.36
2005 VOC Reductions	0	1.83	0.66	2.49

*Virginia reductions from VOC sources emitting more than 25 tpy are assumed in Table 7-1.

Emission Benefit Calculations

Emission benefits for Maryland were calculated using the proposed limit on emissions from miscellaneous metal coatings sources. The RACT limit is set to 3.5 pounds per gallon of coating as applied. Reduction potentials for bakery emissions are based on using an add-on control at the oven vent. The emission reductions creditable from extending RACT into Calvert, Charles, and Frederick are also included. Tables 7-8 and 7-9 present the specific point sources, reduction potentials, and the expected reductions for sources in Maryland.

Table 7-11
Virginia Non-CTG RACT to 25 tons VOCs per year

Source Name	Uncontrolled Emissions (tpd)	Reduction Potential (%)	Reductions (tpd)
2002			
Cellofoam	0.273	23	0.063
Brake Parts Inc.	0.220	99	0.217
Stephenson Inc.	0.167	72	0.120
DC Corrections - Lorton	0.228	100	0.228
2002 Totals	**0.888**		**0.628**
2005			
Cellofoam	0.286	23	0.066
Brake Parts Inc.	0.226	99	0.223
Stephenson Inc.	0.180	72	0.130
DC Corrections - Lorton	0.236	100	0.236
2005 TOTALS	**0.928**		**0.655**

Table 7-12
Maryland Non-CTG RACT to 25 tons VOCs per year

Source Name	Uncontrolled Emissions (tpd)	Reduction Potential (%)	Reductions (tpd)
2002			
Andrews AFB	0.300	90	0.266
Stone Industrial.	0.138	50	0.069
2002 Totals	**0.438**		**0.334**
2005			
Andrews AFB	0.311	90	0.284
Stone Industrial.	0.141	50	0.071
2005 TOTALS	**0.928**		**0.354**

Table 7-13
Maryland Extended State Point Source Regulations to 25 tons VOCs per year

Facility Name	Uncontrolled Emissions (tpd)	Reduction Potential %	Reduction (tpd)
2002			
Naval Surface Warfare Center – Indian Head	1.222	44	0.575
Automated Graphic Systems	0.063	70	0.044
Moore Communications Services	0.119	70	0.083
Metlfab – Grove Road	0.048	44	0.021
EU Services	0.178	70	0.125
Editors Press	0.162	70	0.114
Craftsman Press – Holladay Tyler	0.333	70	0.233
Printers II	0.152	44	0.067
Peake Printers	0.241	44	0.106
Corporate Press – Brightseat Road	0.057	44	0.025
		2002 TOTAL	1.393
2005			
Naval Surface Warfare Center – Indian Head	1.249	44	0.590
Automated Graphic Systems	0.069	70	0.048
Moore Communications Services	0.129	70	0.091
Metlfab – Grove Road	0.049	44	0.022
EU Services	0.194	70	0.136
Editors Press	0.177	70	0.124
Craftsman Press – Holladay Tyler	0.363	70	0.254
Printers II	0.166	44	0.073
Peake Printers	0.263	44	0.116
Corporate Press – Brightseat Road	0.062	44	0.028
		2005 TOTAL	1.480

7.4.8 Graphic arts controls

Controls for offset lithography have been adopted as a new CTG. These controls apply to small printers and sources. VOCs are emitted from the inks used for printing, fountain solutions, and from the solvents used to clean the printing equipment.

Source Type Affected

This regulation affects small printers not currently regulated under RACT measures. Lithographic printing facilities include heatset web, non-heatset web, non-heatset sheet-fed, and newspaper non-heatset web sources.

Control Strategy

The 15% VOC Reduction Plan contained measures based on the draft CTG, which included the following controls:

Emission Source	Recommended Control
Inks	90% control (condenser filters) for heatset plants
Fountain Solution	1.6% isopropyl alcohol (IPA) for heatset plants (90% reduction) alcohol substitution for non-heatset (99% reduction) 5% IPA for sheet-fed (50% reduction)
Cleaning Solutions	30% VOC content limit (70% reduction)

Implementation

District of Columbia - Environmental Health Administration: 20 DCMR Sec. 716, 5/1/99
Maryland - Air and Radiation Management Administration: 26.11.19.11 & .18, 6/5/95 & 11/7/94
Virginia - Department of Environmental Quality: 9 VAC 5-40-7800, 4/1/96

Projected Reductions

	VOC Emission Reductions (tons per day)			
	District of Columbia	Maryland	Virginia	Total
2002 VOC Reductions	0.6	1.6	1.7	3.8
2005 VOC Reductions	0.6	1.6	1.8	4.0

Emission Benefit Calculations

Based on the draft CTG (based on employment), it was assumed that offset lithographic printing accounts for 64% of total graphic arts emissions. This percentage contribution was applied to total graphic arts area source emissions, to estimate total emissions from offset lithography. There is a margin of uncertainty with this calculation, as the exact percentage of lithographic printers in the Washington MSA was not available.

The draft CTG estimated overall reductions for four model plants: heatset web, non-heatset web, non-heatset sheet-fed, and newspaper non-heated web. Since the CTG did not classify the population of sources into these model plants, the numerical average of the overall sources was used for the nonattainment area reductions.

In Virginia and the District, the average control efficiency of 75%, with 80% rule effectiveness and 64% penetration, was applied to area source graphic art emissions to determine total reductions.

In Maryland, the graphic arts category was divided into lithography, flexography, and rotogravure sub-categories. Based on a November 1996 EIIP document entitled Graphic Arts, the estimated percentage of product market share for rotogravure printing is 18 percent and the estimated percentage of market share for flexographic printing is 18 percent. This percentage contribution was applied to total graphic arts area source emissions, to estimate total emissions from either flexographic or rotogravure printing.

The average control efficiency for flexographic printers is assumed to be 60% (from COMAR 26.11.19.10) * 90% (estimated percent of emissions attributable to evaporation of ink solvent). The average control efficiency for rotogravure printers is assumed to be 70% (from COMAR 26.11.19.10) * 90% (estimated percent of emissions attributable to evaporation of ink solvent). The average control efficiency for each type of printing operation and the 18 % penetration were applied to area source graphic art emissions to determine total reductions. Therefore, each category was controlled as follows:

Graphic Arts Controls Lithography (64%):	75% reduction factor * 80% rule effectiveness * 64% Penetration
Graphic Arts Controls MD-Flexography (16%):	60% reduction factor * 90% emissions from ink solvent evaportion * 80% rule effectiveness * 18% Penetration
Graphic Arts Controls MD-Rotogravure (16%):	70% reduction factor * 90% emissions from ink solvent evaportion * 80% rule effectiveness * 18% Penetration

Sample 2005 Calculations:

DC: (1.517 tpd) x (0.75) x (0.80) x (0.64) = 0.583 tpd

VA: (4.703 tpd) x (0.75) x (0.80) x (0.64) = 1.801 tpd

MD: (1.898 tpd) x (0.75) x (0.80) +
(0.534 tpd) x (0.60) x (0.90) x (0.80) +
(0.534 tpd) x (0.70) x (0.90) x (0.80) = 1.639 tpd

References

U.S. Environmental Protection Agency, *Control Techniques Guideline for Offset Lithographic Printing*, Draft, December 14, 1992.

7.4.9 Auto body refinishing

EPA has crafted a national rule for emissions from auto body refinishing. The rule requires reformulated auto body coatings. This source category was originally targeted as a new Control Technique Guideline (CTG), and a draft CTG is available for use in creating a state rule.

Source Type Affected

EPA expects all auto body refinishing facilities to be affected. This category includes the application of base coats, primer coats, finish coats, and sealer/clear coats.

Control Strategy

The 15% VOC Reduction Plan contained a measure that required reduced-solvent coatings for precoats, primer surfaces, primer sealers, and topcoats. The measure also required the use of spray gun cleaners that recycle solvents, and the use of high-volume, low- pressure application equipment.

Implementation

EPA adopted a National Rule for Autobody Refinishing on August 14, 1998.
Maryland - Air and Radiation Management Administration

Projected Reductions

	VOC Emission Reductions (tons per day)			
	District of Columbia	Maryland	Virginia	Total
2002 VOC Reductions	0.5	5.7	3.1	9.3
2005 VOC Reductions	0.5	6.0	3.4	9.8

Emission Benefit Calculations

EPA signed the national rule to control VOC emissions from autobody refinishing on August 14, 1998. These coatings are typically used by industry and small businesses or by vehicle owners. The national rule targets the formulation of these surface coatings. The national rule allows Virginia and the District of Columbia to claim a 35.7% emission reduction due to the new requirement. A total reduction of 35.7% was applied based on EPA guidance to estimate reductions in Virginia and the District of Columbia. This reduction was applied to the base case 2005 projections to estimate the overall benefit. Maryland has a more stringent rule that yields a 60% reduction, and its reductions are calculated accordingly.

2002:
DC: (1.294 tpd) x (0.357) = 0.462 tpd
VA: (8.815 tpd) x (0.357) = 3.147 tpd

MD: (9.502 tpd) x (0.60) = 5.701 tpd

2005:
DC: (1.294 tpd) x (0.357) = 0.462 tpd
VA: (9.388 tpd) x (0.357) = 3.352 tpd
MD: (9.994 tpd) x (0.60) = 5.996 tpd

References

U.S. Environmental Protection Agency, Chemicals and Petroleum Branch, Research Triangle Park, North Carolina, *Automobile Refinishing Control Techniques Guideline*, Final

EPA Reference Docket Number A-95-18

Maryland Department of the Environment, Air and Radiation Management Administration, Baltimore, Maryland, *Summary and Economic Impact of New Regulation .23 under COMAR 26.11.19, Control of VOC Emissions from Vehicle Refinishing* (October 18, 1994)

7.4.10 RESERVED

7.4.11 Ozone Transport Commission (OTC) Portable Fuel Containers Rule

This measure introduces performance standards for portable fuel containers and spouts. The standards are intended to reduce emissions from storage, transport and refueling activities. The rule also included administrative and labeling requirements. Compliant containers must have: only one opening for both pouring and filling, an automatic shut-off to prevent overfill, an automatic sealing mechanism when not dispensing fuel and specified fuel flow rates, permeation rates and warranties.

Source Type Affected

Any person or entity selling, supplying or manufacturing portable fuel containers, except containers with a capacity of less than or equal to one quart, rapid refueling devices with capacities greater than or equal to four gallons, safety cans and portable marine fuel tanks operating with outboard motors, and products resulting in cumulative VOC emissions below those of a representative container or spout.

Control Strategy

Maryland and Virginia adopted the Ozone Transport Commission (OTC) Model Rule for Portable Fuel Containers in January 2002 and November 2003, respectively. The District of Columbia expects to adopt this rule no later than March 1, 2004. The rule will apply to all counties in the nonattainment area. Reductions from this rule are expected to increase annually beginning with implementation in the State of Maryland on January 1, 2004. The District of Columbia and the Commonwealth of Virginia will require compliance with this rule as of January 1, 2005. Because the Washington region expects to demonstrate the 1999-2002 rate of progress in January 2005, only reductions expected to occur by January 1, 2005 are credited towards the 2002 rate-of-progress. Reductions occurring by November 15, 2005 are credited towards the 2005 rate-of-progress.

Implementation

Maryland - Air and Radiation Management Administration
Virginia - Department of Environmental Quality
District of Columbia - Environmental Health Administration

Projected Reductions

	VOC Emission Reductions (tons per day)			
	District of Columbia	**Maryland**	**Virginia**	**Total**
2002 VOC Reductions	0	0.9	0	0.9
2005 VOC Reductions	0.2	1.7	0.7	2.6

*Reductions for the 1999-2002 rate of progress are calculated as of January 1, 2005. Reductions for the 2002-2005 Rate-of-Progress are calculated as of November 15, 2005.

Emission Benefit Calculations

E.H. Pechan calculated state-by-state emission benefits from the consumer products rule for the OTC region. These calculations assumed 2.5 years of implementation by 2005. As all three jurisdictions expect to require compliance with this rule on a later date than was assumed by Pechan, the benefits from the Pechan analysis were scaled down as shown below.

State	Assumed Compliance Date	Pechan Estimate for 2.5 Year Benefits	Reductions Per Year	Jan 1, 2005 Reductions	November 15, 2005 Reductions
District of Columbia	Jan 2005	0.4	0.17	0.00	0.15
Virginia	Jan 2005	2.0	0.80	0.00	0.70
Maryland	Jan 2004	1.8*	0.91	0.91	1.71
Total (tpd VOC)			**1.88**	**0.91**	**2.56**

* MDE estimate for benefits from Jan 1, 2004 – Dec 31, 2005.

The Maryland Air and Radiation Management Administration provided an estimate of benefits for the Maryland portion of the Washington nonattainment region, based on E.H. Pechan calculations. The EH Pechan estimate was for the entire State of Maryland, not for Washington nonattainment area. See Table IV-6 of Pechan report for documentation of Northern Virginia reductions. Reductions for District of Columbia and Maryland are detailed in Appendix C.

References

E.H. Pechan, "Control Measure Development Support Analysis for the Ozone Transport Commission Model Rules", March 31, 2001.

7.4.12 Ozone Transport Commission (OTC) Architectural and Industrial Maintenance Coatings Rule

This rule requires manufacturers to reformulate various types of coatings to meet VOC content limits. Affected products include architectural coatings, traffic markings, high-performance maintenance coatings and other special-purpose coatings. It uses more stringent VOC content limits than the existing Federal consumer products rule.

Source Type Affected

The measure affects all manufacturers of affected coatings.

Control Strategy

Virginia adopted the Ozone Transport Commission (OTC) Model Rule for Architectural and Industrial Maintenance Coatings in November 2003. The District of Columbia and Maryland plan to adopt this rule no later than March 1, 2004. The rule will apply to all counties in the nonattainment area. Compliance with this rule will be required in all jurisdictions in the region by January 1, 2004.

The VOC content limits in this rule are based on a Suggested Control Measure (SCM) adopted by the California Air Resources Board (CARB) and a State and Territorial Air Pollution Program Administrators/Association of Local Air Pollution Officials (STAPPA/ALAPCO) model rule or OTC coatings. Manufacturers are expected to comply with this rule using primarily EPA Test Method 24.

Implementation

District of Columbia - Environmental Health Administration
Maryland - Air and Radiation Management Administration
Virginia - Department of Environmental Quality

Projected Reductions

	VOC Emission Reductions (tons per day)			
	District of Columbia	**Maryland**	**Virginia**	**Total**
2002 VOC Reductions	1.1	6.2	5.0	12.3
2005 VOC Reductions	1.1	6.2	5.0	12.3

*Because the 1999-2002 rate of progress demonstration will be met on May 1, 2005, reductions credited to the 2002 and 2005 rate-of-progress demonstrations are the same.

Emissions Benefit Calculations

E.H. Pechan calculated state-by-state emission benefits from the consumer products rule for the OTC region. Further details are available from Reference 1.

References

E.H. Pechan, "Control Measure Development Support Analysis for the Ozone Transport Commission Model Rules", March 31, 2001.

7.4.13 RESERVED

7.4.14 Ozone Transport Commission (OTC) Solvent Cleaning Operations Rule

This rule establishes hardware and operating requirements and alternative compliance options for vapor cleaning machines used to clean metal parts. These machines are used in manufacturing operations to clean grease, wax, oil and other contaminants from parts when a high level or cleanliness is necessary. The rule also affects cold cleaners, which are used in automobile and maintenance facilities and industrial maintenance shops.

Source Type Affected

Manufacturers and operators of vapor cleaning or cold cleaning machines

Control Strategy

Virginia adopted the Ozone Transport Commission (OTC) Model Rule for Solvent Cleaning Operations in November 2003. The District of Columbia will adopt this rule no later than March 1, 2004. The rule will apply to all counties in the nonattainment area. The State of Maryland had rules in place by 1996 that contain limits comparable to the OTC model rule. Therefore the OTC model rule will not be implemented in Maryland. Compliance with this rule will be required in all jurisdictions in the region by January 1, 2004.

Standards for vapor cleaning machines are based on Federal Maximum Available Control Technology (MACT) standards for chlorinated solvent vapor degreasers. Cold cleaner solvent volatility provisions are based on regulatory programs in place in several states, primarily Maryland and Illinois.

Implementation

District of Columbia - Environmental Health Administration
Virginia - Department of Environmental Quality

Projected Reductions

	VOC Emission Reductions (tons per day)			
	District of Columbia	**Maryland**	**Virginia**	**Total**
2002 VOC Reductions	2.7	0	9.0	11.7
2005 VOC Reductions	2.7	0	9.0	11.7

*Because the 1999-2002 rate of progress demonstration will be met on May 1, 2005, reductions credited to the 2002 and 2005 rate-of-progress demonstrations are the same.

Emission Benefit Calculations

E.H. Pechan calculated state-by-state emission benefits from the consumer products rule for the OTC region. Further details are available from Reference 1.

References

E.H. Pechan, "Control Measure Development Support Analysis for the Ozone Transport Commission Model Rules", March 31, 2001.

7.5 Transportation control measures (TCMs)

Section 108(f) of the Clean Air Act Amendments provides examples of Transportation Control Measures (TCMs) that can be implemented to reduce emissions from mobile sources. Most TCMs are designed to reduce vehicle miles traveled or vehicle trips or improve the flow of traffic.

In conjunction with state departments of transportation and local transit authorities, state air agencies have identified a number of projects designed to reduce vehicle travel and mitigate traffic congestion in the Metropolitan Washington nonattainment area. These measures include purchase of alternative-fueled vehicles, improvements to bicycle and pedestrian facilities, and improvements to transit services and access to transit facilities. All responsible agencies have committed to implementing these projects by January 1, 2005. Commitment letters and specific project descriptions are contained in Appendix G.

Source Type Affected
Transportation-related activities in the Metropolitan Washington nonattainment area

Implementation
District of Columbia – Department of Transportation
Maryland - Department of Transportation
Virginia - Department of Transportation
Washington Metropolitan Area Transit Authority
Northern Virginia Local Governments

Projected Reductions

	VOC Emission Reductions (tons per day)			
	District of Columbia	**Maryland**	**Virginia**	**Total***
2002 VOC Reductions	0.0059	0.0878	0.1446	0.3
2005 VOC Reductions	0.0041	0.0766	0.1215	0.3

*Total includes 0.0706 tpd in 2002 and 0.0674 tpd in 2005 from WMATA that cannot be assigned to specific states.

	NOx Emission Reductions (tons per day)			
	District of Columbia	**Maryland**	**Virginia**	**Total***
2002 NOx Reductions	0.0048	0.1798	0.3187	0.5
2005 NOx Reductions	0.0062	0.1876	0.3104	0.7

*Total includes 0.0156 tpd in 2002 and 0.1725 tpd in 2005 from WMATA that cannot be assigned to specific states.
*Emission reduction estimates were supplied by the District of Columbia Department of Transportation, the Maryland Department of Transportation, the Virginia Department of Transportation and the Washington Metropolitan Area Transit Authority (WMATA). See Appendix G for details.

7.6 Voluntary Bundle

EPA's voluntary measures policy, "Guidance on Incorporating Voluntary Mobile Source Emission Reduction Programs in State Implementation Plans", establishes criteria under which emission reductions from voluntary programs are creditable in a SIP. (See Reference 1.) This policy permits states to develop and implement innovative programs that partner with local jurisdictions, businesses and private citizens to implement emission-reducing behaviors at the local level.

Under EPA's policy, states develop realistic estimates of activity and participation rates for each voluntary program. States assign this credit to a Voluntary Measure in the SIP. States must then implement the voluntary control measure, monitor the measure for effectiveness and report the findings to EPA. If the estimated reductions are not achieved, states commit to take corrective action by either making changes to the existing program or developing a more effective control measure.

The programs identified in the Voluntary Measures package for Rate of Progress will be fully implemented by May 1, 2005, the beginning of the 2005 ozone season, though most reductions will occur by January 2005, the date on which the region will achieve rate of progress. The measures will reduce emissions daily throughout the region's May-September ozone season. These programs will be implemented largely at the local level by county and state governments and agencies and the Washington Metropolitan Area Transit Authority. Implementation will occur in consultation with either the State of Maryland or the Commonwealth of Virginia.

It is expected that this voluntary measures package may be expanded in future SIPs as additional voluntary measures are developed and implemented. Many state agencies and local governments are currently developing programs that could, in the future, qualify as voluntary measures. For example, within the last several years, Maryland has taken an aggressive stance on energy efficiency through the Maryland Energy Administration and the provision of incentives to increase energy efficiency concepts. As part of this initiative, Maryland has implemented a Clean Energy Incentives Act and a Green Energy Executive Order, which improve overall energy efficiency. While these acts were not created with ozone control as the primary focus, they do provide for NOx and VOC emission reductions and could be included as a voluntary measure in future SIPs.

This section contains descriptions of the voluntary measure programs included in this package. A detailed estimate of the benefits resulting from each program in this package is contained in Appendix J. The information contained below summarizes the reductions for the entire voluntary bundle. Individual measures contained in the bundle are described on succeeding pages.

Source Type Affected

This bundle affects, on a voluntary basis, some owners, operators, purchasers or users of the following types of emissions-producing items/equipment in the Metropolitan Washington area: commercial power generation, motor vehicles, school and transit buses, portable fuel containers, consumer products affected under contingency measure 12.2.3.4, locomotives, and traffic paint.

Implementation

Arlington County, Virginia
Fairfax City, Virginia
Fairfax County, Virginia
Maryland Department of Transportation
Maryland National Capital Parks and Planning Commission (Prince George's)
Montgomery County, Maryland
Prince George's County, Maryland
Prince William County, Virginia
Virginia Department of Environmental Quality

Monitoring and Enforcement

The State of Maryland and the Commonwealth of Virginia commit to monitoring, evaluation and reporting of the emissions effects of the programs comprising this voluntary measure. All governments and agencies that have committed to implementing voluntary measures have been informed of the monitoring and evaluation requirement and have agreed to provide monitoring information to the state air agencies.

Maryland and Virginia will re-evaluate the emission benefits from this voluntary measures package through a "true-up" analysis to be conducted at least every three calendar years. The first true-up will be completed by March 2007, three years from the submittal of this SIP revision. Should the re-evaluation program determine that the programs listed in this section have not delivered the estimated reductions, the states commit to remedy the resulting deficiency within one year if rulemaking is not required, or within two years if rulemaking is required. If the March 2007 true-up shows emissions benefits lower than expected, the states will remedy the deficiency by March 2008 if the remedy does not require rulemaking, or by March 2009 if rulemaking is required.

Projected Reductions

The State of Maryland and the Commonwealth of Virginia have used available methods to create a best estimate of the emission benefits created from this bundle of voluntary measures. These estimates have been agreed upon by the implementing agencies and are conservative in nature. In some instances, local agencies developed preliminary estimates of benefits that are included in the jurisdiction or agency's commitment letters. However, the most current estimates used for purposes of this section are included in the "Summary of Voluntary Measure Commitments" section of Appendix J. There are several reasons why the states have chosen a conservative "best estimate" methodology in selecting the initial emission credits. These reasons include:

- Many of these projects are innovative and new and have no track record that allows for simple estimation of future success.

- There is a lack of detailed precise models and emission factors for use in estimating emission benefits for any of the bundle's projects/ programs.

- Local jurisdictions have a key role in implementing most projects and have the final word in the success of these projects.

- Private sector investment, which is not assumed in current emission estimates, may increase the emission reduction potential of any individual measure.

- There is a lack of historical reference with regard to EPA's relatively new voluntary measures policies. There is limited experience with including voluntary measures in SIPs.

- There is a historical problem of enforceability for transportation measures in SIPs.

- States are reluctant to overestimate the potential benefits of any of the bundle's programs/ projects.

- Implementation strategies may change over time depending on political decisions that are out of the states' or implementing agencies' control.

	VOC Emission Reductions (tons per day)			
	District of Columbia	**Maryland**	**Virginia**	**Total**
2002 VOC Reductions	0	0.16	3.04	3.2
2005 VOC Reductions	0	0.16	3.04	3.2

	NOx Emission Reductions (tons per day)			
	District of Columbia	**Maryland**	**Virginia**	**Total**
2002 NOx Reductions	0	0.01	0.18	0.2
2005 NOx Reductions	0	0.01	0.18	0.2

Gas Can Replacement Program

Portable gas cans are a significant source of daily VOC emissions. Emissions from gas cans occur from evaporation and due to spillage for overfilling of power equipment fuel tanks. In transporting and storing cans, emissions are also released through secondary vent holes and permeation. By using newer gas cans with features such as shut off valves, harmful gasoline fumes can be reduced by 75%.

Source Type Affected

Owners of portable fuel containers, except containers with a capacity of less than or equal to one quart, rapid refueling devices with capacities greater than or equal to four gallons, safety cans and portable marine fuel tanks operating with outboard motors, and products resulting in cumulative VOC emissions below those of a representative container or spout.

Control Strategy

This measure builds on the OTC Portable Fuel Containers Rule (see Section 7.4.11). This rule, as implemented in Section 7.4.11, requires merchants to sell low-emission gas cans and relies on equipment turnover for emission reductions. Existing fuel containers in use today will eventually be replaced with low-emission cans as old cans wear out and new cans are purchased.

This measure is envisioned as a region-wide measure encouraging early replacement of gas cans used by public citizens, private industry and state and local governments within the Metropolitan Washington non-attainment area. The program is in the early stages of development, and commitments received at this point affect only local jurisdictions, state agencies, and their contractors operating in the non-attainment area. Jurisdictions have pledged to collect functional cans that were not already scheduled for replacement, and replace those in-use, functional cans with redesigned cans meeting the new Portable Fuel Containers standard. Old cans are destroyed in accordance with requirements for disposal of hazardous waste.

One jurisdiction has also encouraged citizens to use more environmentally sound gas cans and has promoted opportunities for them to trade in or replace older models with newer, low-emission cans. The jurisdiction has offered complimentary cans to encourage replacement. It is hoped that this program will expand in the future to include additional counties in the Metropolitan Washington non-attainment area. The Maryland Department of Transportation has commissioned a study to identify cost-effective methods of replacing large quantities of fuel containers in the region. It is hoped that the results of this study will serve as the foundation for a broader regional program.

Implementation

Arlington County, Virginia
Fairfax County, Virginia
City of Fairfax, Virginia
Maryland National Capital Parks & Planning Commission, Prince George's County
Montgomery County, Maryland
Prince George's County, Maryland
Prince William County, Maryland

Montgomery County has completed its can replacement program. The cost of Fairfax County's gas can replacement program should not exceed $5,000 and will be absorbed with current appropriations. The county has identified all cans to be replaced. Arlington County, Fairfax County, Fairfax City, M-NCPPC, Prince George's County and Prince William County are currently evaluating procurement options.

Monitoring and Enforcement

All jurisdictions and agencies participating in the fuel container replacement program have committed to maintain records of the number of fuel containers replaced and the method of disposal. These records will be provided to the appropriate state air agency on an annual basis and will be used to provide documentation for the region's March 2007 evaluation report.

Projected Reductions

This program is expected to replace 1,478 gas cans, resulting in a benefit of 0.01 tpd VOC. Further details on commitments and projected reductions are included in Appendix J.

Emissions Benefits Calculations

Calculation of emission benefits is based on estimates prepared by EH Pechan for use by the Ozone Transport Commission (Reference 2). In the report, Pechan estimates that 2.28 million gas cans are sold annually in the OTC Region. Table IV-6 in the Pechan document shows that for the 2.5 year period from January 1, 2003 through July 1, 2005, emissions in the OTC region will be reduced by 48 tpd VOC. Over this time period, the expected benefit in the Metropolitan Washington region would be 4.3 tpd, assuming a January 1, 2003 implementation date. (See calculations for Measure 7.4.11.) The estimated annual benefit from the measure in the Washington region is 4.3/48=8.96% of the total benefit.

Assuming that emission reductions are linearly related to gas can turnover, the Washington region accounts for 8.96% of the 2.28 million cans sold in the region per year, or 204,000 cans. From Measure 7.4.11, annual regional reductions from the measure are estimated at 1.88 tpd. Therefore, replacement of one can will, on average, deliver a benefit of 1.88/204,000 = 0.00000922 tpd VOC.

Commitment to Sale of Reformulated Consumer Products in Virginia

The OTC Consumer Products rule requires reformulation of approximately 80 types of consumer products to reduce VOC content. It uses more stringent VOC content limits than the existing Federal consumer products rule. The rule also contains requirements for labeling and reporting. Under this voluntary program, the Consumer Specialty Products Association and the Cosmetic, Toiletry, and Fragrance Association have agreed to sell only consumer products meeting the OTC rule requirements as of January 2005. Further details on the commitments are included in Appendix J.

Source Type Affected

Various specialty chemicals named in the rule, such as aerosol adhesives, floor wax strippers, dry cleaning fluids and general-purpose cleaners.

Control Strategy

The Cosmetic, Toiletry and Fragrance Association (CTFA) and the Consumer Specialty Products Association (CSPA), the premier trade associations representing the personal care and consumer specialty products industries, have signed letters committing to the sale of low-VOC products. These organizations have agreed to voluntarily bring to market products complying with the Ozone Transport Commission (OTC) Model Rule for Reformulated Consumer Products by January 2005. The Commonwealth of Virginia is also moving forward with a regulation requiring the sale of these products as a backstop for this agreement. The regulation is expected to require sale of OTC rule-compliant products as of January 2005. As the District of Columbia and the State of Maryland are adopting the OTC model rule as a contingency measure with early implementation (see Section 12.2.3.4), the rule will become a regional measure applicable to all counties in the nonattainment area by January 2005.

Implementation

Virginia Department of Environmental Quality
Cosmetic, Toiletry and Fragrance Association
Consumer Specialty Products Association

Monitoring and Enforcement

Virginia Department of Environmental Quality is consulting with Maryland Department of the Environment, the District of Columbia Department of Health and the Metropolitan Washington Air Quality Committee to develop an effective monitoring and enforcement program for this measure. The program may involve contracting with a consultant to develop a testing program to assess the VOC content of regionally distributed products at regular intervals. Records from the testing process would be provided to state air agencies on an annual basis and would be used to provide documentation for the region's March 2007 evaluation report.

Projected Reductions

This program is expected to reduce 3.0 tpd VOC.

Emissions Benefits Calculations

Emission benefits for this measure were calculated by E.H. Pechan. (See Reference 2, Table IV-6.)

Low-VOC Paints Program

Interior and exterior paint is applied to a variety of surfaces, including buildings and roads. Though Measure 7.2.12, the Architectural and Industrial Maintenance Coatings rule, requires a lower VOC content for many paints, many manufacturers sell no-VOC paint, or paint with VOC content much lower than the AIM rule standard. Use of no- or very low-VOC paint further reduces VOC emissions in the Washington nonattainment area.

Source Type Affected

The measure affects state and local governments and their contractors involved in some interior and exterior painting and traffic marking activities.

Control Strategy

This measure is envisioned as a region-wide measure encouraging use of very low or zero-VOC paint by public citizens, private industry and state and local governments within the Metropolitan Washington non-attainment area. This program is in the early stages of development, and commitments received at this point affect only local jurisdictions and state agencies in the non-attainment area. State agencies and local governments have committed to using paint and traffic marking materials with very low or zero VOC content. The lower-VOC paint is to be purchased and applied daily throughout the ozone season, and often year-round. It is hoped that continuing outreach efforts will expand this program to include participation from additional government entities and the private sector.

Implementation

Fairfax County, Virginia
Maryland Department of Transportation
Maryland National Capital Parks and Planning Commission (M-NCPPC), Prince George's County
Prince George's County, Maryland

MDOT currently purchases low-VOC traffic paint. MDOT verifies the VOC content through laboratory testing. The paint is being successfully used throughout the Maryland portion of the Washington nonattainment area. Fairfax County has identified several suitable low-VOC substitutes for the exterior high-gloss paints the county currently uses. Prince George's County has identified several suitable substitutes for its flat interior paint. The counties are currently in the process of selecting preferred substitutes and will use those substitutes exclusively by early 2005. Fairfax County, Prince George's County and M-NCPPC will set VOC levels of purchased paint through new contract specifications.

Monitoring and Enforcement

All jurisdictions and agencies participating in the low-VOC paint program have committed to maintain records of the number of gallons of paint used and the paint's VOC content. VOC content will be determined either by using the VOC level certification found on the paint can label or through laboratory testing, at the discretion of the participant. These records will be provided to the appropriate state air agency on an annual basis and will be used to provide documentation for the region's March 2007 evaluation report.

Projected Reductions

This measure affects 562.5 gallons of paint per day and is anticipated to reduce 0.17 tpd VOC. Further information on commitments and projected reductions is included in Appendix J.

Emissions Benefits Calculations

Benefits from this program are calculated by determining emissions reduced over and above those required by the OTC AIM rule (Measure 7.4.12). They are calculated as follows:

$$\text{VOC Reduced (tpd)} = \frac{\frac{gallons}{day} \times 3.7854 \frac{liters}{gallon}}{453.39 \frac{g}{lb} \times 2000 \frac{lb}{ton}} * \left(\frac{g}{liter} \text{cap under AIM rule} - \frac{g}{liter} \text{cap in commitments} \right)$$

Further information on emission benefit calculations is included in Appendix J.

Remote Sensing Device Program

The Commonwealth of Virginia will implement a remote sensing program throughout the Northern Virginia portion of the Washington nonattainment area. This program will reduce the number of high-emitting vehicles in the Virginia portion of the Washington region by requiring vehicles identified as high emitting to undergo out-of-cycle testing. The program will be fully operational by January 1, 2005.

Source Type Affected

The measure affects Virginia motorists driving through the Virginia portion of the Washington nonattainment area.

Control Strategy

Under this measure, cars emitting in excess of the state emission limit will be identified via a remote sensing program as they drive throughout the region. Owners of high-emitting vehicles will be mailed a notice requiring out-of-cycle testing and repair for the vehicle's emission system. High-emitting Virginia vehicles not registered within the I/M program area but driving through the Washington region on a regular basis will also be required to repair their emissions control systems. This will reduce the number of high-emitting vehicles in the Washington nonattainment area.

Implementation

Virginia – Department of Environmental Quality

Monitoring and Enforcement

VDEQ is in the process of developing a rulemaking that will backstop this program and provide clear penalties for noncompliance.

Projected Reductions and Emission Benefit Calculations

Because of the uncertainty surrounding the amount of creditable reductions available from this program, states are claiming zero credit from this measure. Further information on this program is included in Appendix J.

Regional Wind Power Purchase

Under this measure, local governments in the nonattainment area have committed to purchase a specific number of kilowatt-hours of power per ozone season day from wind turbines instead of from the power plants that would normally supply power to the Metropolitan Washington region. This will decrease power generation from coal, oil, and/or gas-fired sources, reducing NOx emissions from those sources.

Source Type Affected

The measure affects certain local governments within the Metropolitan Washington nonattainment area.

Control Strategy

This measure is envisioned as a region-wide measure encompassing wind power purchases by public citizens, private industry and state and local governments within the Metropolitan Washington non-attainment area. This program is in the early stages of development, and commitments received at this point affect only local jurisdictions and state agencies in the non-attainment area. Local governments have signed long-term commitments with wind power distributors for the purchase of a fixed quantity of power. The purchase of wind energy will displace fossil fuel generated power, thus reducing the NOx emitted from those plants.

Montgomery County, Maryland has drafted a Request for Proposal (RFP) to be released in 2004 to purchase 5% of its total energy usage (28,000,000 kWh/yr.) from wind energy. The RFP will contain:

- A requirement that the wind purchase come from a facility within a sufficient geographic proximity to the Washington Metropolitan area whereby NOx emissions displaced from the wind energy purchase are demonstrated to effect a NOx reduction in the Washington Metropolitan area.
- A 5-year term.
- Reporting requirement indicating actual amount of wind energy in kWh purchased during the ozone season and per year.
- The ability for other local and state jurisdictions to “ride” the contract.

The State of Maryland’s NOx Reduction and Trading Program (see Reference 3) includes a provision that sets aside a portion of the state’s total NOx allowance budget for clean air projects. The state will retire NOx set-aside allowances in an amount commensurate with the size of Montgomery County’s 28,000,000 kWh/year energy purchase to ensure reductions of ozone season emissions allowed under Maryland’s NOx Reduction and Trading Program. The wind energy supplier under the contract would not be eligible to receive any set-aside allowances associated with the county’s energy purchase.

Arlington County has committed to an annual purchase of wind power from the Mountaineer plant located in West Virginia, reducing the amount of fossil-fired generation in the region. As

Virginia DEQ does not have set-aside credits, the credits will not be awarded for purchases in Virginia jurisdictions.

Implementation

Arlington County, Virginia
Montgomery County, Maryland

Montgomery County has drafted an RFP and expects to select an energy supplier in the near future. The RFP includes a purchase of power for Montgomery County, the Maryland National Capital Parks and Planning Commission, and the Washington Suburban Sanitary Commission. Purchases for all three agencies are rolled into the Montgomery County estimate. Arlington County will purchase its power from the Mountaineer facility in West Virginia.

Monitoring and Enforcement

All jurisdictions and agencies participating in wind power purchase program have committed to maintain copies of signed contracts and energy bills to verify the amount of wind energy purchased.

Any variances from the estimated emission reductions will be captured in a retrospective analysis to be conducted during the true-up period. This analysis will examine the emissions in the PJM West and/or other appropriate power grids and verify the emission reductions resulting from dispatch of wind power plants. These retrospective analyses will be based on actual power produced and actual emissions reductions measured during the verification period. These records will be provided to the appropriate state air agency on an annual basis and will be used to provide documentation for the region's March 2007 evaluation report.

Projected Reductions

This program is expected to purchase 30.3 MWh of power annually, reducing 0.05 tpd NOx during the ozone season. Further information on the projected reductions is included in Appendix J.

Emissions Benefits Calculations

Quantification of benefits from the purchase of wind power and other renewable generation is an evolving area. Several methods have been used to calculate the benefits resulting from displacement of fossil fuel generation in the dispatch order. The methodology outlined below was developed by Resource Systems Group, Inc. (RSGI) under contract with Environmental Resources Trust (see Reference 4). It has been used to estimate the number of set-aside credits that should be retired under the wind power purchase program.

The methodology is a so-called "power plant dispatch methodology." In developing estimates of emission reductions resulting from the introduction of additional wind energy onto the grid, the prospective analysis employs the following steps based on renewable plant specifications and

existing plant dispatch scheduling for the past 12 months:

1. Obtain and analyze an estimated schedule of the wind power production for the summer ozone season (by time of day, week, and month) based on actual wind anemometer measurements and actual meteorological data;
2. Obtain a list of the conventional generating units on demand (operating on the margin) from relevant utilities;
3. Verify the list of conventional generating units operating at the margin (on demand) by reference to available hourly Continuous Emission Monitoring (CEM) data; information on capacity factors, and actual generating records, on a sample basis;
4. Determine the demand schedule priority (back-down order) of the conventional generating units based on information from: (a) the relevant electric utilities or the Regional Transmission Organization (or Independent System Operator); (b) actual power plant dispatch ranking data (specific plants dispatched in order of economic cost) and transmission constraint data; (c) recent past generation and continuous emissions monitoring (CEM) data;
5. Obtain and analyze emissions data and generation data for displaced units from CEMs for the relevant time periods during the summer ozone season to calculate emissions per Megawatt-hour (MWh); and
6. Determine net reductions in emissions attributable to wind generation by time period during the summer ozone season.

The methodology developed by ERT is a prospective analysis, based on plants specifications and scheduling in PJM West over a recent 12-month period. This methodology estimates the NOx emissions reduced by dispatching a wind generator to meet baseload power demand instead of the average PJM West baseload generator (a coal-fired plant). The analysis assumes a 5.72 lb NOx/MWh avoided by dispatching the wind plant. This number is the average lb/MWh generated by PJM West baseload plants in 2002. The annual and seasonal wind generation capacity factors of 37% and 20%, respectively, were developed by ERT. In assigning SIP reductions to the wind power portion of the voluntary measure bundle, MDE and Virginia DEQ have chosen to credit 50% of the reductions predicted using the ERT method. The 50% reduction effectively reduces the assumed lb/MWh avoided to 2.9, which is approximately the average emission rate for baseload power generation facilities located in the State of Maryland.

Although the analysis contained in Reference 4 focuses on a proposed wind plant located on Backbone Mountain in Garrett County, Maryland, the analysis is relevant to the region's planned wind purchase even if the location varies slightly. The only current wind farm in the region, the Mountaineer Plant, as well as all of the proposed new wind farms, are located in the Allegheny Mountains, close to the Backbone Mountain area. Therefore, the emission reduction profile of the Mountaineer plant as well as the proposed wind plants is expected to be reasonably similar to the estimates in the analysis prepared with respect to the proposed Garrett County site analyzed in Reference 4.

A summary of the calculation methodology follows.

Definitions:

cf = capacity factor
MW=megawatts
generation reserved = wind turbine power generation capacity that must be available at any given time to meet the power demand under the contract

$$\text{MW generation reserved} = \frac{\frac{kWh}{year}\ \text{purchased}}{37\%\ \text{annual cf} \times 8760\frac{hours}{year} \times 1000\frac{kWh}{MWh}}$$

$$\frac{tons}{day}\text{NOx reduced} = \frac{5.72\frac{lb}{Mwh}\text{generated} \times \text{MWh reserved} \times 20\%\ \text{seasonal cf} \times 24\frac{hours}{day}}{2000\frac{lb}{ton}}$$

To ensure a conservative estimate of benefit from this voluntary measure, purchasing jurisdictions have chosen to credit half of the emission reductions predicted by the RSGI methodology.

$$\frac{tons}{day}\text{NOx credited} = \frac{\frac{tons}{day}\text{NOx reduced}}{2}$$

Because of the geographic proximity of the presumed wind energy generators, the same methodology is applicable to both the Arlington County and Montgomery County wind purchases. The equations shown above were used to quantify the benefits of purchases by both counties.

A copy of the ERT/RSGI report and further documentation of the emissions benefit calculations for this program is included in Appendix J.

Diesel Retrofit Program

Under this program, local governments and transit agencies identify high-emitting, high-mileage diesel vehicles, such as older school buses and transit buses for retrofit. These vehicles are retrofitted using any of a variety of technologies certified under EPA's Voluntary Diesel Retrofit Program. Commonly considered technologies include oxidation catalysts and particulate filters.

Source Type Affected

The measure affects local governments and transit agencies within the Metropolitan Washington nonattainment area.

Control Strategy

This measure is envisioned as a region-wide measure encouraging a variety of school and transit bus operators, trucking companies and construction companies within the Metropolitan Washington non-attainment area to retrofit diesel equipment. This program is in the early stages of development, and commitments received at this point affect only one local jurisdictions in the non-attainment area. This local government has committed to retrofit high-emitting diesel school and transit buses using technologies verified under EPA's Voluntary Diesel Retrofit Program. The vehicles operate exclusively in the Washington region.

Implementation

Fairfax County, Virginia

The Fairfax County Board of Supervisors has already approved reprogramming of the electronic controls on certain school buses and the installation of diesel oxidation catalysts on school buses and other diesel-powered county equipment. The Board approved $2 million as part of the FY 2005 Carryover Budget to begin the diesel retrofit program. In addition, funds of $1.5 million have been made available in Fund 100, County Transit Systems for the retrofit of the Fairfax Connector transit buses with the catalyzed diesel particulate filters. Fairfax County has completed the retrofit of the first AmTran school bus as a prototype. It has a reprogrammed electronic control module and a diesel oxidation catalyst, which together give us a 25% reduction in NOx. A full-scale retrofit program will be in operation by March 2004.

Additional details regarding the types of buses retrofitted are included in Appendix J.

Monitoring and Enforcement

All jurisdictions and agencies participating in the diesel retrofit program have committed to maintain copies of signed contracts and appropriate work orders or invoices to verify the number and type of retrofits installed. The jurisdictions have also pledged to keep records of the mileage traveled by retrofitted buses. These records will be provided to the appropriate state air agency on an annual basis and will be used to provide documentation for the region's March 2007 evaluation report.

Projected Reductions and Emission Benefit Calculations

Because of the uncertainty surrounding the amount of creditable reductions available from this program, states are claiming zero credit from this measure. Further information regarding this program is included in Appendix J.

Alternative Fueled Vehicle (AFV) Purchase Program

Under this program, local governments and transit agencies purchase alternative fueled vehicles instead of conventional gasoline powered vehicles.

Source Type Affected

The measure affects local governments and transit agencies within the Metropolitan Washington nonattainment area.

Control Strategy

This measure is envisioned as a region-wide measure encouraging a variety of fleet owners and operators and private citizens within the Metropolitan Washington non-attainment area to purchase alternative fueled vehicles instead of conventional gasoline vehicles. This program is in the early stages of development, and commitments received at this point affect only local jurisdictions in the non-attainment area. Local governments have committed to purchase hybrid-electric vehicles to replace conventional gasoline-fueled passenger vehicles. These vehicles are being purchased both as part of and external to the normal county vehicle replacement cycle.

Implementation

Fairfax County, Virginia
Montgomery County, Maryland
Prince George's County, Maryland
Maryland National Capital Parks and Planning Commission (M-NCPPC), Prince George's County

In Fairfax County, a small number of the vehicles included in this measure are already on the road. The purchase of additional alternative fueled vehicles by May 2005 is funded through the Department of Vehicle Services vehicle replacement funds for FY2004 and FY2005. The approximate cost differential for the purchase of a hybrid vs. non-hybrid is $6,333. Montgomery County, Prince George's County and M-NCPPC have identified funding for the vehicle purchases and will begin the procurement process shortly.

Monitoring and Enforcement

All jurisdictions and agencies participating in the alternative fueled vehicle program have committed to maintain copies of signed contracts and invoices to verify the number and type of AFVs purchased. The jurisdictions have also pledged to keep records of the mileage traveled by the AFVs. These records will be provided to the appropriate state air agency on an annual basis and will be used to provide documentation for the region's March 2007 evaluation report.

Projected Reductions and Emissions Benefit Calculations

Because of the uncertainty surrounding the amount of creditable reductions available from this program, states are claiming zero credit from this measure. Further information regarding this program is included in Appendix J.

Auxiliary Power Units on Locomotives

Diesel locomotives produce large quantities of NOx and particulate matter. Because it is time consuming to start up and shut down locomotives engines, many locomotive operators leave engines running when the locomotives are not in use. This is especially true of locomotives used in switchyards, which must operate frequently at irregular intervals. As a result, operators often tolerate idling so as to have the switcher ready when needed. This program encourages commuter, freight and commercial passenger railroads to install electric-powered APUs on locomotives operating in the Washington nonattainment area. An APU offers a low emission alternative to constantly idling the locomotive engine.

Source Type Affected

Locomotives operating within the Metropolitan Washington nonattainment area.

Control Strategy

This measure is envisioned as a region-wide measure encouraging a variety of locomotive owners and operators within the Metropolitan Washington non-attainment area to purchase install auxiliary power units to reduce locomotive idling. This program is in the early stages of development, and only one commitment has been received at this point. Virginia Railway Express (VRE), a local commuter railroad, has committed to install 13 auxiliary power units (APUs) on locomotives operating within the Metropolitan Washington region. These APUs are used when locomotives would normally idle in the rail yards, reducing fuel usage and locomotive emissions.

Implementation

Virginia Railway Express

VRE has already completed installation of these units, and the units are functioning properly. VRE has budgeted funds for the electricity charges and for routine maintenance on the units.

Monitoring and Enforcement

VRE has committed to maintain copies of signed contracts and invoices to verify the number and type of APUs purchased. VRE has also pledged to track the average hours the APUs are operated. These records will be provided to the appropriate state air agency on an annual basis and will be used to provide documentation for the region's March 2007 evaluation report.

Projected Reductions

VRE is operating 13 APUs at a projected reduction of 0.1 tpd NOx per year.

Emissions Benefits Calculations

Emission benefits are calculated as follows:

$$\frac{\#\text{ of units} \times \frac{hours}{week}\text{ idling avoided} \times \frac{gal}{hour}\text{ avoided fuel consumption} \times \frac{lb}{gal}\text{ emissions avoided}}{2000\frac{lb}{ton} \times 7\frac{days}{week}} = \text{tpd avoided}$$

Further information on emission benefits resulting from this program is included in Appendix J.

References

1. US EPA, “Guidance on Incorporating Voluntary Mobile Source Emission Reduction Programs in State Implementation Plans,” Memorandum from Richard D. Wilson.

2. EH Pechan, “Control Measure Development Support: Analysis of Ozone Transport Commission Model Rules”, March 31, 2001.

3. State of Maryland, “NOx Reduction and Trading Program: Requirements for New Sources and Set-Aside Pool” COMAR 26.11.29.09.

4. Resource Systems Group, Inc. “Prospective Environmental Report for Clipper Wind Power,” April 2003.

5. US EPA, "New Vehicle Certification Standards", EPA 420-B-00-001, February 2000.

6. US EPA, “2003 EPA Certified Vehicle Test Result Report Data”.

8.0 REASONABLY AVAILABLE CONTROL MEASURE (RACM) ANALYSIS

Section 172(c)(1) of the Clean Air Act requires state implementation plans (SIPs) to include an analysis of reasonably available control measures (RACM). This analysis is designed to ensure that the Washington region is implementing all reasonably available control measures in order to demonstrate attainment with the 1-hour ozone standard on the earliest date possible. This chapter presents a summary of analyses conducted to determine whether the SIP includes all reasonably available control measures. Full details of the analysis are included in Volume II of the Appendix. The Metropolitan Washington Council of Governments (MWCOG) conducted this RACM evaluation in coordination with the District of Columbia Department of Health (DC-DOH), Maryland Department of the Environment (MDE) and the Virginia Department of Environmental Quality (VA DEQ).

8.1 Analysis Overview and Criteria

The RACM requirement is rooted in Section 172(c)(1) of the Clean Air Act, which directs states to "provide for implementation of all reasonably available control measures as expeditiously as practicable". In its 1992 General Preamble for implementation of the 1990 Clean Air Act Amendments (57 FR 13498) EPA explains that it interprets Section 172(c)(1) as a requirement that states incorporate in a SIP all reasonably available control measures that would advance a region's attainment date. However, regions are obligated to adopt only those measures that are reasonably available for implementation in light of local circumstances. In the Preamble, EPA laid out guidelines to help states determine which measures should be considered reasonably available:

If it can be shown that one or more measures are unreasonable because emissions from the sources affected are insignificant (i.e. de minimis), those measures may be excluded from further consideration…the resulting available control measures should then be evaluated for reasonableness, considering their technological feasibility and the cost of control in the area to which the SIP applies…In the case of public sector sources and control measures, this evaluation should consider the impact of the reasonableness of the measures on the municipal or other government entity that must bear the responsibility for their implementation. [See Reference 1]

In its opinion on *Sierra Club v. EPA*, decided July 2, 2002, the U.S. Court of Appeals for the DC Circuit upheld EPA's definition of RACM, including the consideration of economic and technological feasibility, ability to cause substantial widespread and long-term adverse impacts, collective ability of the measures to advance a region's attainment date, and whether an intensive or costly effort will be required to implement the measures. Consistent with EPA guidance and the U.S. District Court's opinion, the region has developed specific criteria for evaluation of potential RACM measures. Individual measures must meet the following criteria:

- Will reduce emissions by the beginning of the Washington region's 2004 ozone season (May 1, 2004)[1]
- Enforceable
- Technically feasible
- Economically feasible (defined as a cost of $10,000-$20,000 per ton or less)
- Would not create substantial or widespread adverse impacts within the region
- Emissions from the source being controlled exceed a de minimis threshold, defined as 0.1 tons per day

In addition, any RACM measures, as a group, must meet the following criteria:

- Measures will enable the region to reduce ozone levels to 124 ppb during the 2004 ozone season
- Measures can be implemented without an intensive or costly effort

An explanation of these criteria is given in succeeding sections.

8.1.1 Implementation Date

EPA has traditionally instructed regions to evaluate RACM measures on their ability to advance the region's attainment date. This means that implementation of a measure or a group of measures must enable the region to reduce ozone levels to the 124 ppb required to attain the one-hour ozone standard at least one year earlier than expected. As the Washington region currently expects to reduce ozone levels to 124 ppb during the 2005 ozone season, any RACM measures must enable the region to meet the 124 ppb standard by May 1, 2004, the beginning of the 2004 ozone season.

8.1.2 Enforceability

When a control measure is added to a SIP, the measure becomes legally binding, as are any specific performance targets associated with the measure. If the state or local government does not have the authority necessary to implement or enforce a measure, the measure is not creditable in the SIP and therefore cannot be declared a RACM. A measure is considered enforceable when all state or local government agencies responsible for funding, implementation and enforcement of the measure have committed in writing to its implementation and enforcement.

In addition to theoretical enforceability, a measure must also be practically enforceable. If a measure cannot practically be enforced because the sources are unidentifiable or cannot be located, or because it is otherwise impossible to ensure that the sources will implement the control measure, the measure cannot be declared a RACM. One exception is voluntary measures, such as those implemented under EPA's Voluntary Mobile Emission Reduction Program (VMEP).

8.1.3 Technological Feasibility

All technology-based control measures must include technologies that have been verified by EPA. The region cannot take SIP credit for technologies that do not produce EPA-verified reductions.

8.1.4 Economic Feasibility and Cost Effectiveness

EPA guidance states that regions should consider both economic feasibility and cost of control when evaluating potential RACM measures. Therefore, the Washington region has specified a cost-effectiveness threshold for all possible RACM measures. Measures for which the cost of compliance exceeds this threshold will not be considered RACM.

In setting this threshold, the region took into consideration two major factors. First, EPA has issued guidance regarding the relationship between RACT and RACM. In its RACM analysis for the Dallas/Forth Worth nonattainment area (see Reference 4), EPA states:

"RACT is defined by EPA as the lowest emission rate achievable considering economic and technical feasibility. RACT level control is generally considered RACM for major sources."

In the Washington region, installation of Reasonably Available Control Technology (RACT) costs approximately $8,000 to $10,000 per ton of emissions reduced. Therefore, it seems reasonable to adopt this cost effectiveness for area, nonroad and mobile sources in addition to stationary. Secondly, the National Capital Region Transportation Planning Board (TPB) frequently adopts Transportation Emissions Reduction Measures (TERMs) to offset mobile emissions for the purpose of conformity. The majority of TERMs adopted by TPB in the past ten years for the express purpose of reducing mobile emissions have cost less than $10,000 per ton.[2]

In order to avoid excluding otherwise worthy measures that slightly exceed the cost effectiveness threshold, the region has specified a threshold of $10,000-$20,000 for cost effectiveness. All measures costing under $20,000 per ton NOx or VOC reduced will be evaluated against the remaining criteria to determine whether they meet the requirements for a RACM measure.

8.1.5 Substantial and Widespread Adverse Impacts

Some candidate RACM measures have the potential to cause substantial and widespread adverse impacts to a particular social group or sector of the economy. Due to environmental justice concerns, measures that cause substantial or widespread adverse impacts will not be considered RACM.

8.1.6 *De Minimis* Threshold

In the General Preamble, EPA allows regions to exclude from the RACM analysis measures that control emissions from insignificant sources and measures that would impose an undue administrative burden (see Section 8.1.7). Under severe area RACT requirements, the smallest major source subject to RACT emits 25 tpy, or approximately 0.1 tpd. Following these requirements and the precedent set by the San Francisco RACM analysis (see Reference 5), the region will not consider control measures affecting source categories that produce less that 0.1 tpd NOx or VOC emissions.

8.1.7 Advancing Achievement of 124 ppb Standard

In order for measures to be collectively declared RACM, implementation of the measures must enable the region to demonstrate one or fewer exceedances of the 124 ppb ozone standard one full ozone season earlier than currently expected. As discussed in Section 8.1.1, the Washington region currently expects to demonstrate one or fewer exceedances in 2005. Therefore, any RACM measures would need to enable the region to meet the 124 ppb standard during the 2004 ozone season.

The attainment modeling described in Chapter 12, which was conditionally approved by EPA on April 17, 2003 as part of a new severe area SIP, shows that the region would not be able to attain the one-hour ozone standard without reduced transport of ozone and ozone precursors from upwind sources.

The problem of regional NOx controls will be addressed when the NOx SIP Call is fully implemented on May 31, 2004. Because there is a variable operating cost associated with operating of many types of pollution control equipment, it is possible that many plants may choose not to operate such equipment outside of the ozone season. Furthermore, because the SIP Call requires plants to meet a seasonal average emission rate rather than a daily average, it is possible that many plants will not have control equipment operating by May 31.

The Washington region has historically experienced exceedances early in the ozone season, including the month of May. The most recent May exceedance took place in 2001. Because it is unclear to what extent the SIP Call will actually be implemented by the beginning of the Washington region's 2004 ozone season, it is impossible to determine how many additional tons the region would need to reduce in order to ensure that exceedances are not registered. Therefore, the region is taking a conservative approach and estimating that any group of measures that would collectively reduce ozone by 1 ppb or more could enable the region to meet the 124 pbb standard one year earlier.

Photochemical modeling performed as part of the Washington region's attainment demonstration concludes that reducing one ton of low-level NOx results in a maximum ozone response of 0.1141 ppb, while reducing one ton of low-level VOC results in a maximum response of 0.0294 ppb. See Chapter 11 for details. Therefore in order to

reduce 1 ppb of ozone, any RACM measures would need to collectively reduce 8.8 tpd NOx or 34.0 tpd VOC.

8.1.8 Intensive and Costly Effort

When considered together, the implementation requirements of any RACM measures cannot be so great as to preclude effective implementation and administration given the budget and staff resources available to the Washington region.

8.2 RACM Measure Analysis

8.2.1 Analysis Methodology

Over the last decade, the Metropolitan Washington Air Quality Committee (MWAQC) has compiled an extensive list of potential control measures. MWCOG has also researched measures used as air quality control strategies in other metropolitan regions. These lists of control measures were compiled into a master list of candidate measures for the RACM analysis. The sources of strategies analyzed for the Metropolitan Washington region include the following:

- Clean Air Act Section 108(f) measures (Transportation Control Measures)
- Transportation Emissions Reduction Measures (TERMs) listed in recent Transportation Improvement Programs (TIPs) for the Metropolitan Washington region
- Measures identified in a 1993 MWAQC review of Air Pollution Control Measures
- Measures considered in Baltimore, Atlanta and Houston RACM analyses

These measures were then evaluated against the criteria discussed in Section 8.1 as documented in Volume II of the Appendix.

8.2.2 Analysis Results

Tables 8-1 through 8-4 provide lists, organized by source sector, of potential measures evaluated against the RACM criteria. The tables show which measures were determined to meet the individual measure criteria described in Sections 8.1.1 through 8.1.6. Those measures meeting the preceding criteria are labeled “Possible”, in the RACM column, while the other measures are labeled “No” and the “Reason” column indicates which criterion the measures failed to meet.

Table 8-5 summarizes those measures meeting the criteria for individual RACM measures. The measures in Table 8-5 were evaluated against the two remaining criteria: ability to reduce the region’s ozone levels to 124 ppb by 2004 and potential for intensive and costly implementation.

Table 8-1: Potential Stationary RACM Measures for the Metropolitan Washington Region

Identifier	Measure Name	Definition	RACM	Reason
P1	NOx Limit For Power Plants	Cap the emission rate from each utility boiler and turbine below NOx SIP Call limits	No	Would not deliver benefits by May 2004
P2	Specific Control Technology For Power Plants	Require all power generators to install specific types of control equipment (i.e. SCR, SNCR, low-NOx burners)	No	Would not deliver benefits by May 2004
P3	Controls on Power Plants Outside Nonattainment Area	Require power plants operating in counties adjacent to Washington nonattainment area to install nonattainment area controls	No	Would not deliver benefits by May 2004
P4	Purchase of Alternative Energy	Commit to purchasing a certain amount of the region's power from sources of laternative energy, such as the wind farms, solar farms or landfill gas generators	No	Unenforceable
P5	OTC Phase II NOx MOU	Require reductions in emissions from regional power plants through the OTC Phase II NOx MOU	No	Would not reduce emissions
W1	Reduced Emissions from Wastewater Systems	Adopt SCAQMD Rule 1176: Sumps and Wastewater Separators	No	No creditable emission reductions
X1	NOx Controls on Commercial Power Generating Equipment	Adopt OTC Additional NOx Controls Rule throughout nonattainment area (applies to industrial boilers, stationary combustion turbines and reciprocating engines, emergency generators, load shavers and cement kilns)	No	Would not deliver benefits by May 2004
X2	Enhanced Rule Compliance at Existing Stationary Sources	Step up enforcement of and compliance with existing rules for emissions control by stationary sources	No	No creditable emission reductions

Table 8-2: Potential Area RACM Measures for the Metropolitan Washington Region

Identifier	Measure Name	Definition	RACM	Reason
A1	Reduce Aircraft Non-Gate Idling	Sign MOUs with airlines to limit idling of aircraft while taxiing	No	Would not deliver benefits by May 2004
A2	Airport Congestion Pricing	Charge higher aircraft landing fees during busy times of day to reduce airport delays and congestion	No	Would not deliver benefits by May 2004
B1	Bakeries	Adopt SCAQMD Rule 1153: Commercial Bakery Ovens	No	Would not deliver benefits by May 2004
C1	Episodic limits on asphalt paving and traffic marking activities	Prohibit road paving and traffic marking on ozone action days	Possible	
C2	Low-Emission Asphalt	Adopt SCAQMD Rules 1108: Cutback Asphalt (less than 0.5% VOC evaporating at 260F) and 1108.1: Emulsified Asphalt (less than 3% VOC evaporating at 260F)	No	De minimis
F1	Low-Emission Water Heaters	Adopt SCAQMD Rule 1121: Control of NOx from Residential Type Natural Gas Fired Water Heaters	No	Would not deliver benefits by May 2004
F2	Low-Emission Furnaces	Adopt SCAQMD Rule 1111: NOx Emissions from Natural Gas Fired, Fan-Type Central Furnaces (no more than 40 nanograms of NOx per joule of useful heat)	No	Would not deliver benefits by May 2004
L1	Control Locomotive Idling	Seek voluntary agreement or implement regulations to reduce idling of locomotives at switchyards through installation of APUs or other methods	Possible	
L2	Retrofit/Repower Locomotives	Provide financial incentives to retrofit or repower locomotives operating in the nonattainment area for cleaner burning diesel or alternative fuels	No	Would not deliver benefits by May 2004
O1	Open Burning	Eliminate open burning in counties adjacent to nonattainment area	No	Would not deliver benefits by May 2004
P1	Reduced Emissions from Petroleum Storage Tanks	Adopt SCAQMD Rule 1178: Further Reductions of VOC Emissions from Storage Tanks at Petroleum Facilities	No	Would not deliver benefits by May 2004
X1	Implement OTC Beyond Nonattainment Area	Take credit for reductions due to implementation of OTC measures beyond nonattainment area	No	No creditable emission reductions
X2	Episodic controls on pesticide application	Prohibit application of pesticides on forecasted ozone exceedance days	No	Substantial adverse impacts
X3	Enhanced enforcement	Enhance enforcement of existing area source regulations	No	Would not deliver benefits by May 2004
X4	Implement VOC RACT Beyond Nonattainment Area	Take credit for reductions due to implementation of VOC RACT rules beyond nonattainment area	No	No creditable emission reductions
X5	Implement NOx RACT Beyond Nonattainment Area	Take credit for reductions due to implementation of NOx RACT rules beyond nonattainment area	No	No creditable emission reductions

Table 8-3: Potential Nonroad RACM Measures for the Metropolitan Washington Region

Identifier	Measure Name	Definition	RACM	Reason
A1	Agricultural equipment use restrictions	Mandatory restrictions on use of agricultural equipment during Code Red Ozone Action Days	No	Would not deliver benefits by May 2004
A2	Agricultural equipment retrofits	Require agricultural equipment to be retrofitted with emissions controls	No	Would not deliver benefits by May 2004
A3	Require low-NOx fuel for agricultural equipment	Require agricultural equipment to use low-NOx fuel during ozone season	No	No creditable emission reductions
A4	Low-emissions agricultural equipment	Require sale of low-emissions agricultural equipment in region	No	Would not deliver benefits by May 2004
C1	Construction equipment use restrictions	Restrict use of construction equipment during expected ozone exceedance days	No	Not economically feasible
C2	Construction retrofits	Require construction equipment operating on state and local contracts to be retrofitted with particulate fitlers and/or oxidation catalysts	No	Not economically feasible
C3	Require low-NOx fuel for construction equipment	Require construction equipment operating on state of local contracts to use low-NOx fuel during ozone season	No	No creditable emission reductions
C4	Idling restrictions for construction equipment	Limit idling by construction equipment	No	Would not deliver benefits by May 2004
C5	Low-emissions construction equipment	Require sale of low-emissions construction equipment in region	No	Would not deliver benefits by May 2004
C6	Preference for low-emissions construction equipment	In bids for government construction contracts, award extra points to bidders using low-emission construction equipment	No	Not economically feasible
G1	Episodic restrictions on lawn & garden equipment	Restrict use of lawn and garden equipment during expected ozone exceedance days	No	Would not deliver benefits by May 2004
G2	Lawn & garden equipment retrofits	Require commercial gas-powered lawn & garden equipment to be retrofitted with emissions controls or low emission engines	No	Would not deliver benefits by May 2004
G3	Require low-NOx fuel for lawn & garden equipment	Require lawn & garden equipment to use low-NOx fuel during ozone season	No	No creditable emission reductions
G4	Idling restrictions for lawn & garden equipment	Limit idling by commercial lawn & garden equipment	No	No creditable emission reductions
G5	Low emissions lawn & garden equipment	Adopt EPA lawn & garden equipment rules before they become effective in 2007	No	Would not deliver benefits by May 2004
G6	Preference for low-emissions lawn & garden equipment	In bids for government contracts, award extra points to bidders using low-emission lawn & garden equipment	Possible	

Identifier	Measure Name	Definition	RACM	Reason
G7	"Cash for Clunkers" lawn & garden program	Offer $75 for owners to turn in old, 2 and 4-stroke lawn & garden equipment and purchase electric or push mower	No	Not economically feasible
I1	Episodic restrictions on use of industrial equipment	Moratorium on use of industrial equipment during Code Red Ozone Action Days	No	Would not deliver benefits by May 2004
I2	Industrial equipment retrofits	Require industrial equipment to be retrofitted with emissions controls	No	Would not deliver benefits by May 2004
I3	Require low-NOx fuel for industrial equipment	Require industrial equipment to use low-NOx fuel during ozone season	No	No creditable emission reductions
I4	Idling restrictions for industrial equipment	Limit idling by industrial equipment	No	No creditable emission reductions
I5	Low-emissions industrial equipment	Require sale of low-emissions industrial equipment in region	No	Would not deliver benefits by May 2004
I6	Industrial equipment replacement	Subsidize replacement of fossil-fuel fired industrial equipment with electric industrial equipment	No	Would not deliver benefits by May 2004
I7	Preference for low-emissions industrial equipment	In bids for government contracts, award extra points to bidders using low-emission industrial equipment	No	Not economically feasible
M1	"Cash for Clunkers" outboard motor program	Offer small cash reward for owners to turn in old, high-emission outboard motors	No	Not economically feasible
M2	Idling restrictions for recreational marine equipment	Limit idling by recreational marine equipment during ozone season	No	Would not deliver benefits by May 2004
M3	Recreational marine equipment use restrictions	Moratorium on use of recreational marine equipment on Code Red Ozone Action Days	No	Would not deliver benefits by May 2004
M4	Require low-NOx fuel for recreational marine equipment	Require diesel-fired recreational marine equipment to use low-NOx fuel during ozone season	No	No creditable emission reductions
M5	Graduated registration fees for recreational boats	Levee additional registration fee for registration of boats with old, high-emission engines	No	Would not deliver benefits by May 2004
R1	Episodic restrictions on recreational equipment use	Restrict use of recreational equipment during expected ozone exceedance days	No	Would not deliver benefits by May 2004
R2	"Cash for Clunkers" recreational equipment program	Offer small cash reward for owners to turn in old, high-emission recreational equipment	No	Not economically feasible
R3	Require low-NOx fuel for recreational equipment	Require recreational equipment to use low-NOx fuel during ozone season	No	No creditable emission reductions
R4	Recreational equipment retrofits	Require recreational equipment to be retrofitted with particulate fitlers and/or oxidation catalysts	No	No creditable emission reductions
S1	Subsidize electric airport ground service equipment (GSE)	Subsidize, through direct contributions or tax breaks, installation of electric ground service equipment and/or charging stations at regional airports	No	Would not deliver benefits by May 2004
S2	Require low-NOx fuel for airport GSE	Require airport GSE to use low-NOx fuel during ozone season	No	No creditable emission reductions

Identifier	Measure Name	Definition	RACM	Reason
S3	Airport GSE retrofits	Subsidize the retrofit of airport GSE with emissions control equipment	No	Would not deliver benefits by May 2004
S4	Reduce idling by airport GSE	Develop voluntary program to encourage operators to limit idling of airport GSE	Possible	
S5	Control aircraft auxiliary power units	Seek voluntary agreement to reduce use of aircraft APUs through use of gate-provided services or other strategies	No	Not economically feasible
T1	Light commercial equipment use restrictions	Restrict use of light commercial equipment during expected ozone exceedance days	No	Would not deliver benefits by May 2004
T2	Light commercial equipment retrofits	Require light commercial equipment to be retrofitted with emissions controls	No	Would not deliver benefits by May 2004
T3	Require low-NOx fuel for light commercial equipment	Require light commercial equipment to use low-NOx fuel during ozone season, if applicable	No	No creditable emission reductions
T4	Idling restrictions for light commercial equipment	Limit idling by light commercial equipment	No	No creditable emission reductions
T5	Low-emissions light commercial equipment	Require sale of low-emissions light commercial equipment in region	No	Would not deliver benefits by May 2004
T6	Preference for low-emission light commercial equipment	In bids for government contracts, award extra points to bidders using low-emission light commercial equipment	No	Not economically feasible
X1	EPA Tier II Emissions Standards for Large SI Engines	Adopt EPA Tier II standards before they become effective in 2007	No	Would not deliver benefits by May 2004
X2	Biodiesel for Off-Road Equipment	Require all off-road diesel equipment to burn biodiesel during ozone season	No	Not technologically feasible

Table 8-4: Potential Mobile RACM Measures for the Metropolitan Washington Region

Identifier	Measure Name	Definition	RACM	Reason
A1	Bose Anti-Air Pollutant and Energy Conservation System	Fund trial of Bose system in local vehicle fleets. The Bose system is a mechanical system that uses high-speed centrifugal separation to remove light combustible gases from the exhaust stream. The system can be used with all types of fuel.	No	Not technologically feasible
A2	W15-590 Diesel Fuel Additive	Fund trial of the fuel additive W15-590 to reduce NOX emissions. The additive can be mixed with the fuel before or after delivery from the distribution center.	No	Not technologically feasible
A3	CNG Buses Instead of New Diesel	Purchase additional CNG buses for local transit authorities instead of normally scheduled replacement diesel bus purchases. This would also require expanded CNG fueling and maintenance facilities.	No	Not economically feasible
A4	State & Local Fleet Replacement	Replace public sector gasoline-fueled automobile fleet with hybrid vehicles (i.e. Toyota Prius)	No	Not economically feasible
A5	CNG Fueling Stations for DC Metro Region	Build new modular CNG fueling stations	No	Not economically feasible
A6	Fleet ILEV for light-duty gasoline vehicles	Require fleets operating in nonattainment area to be comprised of a percentage of ILEV vehicles	No	Would not deliver benefits by May 2004
A7	International Green Diesel Retrofit	Fit 500 transit buses running on ultra low sulfur diesel with a quad-catalytic filter	No	Not economically feasible
A8	ZEV program	Adopt California ZEV program	No	Would not deliver benefits by May 2004
A9	Expand WMATA Fleet with Hybrid-Electric Buses	Purchase hybrid electric buses instead of clean diesel as part of WMATA fleet expansion	No	Would not deliver benefits by May 2004
A10	CNG Rental Cars	Purchase CNG rental cars for use in the region	No	Not economically feasible

Identifier	Measure Name	Definition	RACM	Reason
A11	CNG Refuse Haulers	Purchase new CNG powered trash trucks instead of conventional diesel vehicles	No	Would not deliver benefits by May 2004
A12	CNG Taxicabs	Replace regional taxicabs 7 years or older with CNG or other alternative fuel vehicles	No	Not economically feasible
B1	Bike Lockers at Metro Stations, Park & Ride Lots, Other Locations	Expand existing bike lockers at Metrorail stations, install bicycle storage spaces in parking lots	No	Not economically feasible
B2	Bike Racks on Transit Buses	Provide external bike racks on WMATA and other local transit buses	No	Not economically feasible
B3	Improvements to Bicycle and Pedestrian Access	Provide incentives to developments that speed improvements to bicycle/pedestrian access. This includes improvements to sidewalks, curb ramps, crosswalks, lighting, etc.	No	Not economically feasible
B4	Employers Provide Free Bicycles for Midday Use	Require employers to provide one bicycle per 50 employees for mid-day business or personal use.	No	Would not deliver benefits by May 2004
B5	Bike/Pedestrian Paths	Fund construction of additional bicycle/pedestrian paths in the region	No	Not economically feasible
B6	Bicycle Racks in DC	Install bicycle racks at various locations throughout the region	Possible	
E1	4 Day Work Week/Flexible Work Schedules	Encourage employers to adopt a shorter work week, with employees working 4 10-hour days	No	Would not deliver benefits by May 2004
E2	Build Park & Ride Lots at Major Intersections of Commuter Highways	Construct new park & ride commuter lots along HOV facilities	No	Would not deliver benefits by May 2004
E3	Telecommuting Centers	Telecommuting centers, including marketing activity, consultant support, commuter and employer information and assistance	Possible	
E4	Commuter Operations Center	Provides commuter assistance services, including carpool and vanpool ridematching	No	Not economically feasible

Identifier	Measure Name	Definition	RACM	Reason
E5	Vanpool Programs	Create programs and incentives designed to increase the number of vanpools in the region.	No	Not economically feasible
E6	Express Buses From Outyling Areas	Implement direct bus service from outlying Park & Ride lots and far suburbs to major work centers	No	Would not deliver benefits by May 2004
E7	New Surface Parking at Transit Centers	Add new parking spaces at transit centers (bus, Metrorail, MARC) parking lots	No	Not economically feasible
E8	Express Reverse Commuter Buses	Implement reverse commute express buses from the District to major outlying work centers	No	Would not deliver benefits by May 2004
E9	Free Reserved Carpool/Vanpool Spaces	Provide free reserved parking spaces for all carpools or vanpools	No	Would not deliver benefits by May 2004
E10	Government Actions (ozone action day similar to snow day)	Implement a liberal leave policy for local, state and federal employees on Code Red Ozone Action Days, permitting employees to work from home or take unscheduled leave	Possible	
E11	Guaranteed Ride Home	Provides free rides home in event of unexpected emergency or unscheduled overtime to commuters using public transport	No	Not economically feasible
E12	Integrated Rideshare	Provides transit, park & ride, and telecenter information to all commuters on a matchlist	Possible	
E13	Mandatory Employee Commute Reduction	Mandatory employer trip reduction to reduce trips by regional average of 20%	No	Would not deliver benefits by May 2004
E14	Student & staff based college & university rideshare programs	Create rideshare program focused on students and staff at regional universities	No	Would not deliver benefits by May 2004
E15	Vanpool Insurance	Establish a special risk pool to underwrite the cost of vanpool insurance	No	Would not deliver benefits by May 2004

Identifier	Measure Name	Definition	RACM	Reason
E16	Ban Vehicles from Downtown Streets	Restrict private vehicle use in certain downtown areas during business hours, encouraging pedestrian and bicycle use instead.	No	Would not deliver benefits by May 2004
F1	Expand HOV Network on the Freeway System	Construct additional HOV lanes on regional freeways, for example I-95 and I-695	No	Would not deliver benefits by May 2004
F2	Extend Ramp Metering	Install signals to control flow of vehicles at selected freeway ramp entrances to maintain level of service	No	Would not deliver benefits by May 2004
F3	Permit Right Turn on Red	Reduce vehicle idling time by permitting right turn on red, where safety allows	Possible	
F4	Replace Traffic Signals with Lesser Controls	Install roundabouts in place of signalized intersections	No	Would not deliver benefits by May 2004
F5	Signals to Flashing Yellow 12am-5am	From midnight until 5am, set intersection signals to flashing yellow in predominant direction and flashing red in minor direction for all low volume intersections where safety permits	No	Would not deliver benefits by May 2004
F6	Speed Limit Adherance	Increase speed limit enforcement on portions of the freeway system where speeding is a problem so that more vehicles are traveling at or below the posted limit	No	Would not deliver benefits by May 2004
F7	Regional Traveler Information/Assistance Systems	Regional traveler information/assistance systems to facilitate efficient traffic management during incidents and accidents.	No	Not economically feasible
L1	Smart Growth and Infill Development Programs	Encourage development/redevelopment of land in designated growth areas, encouraging local governments to place greater emphasis on land development near transit stations	No	Would not deliver benefits by May 2004
L2	Convenience Commercial Centers in Residential Areas	Change zoning ordinances to allow neigborhood-serving retail establishments in residential areas	No	Would not deliver benefits by May 2004

Identifier	Measure Name	Definition	RACM	Reason
L3	Proximity Commuting (Live Near Your Work)	Provides financial incentives to homebuyers moving to designated neighborhoods near their workplaces	No	Would not deliver benefits by May 2004
L4	Incentives for Mixed Use at Transit Centers	Include incentives for mixed-use development at transit centers to reduce sprawl and VMT	No	Would not deliver benefits by May 2004
M1	Parking Impact Fee	Levy a $250 annual fee on every commuter parking space in the Washington nonattainment area	No	Would not deliver benefits by May 2004
M2	Annual Gasoline Vehicle Pollution Fee	Levy an annual fee on petroleum-powered vehicles based on mileage driven and emission rates.	No	Would not deliver benefits by May 2004
M3	Cash for Clunkers	Purchase pre-1980 vehicles with minimal/no emissions controls	No	Would not deliver benefits by May 2004
M4	Commuter Choice Tax Credit	Employers subsidize employees' monthly transit or vanpool costs and receive a tax credit for incurred expenses.	No	Not economically feasible
M5	Congestion Pricing on Low Occupancy Vehicles	Impose a fee on vehicles containing two or fewer persons that use designated roadways during the peak AM period	No	Would not deliver benefits by May 2004
M6	Gas Tax Increase	Increase state and local gas taxes to add 10% to purchase price of gasoline. Use proceeds to fund regional transit operations.	No	Would not deliver benefits by May 2004
M7	Graduated Vehicle Registration Fee Based on Number of Vehicles	Assess graduated vehicle registration fee/car tax on every privately owned vehicle in the region. Households with multiple vehicles pay higher tax on each additional vehicle	No	Would not deliver benefits by May 2004
M8	Market Based Parking Charges at Federal Facilities	Require all federal work sites to charge the equivalent of commercial parking rates.	No	Would not deliver benefits by May 2004

Identifier	Measure Name	Definition	RACM	Reason
M9	Commuter Choice - State & Local Government Employees	Provide the region's local, state and municipal employees with transit benefits	No	Not economically feasible
M10	Pay-as-you-drive auto insurance ($/gal)	Offer auto insurance rates linked to number of gallons of fuel consumed by vehicle	No	Would not deliver benefits by May 2004
M11	VMT Tax (2 cents/mile)	Charge VMT tax of $0.02 per mile for all vehicles registered or garaged in the region	No	Would not deliver benefits by May 2004
M12	Voluntary Employer Parking Cash-Out Subsidy	Employers who provide free parking would be encouraged to provide the cash equivalent of the parking subsidy to employees who do not drive to work.	No	Would not deliver benefits by May 2004
M13	Half Price Fares on Feeder Bus Service	All metro bus and local bus services to Metrorail and commuter rail stations reduce fares by half.	No	Would not deliver benefits by May 2004
M14	Free Parking for Carpools	All employers must provide free parking spaces for all carpools or vanpools.	No	Would not deliver benefits by May 2004
M15	Tax Parking Spaces Above Code Minimum	Discourage developers from providing parking in excess of code minimum by imposing a graduated tax on excess spaces.	No	Would not deliver benefits by May 2004
M16	Reduce Parking Fees at Facilities Outside the Beltway Adjacent to Metro	Reduce parking fees at Metro parking facilities or county/city managed facilities outside of the Beltway that are located near Metro stations.	No	Would not deliver benefits by May 2004
O1	Bike to Work Day	Conduct a one-day bike to work event. Provide outreach activities, education on the bike-to-work option, and assistance in trying bike-to-work	No	Will not reduce emissions
O2	Clean Air Partners Program	This program motivates individuals to take voluntary actions to reduce emissions on Ozone Action Days	No	Not economically feasible
O3	Clean Commute/Try Transit Week	Promotes use of alternative transportation, including transit, by daily commuters for one week per year	No	Will not reduce emissions

Identifier	Measure Name	Definition	RACM	Reason
O4	Employer Outreach (Private Sector)	Provide regional outreach to encourage large private-sector employers to voluntarily implement alternative commute strategies to reduce vehicle trips to work sites	Possible	
O5	Employer Outreach (Public Sector)	Provide regional outreach to encourage public-sector employers to voluntarily implement alternative commute strategies to reduce vehicle trips to work sites	No	Not economically feasible
O6	Mass Marketing Campaign	6 year marketing effort involving business-to-business advertising campaign in print media and on world wide web. Aims to increase transit, ridesharing and other travel demand management programs	Possible	
P1	Control Parking at Schools	Restrict high school students from driving to and parking at high schools when bus service is available.	No	Would not deliver benefits by May 2004
P2	Restrict Construction of New Parking	Restrict construction of new parking at employment centers based on distance from transit and urban core	No	Would not deliver benefits by May 2004
T1	Transit Prioritization -- Queue Jumps	Provide queue jumps for buses at over-capacity signalized intersections throughout the region. Queue jumps allow buses to use a shoulder or other designated lane to bypass intersection queues and move forward towards the stop line.	Possible	
T2	Flat Fare For All Transit Trips	Single price all public transit services with a flat $1.10 fare and free transfers all day, 7 days per week	No	Would not deliver benefits by May 2004
T3	Access to Jobs Program	Identifies gaps in transit service between places of residence and places of work for low wage workers	No	Would not deliver benefits by May 2004
T4	Automatic Vehicle Locator System	System would provide bus location information to WMATA dispatchers. This would decrease wait time and improve on-time arrival/departure.	No	Would not deliver benefits by May 2004
T5	College 33 Pass System	Expand Baltimore college bus fare program to DC area. Program allows students to receive reduced fares near 19 participating schools in the region.	No	Would not deliver benefits by May 2004
T6	Expand Peak Period Metrorail Service	Extend peak-period service on Metrorail so trains run at 6 minute frequency from 6-11 am and 3-8 pm.	No	Would not deliver benefits by May 2004

Identifier	Measure Name	Definition	RACM	Reason
T7	Free Bus Service Off-Peak	Institute free off-peak bus service from 10-2 on weekdays and all day on weekends.	No	Would not deliver benefits by May 2004
T8	Free bus-to-rail / rail-to-bus transfers	Institute free bus-to-rail transfer similar to free rail-to-bus transfer currently in place.	No	Would not deliver benefits by May 2004
T9	Free Rail Use 10-3	Free Metrorail trips for all riders from 10AM-3PM on weekdays	No	Would not deliver benefits by May 2004
T10	Free Transit Passes to Students	Free transit passes for high school and college students, subsidized by schools or through student registration fee	No	Would not deliver benefits by May 2004
T11	Increase Commuter Rail Frequency	Increase frequency of MARC service to every 15 minutes on Penn and Camden lines and every 10 min on the Brunswich line. Increase VRE frequency to every 15 minutes	No	Would not deliver benefits by May 2004
T12	Interactive Rideshare Kiosks	Transportation Information Kiosks in Maryland, Virginia and the District of Columbia	No	Not economically feasible
T13	New MARC Coaches	Purchase additional coaches for MARC to accommodate increased ridership	No	Would not deliver benefits by May 2004
T14	Employer Metro Shuttle Bus Services	Provide incentives for businesses to provide employee shuttle service to the nearest rail or transit stop	No	Not economically feasible
T15	Metrorail Feeder Bus Service & Fare Buydown	Improve Metrorail feeder bus service at underutilized park & ride lots, implement fare buydown program	No	Not economically feasible
T16	Mobile Commuter Stores	Fund mobile commuter stores in suburban commercial areas	No	Not economically feasible

Identifier	Measure Name	Definition	RACM	Reason
T17	Real-Time Bus Schedule Information	Expand trials of real-time bus schedule information to local transit providers	No	Would not deliver benefits by May 2004
T18	Discount Multi-Trip Bus Fares	Introduce discount programs reducing cost of multiple bus rides through purchase of pass books (e.g. 10-trip tickets)	No	Not economically feasible
T19	Shorter Distance from Buildings to Bus Stops	For existing buildings, re-route traffic to allow buses to come closer to the building. For new buildings, alter setback requirements to allow closer bus access	No	Would not deliver benefits by May 2004
T20	Additional Transit Stores	Establish additional stationary transit stores in the region	No	Would not deliver benefits by May 2004
T21	Universal Transportation Access (MD + WMATA)	SmarTrip card will allow users to pay fares on all rail and bus systems in the region (including parking in Metrorail lots) using one electronic card	No	Not economically feasible
T22	Expand VRE Train Service	Expand VRE train service to include additional departures	No	Would not deliver benefits by May 2004
T23	WMATA Bus Information Displays with Maps	Install additional information boxes with maps and schedule information. Would include schedules in languages other than English in neighborhoods where most residents speak another language	No	Would not deliver benefits by May 2004
T24	Regional bus service expansion	Expansion of Metrobus and other regional bus services.	No	Not economically feasible
T25	Rush Hour Shift	Shift Metrorail AM and PM rush hours to start 30 min earlier and end 30 min earlier	No	Would not deliver benefits by May 2004
U1	Trip reduction ordinances	Prohibit drivers from traveling during certain periods, based on vehicle tags or other easily identifiable criteria. Can be a permanent or episodic control.	No	Widespread and adverse impacts

Identifier	Measure Name	Definition	RACM	Reason
V1	Control Extended Idling of Buses and Trucks	Step-up enforcement of existing regulations to prevent extended vehicle idling	No	Would not deliver benefits by May 2004
V2	High cetane diesel fuel for onroad vehicles	Require onroad diesel vehicles to use high cetane fuel	No	Would not deliver benefits by May 2004
V3	Light-duty and/or heavy-duty diesel I/M	Develop I/M program for light-duty and/or heavy-duty diesel vehicles	No	Would not deliver benefits by May 2004
V4	Remove Trash Trucks From Area Streets	Reduce use of trash trucks through transport of trash by barge	No	Would not deliver benefits by May 2004
V5	Early Bus Engine Replacement	Replaces high-polluting diesel engines in WMATA buses with new diesel engines	No	Not economically feasible
V6	Taxicab Replacement - Conventional Vehicles	Replace taxicabs with new "conventional" LDGVs	No	Would not deliver benefits by May 2004
V7	Zero I/M waivers and exemptions	Eliminate all waivers and exemptions in the I/M program	No	Would not deliver benefits by May 2004
V8	Car Sharing Program	Fund incentives for new car sharing customers (I.e. Flexcar or Zipcar services)	No	Not economically feasible
W1	CARB Diesel Fuel (On-Road)	Implement CARB diesel fuel standards	No	Would not deliver benefits by May 2004
W2	Biodiesel (On-Road)	Require regional use of biodiesel fuel for on-road vehicles	No	Not economically feasible

Identifier	Measure Name	Definition	RACM	Reason
W3	Low-NOx Diesel Fuel (On-Road)	Require regional use of low-NOx fuel for on-road diesel vehicles	No	Not economically feasible
X1	Telecourses at Local Colleges and Universities	Encourage local colleges and universities to offer telecourses. This would reduce vehicle trips.	No	Would not deliver benefits by May 2004
X2	ATM Machines Installed at Metro Stations	Install ATMs near metro stations for rider convenience	No	Unenforceable

Table 8-5: Potential RACM Measures From All Source Sectors Meeting Criteria Described in Sections 8.1.1-8.1.6

Source Sector	Measure Number	Measure Name	Measure Description	NOx (tpd) [3]	VOC (tpd) [2]
Area	C1	Episodic limits on asphalt paving and traffic marking activities	Prohibit road paving and traffic marking on ozone action days	N/A	2.91
Area	L1	Control Locomotive Idling	Seek voluntary agreement or implement regulations to reduce idling of locomotives at switchyards through installation of APUs or other methods	0.01	0.01
Non-Road	G6	Preference for low-emissions lawn and garden equipment	In bids for government contracts, award extra points to bidders using low-emission lawn & garden equipment	N/A	0.13
Non-Rroad	S4	Reduce idling by airport GSE	Develop voluntary program to encourage operators to limit idling of airport GSE	0.17	0.04
On-Road	B6	Install Bicycle Racks	Install bicycle racks at various locations throughout the region	0.00	0.00
On-Road	E3	Telecommuting Centers	Telecommuting centers, including marketing activity, commuter and employer information and assistance	0.26	0.14
On-Road	E10	Government Actions (ozone action day similar to snow day)	Implement a liberal leave policy for local, state and federal employees on Code Red Ozone Action Days, permitting employees to work from home or take unscheduled leave	1.58	0.94
On-Road	E12	Integrated Rideshare	Provides transit, park & ride, and telecenter information to all commuters on a matchlist	0.11	0.06
On-Road	F3	Permit Right Turn on Red	Reduce vehicle idling time by permitting right turn on red, where safety allows	0.07	0.14
On-Road	O4	Employer Outreach (Private Sector)	Provide regional outreach to encourage large private-sector employers to voluntarily implement alternative commute strategies to reduce vehicle trips to work sites	1.07	0.63
On-Road	O6	Mass Marketing Campaign	Marketing effort involving business-to-business advertising campaign in print media and on world wide web to increase transit, ridesharing and other travel demand management programs.	0.15	0.09

	Measure Number	Measure Name	Measure Description	NOx (tpd) [3]	VOC (tpd) [2]
On-Road	T1	Transit Prioritization – Queue Jumps	Provide queue jumps for buses at over-capacity signalized intersections throughout the region. Queue jumps allow buses to use a shoulder or other designated lane to bypass intersection queues and move forward towards the stop line.	0.01	0.01
TOTAL				3.4	5.1
THRESHOLD FOR RACM (from Section 8.1.7)				8.8	34.0

8.3 RACM Determination

If implemented collectively, the measures included in Table 8-5 would reduce 5.1 tpd VOC and 3.4 tpd NOx. This does not meet or exceed the 34.0 tpd VOC or 8.8 tpd NOx required to reduce regional ozone levels to 124 ppb by May 1, 2004. Therefore there are no reasonably available control measures (RACM) appropriate for the Washington region's severe area SIP.

Though the measures listed in Tables 8-1 through 8-4 did not meet the criteria for RACM, many of the measures are worthwhile measures that effectively reduce emissions. These measures will continue to be considered for future SIPs prepared for the Washington region.

References

US EPA, "State Implementation Plans; General Preamble for the Implementation of Title I of the Clean Air Act Amendments of 1990", (57 FR 13498), April 16, 1992.

US EPA Region VI, "Reasonably Available Control Measures (RACM) Analysis for the Dallas/Fort Worth Ozone Nonattainment Area", December 2000.

Bay Area Air Quality Management District, Metropolitan Transportation Commission and Association of Bay Area Governments, "Bay Area 2001 Ozone Attainment Plan," October 24, 2001, Appendix C.

[1] See discussion in "Approval and Promulgation of Air Quality Implementation Plans; District of Columbia, Maryland, Virginia; Post 1996 Rate-of-Progress Plans and One-Hour Ozone Attainment Demonstrations; Final Rule (April 17, 2003, 68 FR 19106).

[2] Though several expensive TERMS have been adopted in recent years, these measures were designed for congestion mitigation or other transportation purposes. Emission reductions were credited as an ancillary benefit, and the projects would have proceeded even if no emission credits were generated.

[3] Benefits shown as zero were rounded to zero, as the relevant control measure produced benefits of less than 0.005 tpd VOC or NOx.

9.0 MOBILE SOURCE CONFORMITY

In order to balance growing metropolitan regions and expanding transportation systems with improving air quality, EPA established regulations ensuring that enhancements to existing transportation networks will not impair progress towards air quality goals. Under the Clean Air Act Conformity Regulations, transportation modifications in an ozone or carbon monoxide nonattainment area must not impair progress made in air quality improvements. These regulations, published in EPA's Transportation Conformity rule on November 24, 1993 in the Federal Register and amended in a final rule signed on July 31, 1997, require that transportation modifications "conform" with air quality planning goals established in air quality SIP documents.
To be found in "conformity" with air quality plans before the attainment plan is approved by EPA, the VOC, NOx, and carbon monoxide emissions generated by mobile sources when a transportation plan is implemented must meet certain emission tests:

- When a mobile source emissions budget SIP has been submitted and found adequate, mobile source emissions must not exceed the mobile emissions budget established in the SIP;
- In areas without a mobile source emissions budget, mobile source emissions must be less than mobile source emissions in 1990 and projected emissions with the improvements included in the transportation plan (action scenario) must be less than projected emissions without the improvements (base scenario).

9.1 Mobile Emissions Budget and the Washington Area Transportation Conformity Process

Mobile source emissions in the Constrained Long Range Plan (CLRP) and six-year Transportation Improvement Program (TIP) cannot exceed the mobile emissions budget. The transportation plans are required to conform to the mobile budget established in the SIP for the short-term TIP years, as well as for the forecast period of the long-range plan, which must be at least twenty years.

In the metropolitan Washington area, modifications to the existing transportation network are advanced through the Transportation Planning Board (TPB) by state, regional and local transportation agencies through periodic updates to the CLRP and TIP. The TIP is updated annually for the metropolitan Washington area and includes transportation modifications and improvements on a six-year program cycle. Pursuant to the conformity regulations, the CLRP and TIP must contain analyses of the motor vehicle emissions estimates for the region resulting from the transportation improvements. These analyses must show that the transportation improvements in the TIP and the plan do not result in a deterioration of air quality goals established in the SIP.

9.2 Budget Level for On-Road Mobile Source Emissions

As part of the development of the SIP, MWAQC, in consultation with the Transportation Planning Board (TPB), establishes a mobile source emissions budget. This budget will be the benchmark used to determine if the region's constrained long range transportation plan (CLRP) and six year transportation improvements program (TIP) conform with the Clean Air Act Amendments of 1990. Under EPA regulations the projected mobile source emissions for 2005 becomes the mobile emissions budget for the region unless MWAQC takes actions to set another budget level.

The 2005 mobile emissions inventory reflects the most recent models available, EPA's MOBILE6 and the Travel Demand Model Version 2.1C, used by COG's Transportation Planning Department, and the most recent data available, namely 2002 vehicle registration data. The methodology used to project the 2005 attainment year mobile inventory and to recalculate mobile inventories for milestone years is discussed in detail in Section 3.2.3 and Section 4.1.3.

The mobile emissions budget for attainment and the 2005 Rate-of-Progress is based on the projected 2005 mobile source emissions accounting for all the mobile control measures, including Transportation Control Measures and projected regional growth.

The Mobile Emissions Budget for attainment and the 2005 Rate-of-Progress, based upon the projected 2005 mobile source emissions accounting for all the mobile control measures, including the Transportation Control Measures:

VOC = 97.4 tons/day NOx = 234.7 tons/day

The mobile emissions budget for the 2002 Rate-of-Progress is based on the projected 2002 mobile source emissions accounting for all the mobile control measures, including Transportation Control Measures. The mobile emissions budget for the 2002 Rate-of-Progress is 125.2 tons/day VOC and 290.3 tons/day NOx.

9.3 Transportation Control Measures (TCMs)

Each time the Constrained Long Range Transportation Plan (CLRP) or the six-year Transportation Improvement Plan (TIP) is amended, the TPB will estimate the emissions from the regional transportation network and compare the expected emissions against the mobile emissions budget set in this SIP. This determination will take into account the projects included in the region's transportation plans and the TCMs shown in Table A, which amount to 0.3 tpd VOC and 0.5 tpd NOx in 2002 and 0.3 tpd VOC and 0.7 tpd NOx in 2005. Further information on TCMs can be found in Section 7.5 and in Appendix G.

In anticipation of possible mobile emissions mitigation needs associated with TPB plans and

programs, the TPB Technical Committee Travel Management Subcommittee has analyzed a wide range of transportation emissions reduction measures (TERMs). Emission reduction strategies for conformity purposes are identified on an as-needed basis during the development of the TIP and CLRP.

9.4 Trends in Mobile Emissions

The mobile emissions budgets for 2005 for Volatile Organic Compounds (VOCs) and Nitrogen Oxides (NOx) reflect a continuation of a downward trend in mobile emissions over time. The VOC and NOx emission levels for mobile sources provided in Section 9.2 reflect declines of 22% and 19% for VOC and NOx, respectively, over the period from 2002 to 2005.

The steady reductions in mobile emissions are attributable largely to a series of increasingly stringent federal regulations requiring cleaner vehicles and fuels, including the federal Tier II regulations for motor vehicles. The decline in mobile source emissions is also attributable in part to transportation policies that have resulted in large and continuing investments in mass transit facilities and services. Related efforts to promote transit-oriented development are helping to encourage use of transit rather than private vehicles. The Rosslyn-Ballston corridor in Arlington County, Virginia is a nationally recognized model of long-range planning which has resulted in the location of high-density commercial and residential development within close proximity of Metrorail stations and accompanying high levels of transit use. Similar success stories can be found in the District of Columbia and suburban Maryland. The current transportation program includes a new Metrorail station and associated transit-oriented development at New York Avenue on the Red Line in the District of Columbia, an extension of the Blue Line from Addison Road to Largo in Prince George's County, and a new light rail line in Anacostia in the District of Columbia. All of these rail improvements will be open and contributing to emissions reductions in the attainment year of 2005.

In addition to continuing investments in major transit facilities, ongoing programs to encourage alternatives to the private automobile have helped keep levels of ridesharing and transit use in the Washington region among the highest in the country. The rapidly increasing use of the Washington Metro's SmarTrip cards is permitting the direct provision of MetroChek subsidies for many transit riders at farecard machines, and the expansion of this technology to commuter rail and buses will provide for seamless transfers for transit riders within the next few years.

The region's Transportation Improvement Program (TIP) includes substantial ongoing funding commitments to promoting ridesharing, telecommuting, and transit use as well as vehicle replacement and retrofit measures and bicycle and pedestrian programs. These commitments provide additional reductions in emissions, which are being reflected in conformity determinations. While not included in the SIP, these ongoing commitments are reducing emissions from mobile sources and are an important part of the contribution of the transportation sector to cleaner air.

Trends toward reduced mobile emissions are occurring despite the negative effects of a shift toward use of sport utility vehicles instead of passenger cars and a steady increase in population, employment and vehicle miles traveled (VMT) within the Washington region. Between 1990 and

2005, regional population and employment will increase an estimated 27% and 24%, respectively, while daily VMT will increase by an estimated 21%. The emission increases from this additional travel have been further exacerbated by a shift toward the use of higher-emitting, less fuel-efficient light-duty trucks, such as SUVs, instead of passenger vehicles. When the Commonwealth of Virginia modified its vehicle registration data reporting to separate passenger cars from sport utility vehicles, new data showing the large number of SUVs in use resulted in a dramatic increase in modeled vehicle emissions. This trend is present throughout the region: an analysis presented to the Transportation Planning Board in December 2002 showed that by 2005, light-duty gasoline trucks such as SUVs will drive just over 50% of the total miles traveled in Montgomery County.[1]

Trends toward increasing population, employment and VMT are expected to remain strong beyond 2005. The regional cooperative forecasting process predicts that from 2005 to 2025, regional population will grow by 20% and employment will grow by 30%. Regional VMT is predicted to increase by 25% over this time. Furthermore, EPA predicts that the trend toward larger vehicles will also continue, with the percentage of light-duty gasoline trucks nationwide increasing from 45.5% in 2005 to 56.7% in 2015 and 59.0% in 2030.[2] However, these trends will not reverse the expected decline in regional mobile emissions resulting from cleaner fuels and improved vehicle technology. The recent Tier II passenger vehicle standards and regulations on emissions from heavy-duty diesel vehicles and fuels are expected to produce further dramatic reductions in VOC and NOx emissions as vehicles are replaced and retrofitted over the next 20 years. Projections contained in the National Capital Region Transportation Planning Board (TPB)'s Draft Air Quality Conformity Determination of the 2003 Constrained Long-Range Plan (CLRP) and FY 2004-2009 Transportation Improvement Program (TIP) for the Metropolitan Washington Region indicate that for both pollutants, mobile emission reductions in excess of 50% will occur during this period.

[1] R. Kirby, "Transportation Emissions Reduction Measure (TERM) analysis using MOBILE 6 – proposed methods", December 11, 2002.
[2] US EPA, default national data for the MOBILE 6.2 model

10.0 SEVERE AREA PLAN COMMITMENTS

Achieving the results shown in this Plan requires a commitment to implement the regulatory measures upon which the plan is based. The locally adopted measures included in the analysis are those included in Table A. Chapter 7 provides documentation of the reductions achieved by those measures. The States and the District are also taking action to implement regional measures to reduce ozone transport. Tables 10-1, 10-2, 10-3 and 10-4 provide information on the implementation of each measure by Maryland, Virginia and the District of Columbia.

Commitments for regulations required by the CAAA Section 182 (d) for severe nonattainment areas are shown in Tables 10-5, 10-6, and 10-7.

10.1 Schedules of Adopted Control Measures

Table 10-1
District of Columbia Schedule of Adopted Control Measures
Washington Nonattainment Area

No.	Control Measure	Regulation Number	Effective Date
Federally Mandated Measures			
6.2.1	High Tech Inspections & Maintenance	18 DCMR* Chapters 4, 6, 7, 10, 11; 26 DCMR Chapter 26	4/30/99
7.2.2	State II Vapor Recovery Nozzle	20 DCMR Sec. 705	2/1/85
7.2.3	Federal Tier I Vehicle Standards and new Car Evaporative Standards	40 CFR part 86	Model Year 1994-1996; Evap Stds. 1996
7.2.4	Non-CTG RACT	20 DCMR Sec 715	10/2/98
7.2.5	Phase II Gasoline Volatility Controls	N/A	N/A
7.2.6	EPA Non-Road Gasoline Engines Rule	40 CFR parts 90 and 91	12/3/96
7.2.7	EPA Non-Road Diesel Engines Rule	40 CFR Part 9 et al.	Model Year 2000-2008 depending on engine size
7.3.3	National Low Emissions Vehicle Program	20 DCMR, Sec 915	1/20/2000

No.	Control Measure	Regulation Number	Effective Date
7.5.9	EPA Nonroad Spark Ignition Marine Engine Rule	40 CFR Parts 89, 90, 91	1998 Model Year
7.3.5	Emissions Controls for Locomotives	63 FR 18998	6/15/98
7.3.6	Heavy-duty Diesel Engine Rule	62 FR 54694	12/22/97
7.2.8	State NOx RACT Requirements	20 DCMR Sec. 805	11/19/93
Other Federal Programs			
7.3.1	Reformulated Surface Coatings	63 FR 48849 64 FR 34997 65 FR 7736	9/11/98 6/30/99 2/16/00
7.3.2	Reformulated Consumer Products	63 FR 48848	9/11/98
7.3.4	Reformulated Industrial Cleaning Solvents	20 DCMR Sec 708	10/2/98
State and Local Measures			
7.4.1	Reformulated Gasoline (on-road)	Federal - local opt-in	1/1/95
7.4.2	Reformulated Gasoline (off-road)	Federal - local opt-in	1/1/95
7.4.3	Surface Cleaning/Degreasing for Machinery/Automobile Repair	20 DCMR Sec. 708.9-708.12	5/1/99
7.4.4	Landfill Regulations	N/A	N/A
7.4.5	Seasonal Open Burning Restrictions	20 DCMR Sec. 604	2/1/85
7.4.6	Stage I Expansion	N/A	N/A
7.4.7	Expanded Point Source Regulations to 25 tpy	N/A	N/A
7.4.8	Graphic Arts Controls	20 DCMR Sec. 716	5/1/99
7.4.9	Autobody Refinishing	Adopting Federal Regulation	
7.4.10	Consumer Products	20 DCMR Sec. 719	2/04
7.4.11	Portable Fuel Containers	20 DCMR Sec. 720	2/04
7.4.12	Architectural & Industrial Maintenance Coatings (AIM)	20 DCMR Sec. 722	2/04
7.4.13	Mobile Equipment Repair & Refinishing	20 DCMR Sec. 718	2/04
7.4.14	Solvent Cleaning	20 DCMR Sec. 721	2/04

No.	Control Measure	Regulation Number	Effective Date
Regional Control Measures			
7.2.9	Regional Transport NOx Reductions	20 DCMR Ch. 10	1/20/2000

This information was obtained from the District of Columbia Environmental Health Administration.
*District of Columbia Municipal Regulations.

Table 10-2
Maryland Schedule of Adopted Control Measures
Washington Nonattainment Area

No.	Control Measure	Regulation Number	Effective Date
Federally Mandated Measures			
7.2.1	High Tech Inspections & Maintenance	11.14.08	1/2/95
7.2.2	State II Vapor Recovery Nozzle	26.11.24	2/15/93
7.2.3	Federal Tier I Vehicle Standards and new Car Evaporative Standards	40 CFR part 86	Model Year 1994-1996; Evap Stds. 1996
7.2.4	Non-CTG RACT	See Table 10-3	See Table 10-3
7.2.5	Phase II Gasoline Volatility Controls	03.03.03.05	10/26/92
7.2.6	EPA Non-Road Gasoline Engines Rule	40 CFR parts 90 and 91	12/3/96
7.2.7	EPA Non-Road Diesel Engines Rule	40 CFR Part 9 et al.	Model Year 2000-2008 depending on engine size
7.3.3	National Low Emissions Vehicle Program	26.11.20.04	3/22/99
7.5.9	EPA Nonroad Spark Ignition Marine Engine Rule	40 CFR Parts 89, 90, 91	1998 Model Year
7.3.5	Emissions Controls for Locomotives	63 FR 18998	6/15/98
7.3.6	Heavy-duty Diesel Engine Rule	63 FR 54694	12/22/97
7.2.8	State NOx RACT Requirements	26.11.29.08	5/10/93

No.	Control Measure	Regulation Number	Effective Date
Other Federal Programs			
7.3.1	Reformulated Surface Coatings	63 FR 48849 64 FR 34997 65 FR 7736	9/11/98 6/30/99 2/16/00
7.3.2	Reformulated Consumer Products	63 FR 48848	9/11/98
7.3.4	Reformulated Industrial Cleaning Solvents	Proposed	Not determined, Schedule Proposed
State and Local Measures			
7.4.1	Reformulated Gasoline (on-road)	Federal - local opt-in	1/1/95
7.4.2	Reformulated Gasoline (off-road)	Federal - local opt-in	1/1/95
7.4.3	Surface Cleaning/Degreasing for Machinery/Automobile Repair	26.11.19.09	6/5/95
7.4.4	Landfill Regulations	26.11.19.20	3/9/98
7.4.5	Seasonal Open Burning Restrictions	26.11.07	5/22/95
7.4.6	Stage I Expansion	26.11.13.04C	4/26/93
7.4.7	Expanded Point Source Regulations to 25 tpy	26.11.19.01B(4)	5/8/95
7.4.8	Graphic Arts Controls	26.11.19.11 & .18	6/5/95 & 11/7/94
7.4.9	Autobody Refinishing	26.11.19.23	5/22/95
7.4.11	Portable Fuel Containers	26.11.13.07	12/21/01
7.4.10	Consumer Products	26.11.32	11/24/03
7.4.12	Architectural & Industrial Maintenance Coatings (AIM)	26.11.33	2/04
Regional Control Measures			
7.2.9	NOx Phase II Controls	26.11.27 & .28 26.11.29 & 30	10/18/99

This information was obtained from the Maryland Department of the Environment.

Table 10-3
Maryland Non-CTG RACT
Washington Nonattainment Area

Overall requirement in COMAR 26.11.19.02G effective 4-26-93 (20: Md. R 726).
The following case-by-case RACT regulations have been adopted to ensure consistency.

RACT Regulation	Regulation Number	Effective Date	MD Register
Definition of Gasoline to include JP-4	26.11.13.01	8-11-97	24:16 Md R. 1161
Plastic Parts Coating	26.11.19.07E	6-5-95	22:11 Md R 823
Printing on Plastic	26.11.19.07F	9-8-97	24:18 Md R 1298
Aerospace Coating Operations	26.11.19.13-1	9-22-97	24:19 Md R 1344
Yeast Manufacturing	26.11.19.17	11-7-94	21:22 Md R 1879
Expandable Polystyrene Operations	26.11.19.19	7-3-95	22:13 Md R 970
Commercial Bakery Ovens	26.11.19.21	7-3-95	22:13 Md R 970
Vinegar Generators	26.11.19.22	8-11-97	24:16 Md R 1161
Leather Coating	26.11.19.24	8-11-97	24:16 Md R 1161
Explosives and Propellant Manufacturing	26.11.19.25	8-11-97	24:16 Md R 1161
Reinforced Plastic Manufacturing	26.11.19.26	8-11-97	24:16 Md R 1162
Marine Vessel Coating Operations	26.11.19.27	10-20-97	24:21 Md R 1453

Table 10-4
Virginia Schedule of Adopted Control Measures
Washington Nonattainment Area

No.	Control Measure	Regulation Number	Effective Date
Federally Mandated Measures			
7.2.1	High Tech Inspection & Maintenance	9 VAC 5 Chapter 91	4/2/97
7.2.2	Stage II Vapor Recovery Nozzle	9 VAC 5–40-5220	1/1/93
7.2.3	Federal Tier I Vehicle Standards and new Car Evaporative Standards	40 CFR part 86	Model Year 1994-1996; Evap Stds. 1996
7.2.4	Non-CTG RACT - VOC	9 VAC 5-40-5220	1/1/93
7.2.5	Phase II Gasoline Volatility Controls	2 VAC 5 420-10	7/28/93
7.2.6	EPA Non-Road Gasoline Engines Rule	40 CFR parts 90 and 91	12/3/96
7.5.9	EPA Nonroad Spark Ignition Marine Engine Rule	40 CFR Parts 89, 90, 91	1998 Model Year
7.2.7	EPA Non-Road Diesel Engines Rule	40 CFR part 9 et al.	Model Year 2000-2008 depending on engine size
7.3.6	Heavy-duty Diesel Engine Rule	63 FR 54694	12/22/97
7.3.3	National Low Emissions Vehicle Program	9 VAC 5-200	4/14/99
7.3.5	Emissions Controls for Locomotives	63 FR 18998	6/15/98
7.2.8	Non-CTG RACT - NOx	9 VAC 5-40-310; 9 VAC 5-40-311	1/1/93
Other Federal Programs			
7.3.1	Reformulated Surface Coatings	63 FR 48849 64 FR 34997 65 FR 7736	9/11/98 6/30/99 2/16/00
7.3.2	Reformulated Consumer Products	63 FR 48848	9/11/98

7.3.4	Reformulated Industrial Cleaning Solvents		Per regulatory calendar
State and Local Programs			
7.4.1	Reformulated Gasoline (on-road)	Federal - local opt-in	1/1/95
7.4.2	Reformulated Gasoline (off-road)	Federal - local opt-in	1/1/95
7.4.3	Surface Cleaning/Degreasing for Machinery/Automobile Repair	9 VAC 5-40-3260 et. seq.	4/1/96
7.4.4	Landfill Regulations	9 VAC 5-40-5800 et. seq.	4/1/96
7.4.5	Seasonal Open Burning Restrictions	9 VAC 5-40-5630	4/1/96
7.4.6	Stage I Expansion	9 VAC 5-40- 5200	1/1/99
7.4.7	Expanded Point Source Regulations to 25 tpy - VOC	9 VAC 5-40-300	4/1/96
7.4.8	Graphic Arts Controls	9 VAC 5-40-7800 et. seq.	4/1/96
7.4.9	Autobody Refinishing	9 VAC 5 40-3860 et. seq.	7/1/91
7.4.11	Portable Fuel Containers	9 VAC 5-40-5700	2/23/04
7.4.12	Architectural & Industrial Maintenance Coatings (AIM)	9 VAC 5-40-7120	2/23/04
7.4.13	Mobile Equipment Repair & Refinishing	9 VAC 5-40-6970	2/23/04
7.4.14	Solvent Cleaning	9 VAC 5-40-6820	2/23/04
Regional Control Measures			
11.2	Regional Transport NOx Reduction Controls	By permit or compliance agreement	6/25/98

This information was obtained from the Virginia Department of Environmental Quality.

10.2 Stationary Source Threshold Revision

The Clean Air Act Amendments, Section 182 (d) requires the states in severe nonattainment areas to adopt lower permit thresholds for point sources from 50 tons per year to 25 tons per year. Maryland, Virginia and the District of Columbia are committing to adopt these measures, listed in Table 10-5, on the schedule shown.

Table 10-5
Schedule of Stationary Source Revisions
Washington Nonattainment Area

No.	State	Control Measure	Regulation Number	Effective Date
7.2.9	Maryland	Control of NOx Emissions for Major Stationary Sources	COMAR 09.08	11/24/03
7.2.5 and 7.2.9	Virginia	Emissions Standards for General Process Operations	9 VAC 5-40-240 of Part II of 9 VAC 5 Ch.40, specifically 9 VAC 5-40-300 (VOCs), 9 VAC 5-40-310 (NOx)	6/4/03
7.2.5 and 7.2.9	District of Columbia	Major Source Thresholds	20 DCMR Sections 715.2,715.3,715.4 (VOC RACT)	8/29/03

10.3 New RACT Rules Applicability

Virginia, Maryland and the District have committed to adopt additional reasonably available control technology (RACT) rules for sources subject to the new lower major source applicability size threshold. The requirements for VOCs have been in the regulations for some time due to earlier regulatory actions. The latest regulatory actions lower the major source threshold to 25 tons per year for major stationary sources of NOx and the new sources are subject to RACT rules.

Table 10-6
New RACT Rules Applicability
Washington Nonattainment Area

No.	State	Control Measure	Regulation Number	Effective Date
7.2.9	Virginia	Non-CTG RACT	9 VAC 5-40-240	6/4/03
7.2.9	Maryland	Control of NOx Emissions	COMAR 9.08	11/24/03
7.2.9	District of Columbia	Major Source Thresholds	20 DCMR sections 805.1,805.6,805.7 (NOx RACT)	8/29/03

10.4 Revision of New Source Review (NSR) Regulations

The states are required to lower thresholds for definition of "Major" sources requiring controls to 25 tons per year (from 50 tons per year) and to revise New Source Review (NSR) regulations to apply the 1.3:1 offset requirement to major stationary sources of VOC and NOx.

The nonattainment New Source Review permit regulations in Virginia are structured so that the pertinent requirements such as major source thresholds and offset ratios are self-implementing depending upon changes to the list of nonattainment area classification.

Table 10-7
Schedule for Revision of NSR Regulations
Washington Nonattainment Area

State	Control Measure	Regulation Number	Effective Date
Maryland	Requirements for Major New Sources and Modifications: Definitions and General Conditions	COMAR 17.01 and COMAR 17. 03	11/24/03
Virginia	Permits for Major Stationary Sources and Major Modifications Locating in Nonattainment Areas	9 VAC 5-80-2000 of Part II of 9 VAC 5 Chapter 80	5/1/02
Virginia	Nonattainment Areas (NSR permit regulations)	9 VAC 5-20-204	6/4/03
District of Columbia	Nonattainment Areas (NSR Permit Regulations)	20 DCMR sections 715.2, 715.3, 715.4, 805.1, 805.6, 805.7, 20 DCMR section 204.4	8/29/03

10.5 Vehicle Miles Traveled (VMT) Offset Provision

Section 182(d)(1)(A) of the Clean Air Act (CAA) requires states containing ozone non-attainment areas classified as severe, pursuant to section 181(a) of the Act, to adopt transportation control strategies and Transportation Control Measures (TCMs) to offset increases in emissions growth in Vehicle Miles Traveled (VMT) or numbers of vehicle trips and to obtain reductions in motor vehicle emissions as necessary (in combination with other emission reduction requirements) to comply with the Act's reasonable Further Progress milestones (section 182(b)(1) and (c)(2)(B)) and attainment demonstration requirements (section 182(c)(2)(A)).[1] The EPA general Preamble (57 FR 13498, 13521-13523, Aril 16, 1992) explains how to demonstrate that the VMT requirement is satisfied. Sufficient measures must be adopted so that projected motor vehicle VOC emissions will stay beneath a ceiling level established through modeling of mandated transportation-related controls. When growth in VMT and vehicle trips would otherwise cause a motor vehicle emissions upturn, this upturn must be prevented by TCMs. If projected motor vehicle emissions during the ozone season in one year are not higher than during the previous ozone season due to the control measures in the SIP, the VMT offset requirement is satisfied. This requirement applies to projected emissions in the years between the submission of the SIP revision and the attainment demonstrations.[2]

Therefore, a VMT offset provision is being discussed here for the Washington region to satisfy the requirements of the CAA § 182(d)(1)(A). This provision demonstrates the offsetting of emissions increases due to growth in VMT and vehicle trips by showing the downward trend of the mobile source baseline emission estimates and by including emissions reductions from additional transportation control measures (see Chart 1 "Washington Area Mobile Source VOC Emissions Estimates"). This provision also identifies the mandated and additional transportation control measures generating reductions in mobile source emissions.

Calculation of Mobile Source Baseline Emissions Estimates and Ceiling

The mobile source baseline emissions estimates for the Washington Ozone Nonattainment Area covers 1990 through 2005 (see Chart 1 "Baseline Emissions Estimates" curve). MWCOG prepared an analysis and projection of mobile source emissions of VOC from 1990 to 2005, including the effects of all federally mandated programs. These estimates include the net effect of increases and decreases in emissions from growth in VMT and the implementation of mandated control programs such as Federal Motor Vehicle Control Program (FMVCP) for new vehicles, low-Reid Vapor Pressure fuel, reformulated gasoline, and vehicle emissions testing (Details given below). As long as the curve does not turn upward (indicating the control programs are offsetting increases in emissions from growth in VMT), new transportation control measures are not necessary. The lowest point of this baseline curve, 97.7 tons/day VOC, does not occur until the year 2005. This defines the horizontal ceiling line, which future mobile source emissions in the area may not exceed. As seen in the chart 1, 2005 mobile emissions are lesser compared to 2002 even though there is a 4.03 % increase in VMT during these two years. Since 2002 and 2005 are the years of submission of the SIP revision and the attainment demonstrations respectively and motor vehicle emissions have not increased between these two years, according to the EPA preamble discussed above VMT offset requirement is satisfied and no new TCMs are necessary.

Though the above discussion indicates that additional TCMs are not necessary, MWAQC supports the inclusion of a number of TCMs into the SIP. The effect on emissions is summarized in Chart 1 (see inset table: "Emissions Estimates with additional TCMs").

VMT Offset Strategies

a) Federal Clean Air Act Mandated Mobile Source Control Programs:

The following is a list of the mobile source control programs identified as producing the emissions reductions to offset emissions increases due to growth in VMT:

- The Federal Motor Vehicle Control Program (FMVCP) for new vehicles, including the Tier I and Tier II standards.
- A fuel volatility, or Phase II RVP, of 7.8 pounds per square inch (psi). This control was replaced by the Reformulated Gasoline program.
- Reformulated Gasoline Program, which started in January 1995.
- Vehicle Emissions Testing: Enhanced I/M Program including both exhaust and evaporative programs.

b) TCMs:

The MWAQC for the Washington region has committed to implement TCMs (see Appendix G) to reduce the emissions of NOx and VOC in the region. These TCMs have been included in the VMT offset provision as measurable emission reduction credits. These measures are described in Tables 10-8 and 10-9.

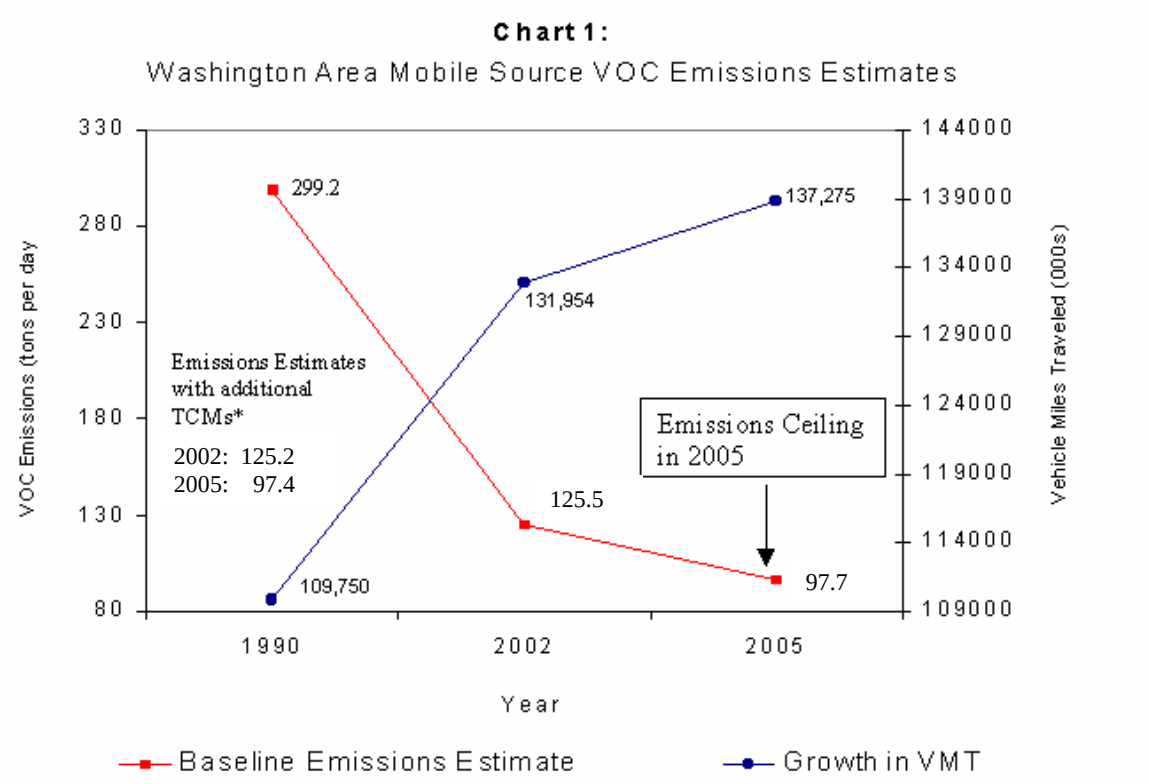
Table 10-8: Transportation Control Measures Credited in the 2002 Rate-of-Progress

ID	Measure	VOC (tpd)	NOx (tpd)
	Virginia		
NV-1	Park-and-Ride spaces Northern Virginia Districtwide	0.0404	0.0953
NV-2	Transit Access Improvements	0.0231	0.0465
NV-3	Purchase of New Transit Buses	0.0250	0.0670
NV-5	Construction of Bus Shelters	0.0000	0.0012
NV-6	Park-and-Ride spaces Northern Virginia Districtwide	0.0469	0.0998
NV-7	Bicycle Lanes / Trails in Northern Virginia	0.0074	0.0063
NV-8	Bicycle Lockers in Northern Virginia	0.0005	0.0007
NV-9	Hybrid Vehicle Purchase	0.0004	0.0009
NV-11	Sidewalk Improvements	0.0011	0.0009
	Maryland		
MD-1	MD Suburban Bus Replacements	0.0100	0.0250
MD-2	Transit Parking Facilities	0.0058	0.0107
MD-3	MARC Replacement/Expansion Coaches	0.0519	0.1191
MD-4	Bicyle Facilities	0.0115	0.0024
MD-5	Park and Ride Facilities	0.0086	0.0226
	WMATA		
WM-1	Bicycle Racks on Transit Buses (1458 total racks)	0.0106	0.0156
WM-2	Ultra Low Sulfur Diesel Fuel with CRT filters (886 buses)	0.0600	-
	District of Columbia		
DC-1	Bicycle Lanes (8 miles)	0.0050	0.0042
DC-3	Bicylce Racks (150 Racks)	0.0009	0.0006
	Regional Total	**0.3**	**0.5**

Table 10-9: Transportation Control Measures Credited in the 2002 Rate-of-Progress

ID	Measure	VOC (tpd)	NOx (tpd)
	Virginia		
NV-1	Park-and-Ride spaces Northern Virginia Districtwide	0.0280	0.0800
NV-2	Transit Access Improvements	0.0160	0.0390
NV-3	Purchase of New Transit Buses	0.0250	0.0670
NV-4	Improvements to Pedestrian Facilities	0.0010	0.0020
NV-5	Construction of Bus Shelters	0.0000	0.0010
NV-6	Park-and-Ride spaces Northern Virginia Districtwide	0.0325	0.0838
NV-7	Bicycle Lanes / Trails in Northern Virginia	0.0051	0.0053
NV-8	Bicycle Lockers in Northern Virginia	0.0004	0.0006
NV-9	Hybrid Vehicle Purchase	0.0004	0.0009
NV-10	Bicycle Lane/Trail	0.0124	0.0127
NV-11	Sidewalk Improvements	0.0007	0.0007
NV-12	CNG Buses	0.0000	0.0174
	Maryland		
MD-1	MD Suburban Bus Replacements	0.0100	0.0250
MD-2	Transit Parking Facilities	0.0040	0.0090
MD-3	MARC Replacement/Expansion Coaches	0.0360	0.1000
MD-4	Bicyle Facilities	0.0080	0.0020
MD-5	Park and Ride Facilities	0.0060	0.0190
MD-6	Grosvenor Metro Garage	0.0060	0.0155
MD-7	Park & Ride Lots (Recent Additions)	0.0066	0.0171
	WMATA		
WM-1	Bicycle Racks on Transit Buses (1458 total racks)	0.0074	0.0131
WM-2	Ultra Low Sulfur Diesel Fuel with CRT filters (886 buses)	0.0600	-
WM-3	Compressed Natural Gas Buses (164 buses)	-	0.1594
	District of Columbia		
DC-1	Bicycle Lanes (8 miles)	0.0035	0.0035
DC-2	CNG Refuse Haulers (2 vehicles)	0.0000	0.0022
DC-3	Bicycle Racks (150 Racks)	0.0006	0.0005
	Regional Total	**0.3**	**0.7**

Figure 10-1: Washington Area Mobile Source VOC Emission Estimates



* Due to the small differences in emissions, a curve depicting emissions reductions with TCMs has not been included.

10.6 Fee Requirement (Section 185) for Failure to Attain

Section 185 of the Clean Air Act requires severe non-attainment areas to adopt a penalty fee for stationary sources for failure to attain. The required fee penalty is a base amount $5,000 per ton of VOC or NOx emitted with a CPI adjustment each year since 1989 for all emissions in excess of 80 percent of the stationary source's baseline emissions level. This is a substantial financial penalty. The baseline amount is computed using the lower of the source's actual or permitted level of emissions, or the emissions allowed under the region's implementation plan, if no permit has been issued for the attainment year. Should the source's emissions vary widely from year to year, a multiyear baseline may be established.

Maryland, Virginia and the District of Columbia are committed to fulfill the requirements of Section 185. The requirement would have to be met if the states and the District fail to attain the one-hour ozone National Ambient Air Quality Standard (NAAQS) by November 15, 2005. The Commonwealth of Virginia plans to fulfill this requirement through legislation, which was proposed during the session convening January 14, 2004. The District of Columbia has pursued the fee requirement through a regulation, numbered 20 DCMR 305.4. The State of Maryland will meet this requirement through legislation, regulation or other options provided for in EPA guidance.

There are two significant future issues that may obviate the need for the states to adopt a fee penalty for failure to attain as required in Section 185. These issues are EPA's implementation of

the 8-hour ozone standard and proposed legislation in Congress addressing EPA's reclassification of downwind areas.

10.6.1 Transition to 8-Hour Non-Attainment

EPA's Proposed Rule to Implement the 8-Hour Ozone National Ambient Air Quality Standard (40 CFR Part 51) proposes two options for implementing the transition from the 1-hour to the 8-hour ozone standard, partial revocation or complete revocation of the 1-hour standard. EPA expects to finalize this rule in two phases. The first phase is expected to be finalized in January 2004. The second phase is scheduled for adoption in April 2004.

The revocation of the 1-hour standard would take place in April 2005, a year after the region's 8-hour nonattainment area designation becomes effective. Under both revocation options, the state's obligations for the one-hour standard would continue to guarantee that there would be no "backsliding." The states' obligations under the 1-hour would continue to include a control obligation (control measures), a measure to address growth in new sources (NSR and offset ratios), and a planning obligation (attainment and RFP demonstrations. The 1-hour requirements would include the NOx SIP call requirement as part of the anti-backsliding provision (Section 110(1)). The Section 185 fee requirement would not continue as an obligation under the 8-hour standard if the region is designated as in "serious" nonattainment because the fee penalty is not considered a control measure or an NSR requirement. If the region is designated a "severe" nonattainment area for the 8-hour ozone standard., the states will be required to adopt a fee penalty requirement under Section 185 for inclusion in the future 8-hour SIP.

10.6.2 Energy Bill and Barton Amendment

In the 108th Congress, Section 1443 ("Barton amendment") in the of the Energy Policy Act of 2003 approved by the House-Senate Conference Committee and subsequently by the House of Representatives would allow EPA to extend the dates for attaining the ozone NAAQS for a downwind area, if an upwind area significantly contributes to nonattainment in that area, without having to reclassify the downwind area. The provision is not limited to the 1-hour ozone NAAQS. The provision contains a "grandfathering" clause that requires EPA to revoke the reclassification of downwind areas that EPA reclassified within the past 18 months, as long as EPA approves a SIP revision for such area within 12 months of enactment. The Senate will reconsider the Energy Policy Act in January 2004. If it is passed with Section 1443 intact, the Washington, DC-MD-VA nonattainment area's severe classification, promulgated in January 2003, would be revoked, and the region would become a serious nonattainment area. Because the Clean Air Act Section 185 applies only to areas classified as "severe," the Washington NAA would no longer have a requirement to adopt a fee penalty for failure to attain.

10.6.3 Implementation

The states in the Washington, DC-MD-VA nonattainment area are committed to fulfilling their obligation as much as legally possible to meet the Section 185 requirement for severe nonattainment areas. The state air agencies are making a good faith effort to get the Section 185 penalty fee enacted.

In Virginia the will of the legislature will determine if the proposed bill is enacted. The legislature may not act on the proposed bills until late April when the legislative sessions end, but this cannot be stated with certainty due to the crowded legislative agendas in both states.

The District of Columbia Department of Health has adopted a regulation to enact a fee penalty provision for failure to attain the 1-hour ozone standard. The District's regulation (20 DCMR 305.4) states that the implementation is contingent upon a region-wide adoption of similar provisions in the MD-VA jurisdictions of the Washington consolidated metropolitan statistical area. The District of Columbia adopted this regulation in February 2004.

Maryland will enact the Section 185 program by proposing legislation or by using other options provided for in EPA rules or guidance.

10.7 Commitment to Meet Rate-of-Progress Requirements

The control measures appearing for 2002 and 2005 in Table A meet the rate of progress requirements in the metropolitan Washington region for Maryland, Virginia, and the District of Columbia. Emission reductions for the 1999-2002 rate of progress requirements will total 179.4 tons per day of VOC and 268.7 tons per day of NOx. Emission reductions for the 2002-2005 rate of progress requirements will total 214.7 tons per day of VOC and 393.3 tons per day NOx. The total emission reductions committed to by each jurisdiction are shown in Tables 4-7 through 4-12 and Table 10-9. This Plan demonstrates that the Metropolitan Washington Ozone Nonattainment Area meets the rate-of-progress requirements.

Table 10-10
Emission Reduction Commitments to Meet ROP Requirements for the Washington Metropolitan Region through 2005
(tons per day)

		District of Columbia	Maryland	Virginia	Regional Total
VOC	2002 ROP	12.3	83.7	83.1	179.4
NOx	2002 ROP	7.8	205.8	54.6	268.7
VOC	2005 ROP	14.7	99.0	100.7	214.7
NOx	2005 ROP	12.4	284.2	96.1	393.3

* Benefits from regional TCMs are included in the regional total but are not allocated by state.

Maryland, Virginia and the District of Columbia have adopted five Ozone Transport Commission model rules to reduce VOC emissions to meet the rate of progress requirements. These regulations are discussed in greater detail in Chapter 7.

10.8 Commitment to a Midcourse Review of Progress toward Attainment

A midcourse review of progress toward attainment will be performed after the end of the 2004 ozone season. The District of Columbia, Maryland, Virginia and MWAQC commit to completing this review and submitting a report to EPA on December 31, 2004. The midcourse review will include an evaluation of trends in monitor data, local emissions, implementation of local emissions strategies, and comparison to the state implementation plans to determine progress the region is making towards attainment of the one-hour ozone standard. MWAQC and the States commit to work with EPA in a public consultative process to develop a methodology for performing the midcourse review and developing the criteria by which adequate progress will be judged. Due to the Washington area's need for interstate NOx reductions to attain the one-hour ozone standard, the outcome of the mid-course review will depend on the implementation of NOx reductions over a large interstate region to reduce transport to the Washington area.

11.0 Attainment Demonstration

The Severe Area Plan analyzes the potential of the Washington metropolitan area to achieve attainment of the one-hour ozone standard. The demonstration of achieving the one-hour ozone standard is based on several analyses including Urban Airshed Modeling, EPA's Tier 2 modeling results, and two Weight of Evidence tests namely, the Attainment Year Design Value test and the Relative Rate of Reduction test. Details of each of these tests are being provided below.

11.1 Modeling Demonstration

The Washington D.C. Metropolitan Statistical Area (MSA) was earlier designated as a "Serious" ozone non-attainment area by the U.S. Environment Protection Agency (EPA) based on the air quality data during the period from 1987 to 1989 and then more recently in 2003 was bumped up to a "Severe" ozone non-attainment area. In accordance with the provisions of Section 182(C)(2)(A) of the Clean Air Act as amended on November 15, 1990, "serious" and "severe" ozone (O3) non-attainment areas must submit, as part of their State Implementation Plan (SIP), an attainment demonstration using photochemical grid modeling by the applicable date. For the Washington D.C. ozone non-attainment area, the attainment of the one-hour ozone NAAQS has to be achieved by the year 2005.

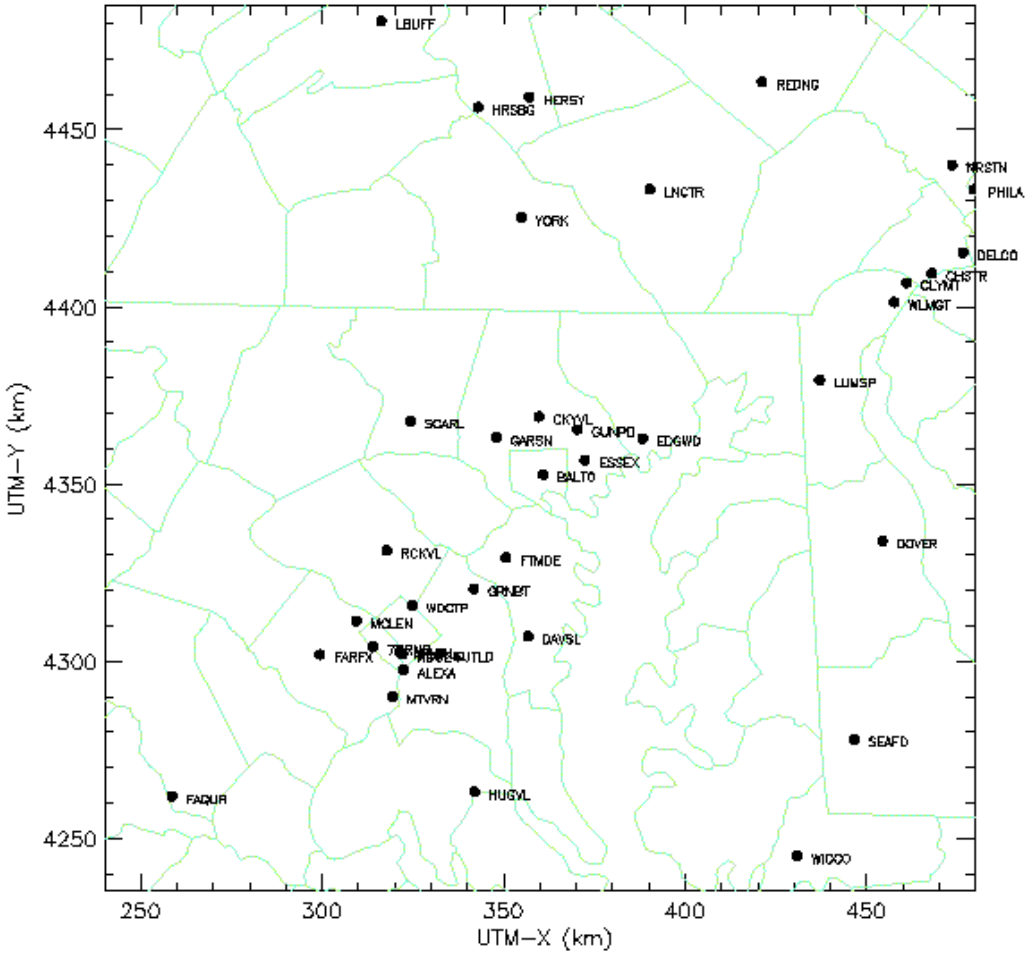
For the reason mentioned above, a photochemical modeling study was undertaken by Virginia Dept. of Environmental Quality on behalf of the Washington metropolitan area during 1997 to demonstrate attainment of the one-hour ozone NAAQS. Details of this modeling are being provided below:

11.2 Local Modeling Tools

The selected modeling tool for attainment modeling is the UAM -IV,[1] which was the first model adopted by the EPA as the preferred guideline model for applications involving entire urban areas.[2] The modeling runs were performed for the entire Baltimore-Washington Domain using the projection modeling inventories for the entire domain. (The boundaries of the Baltimore-Washington Domain are shown on Figure 1).

The model produces results for the entire domain includes all of the nonattainment areas for Baltimore and Washington as well as part of the Philadelphia nonattainment area. Yet, the Washington area is the only portion of the domain for which MWAQC prepares an attainment plan. To enable the Washington region to evaluate its progress toward attainment, the Policy Committee established a Washington Subdomain. The boundaries of the Washington subdomain area shown on Figures 7-16 and many of the charts in this chapter refer to the Washington subdomain.

Figure 11-1



UAM Modeling Domain
for Baltimore-Washington, DC CMSA
Scale: 1".25 km, each tick mark is 10 km
UTM zone 18, Eastings in km on top, Northings on right

In the Washington and Baltimore metropolitan areas, Maryland, Virginia and the District of Columbia began working on this effort in the early 1990's and the effort continues on today. Because of the close proximity of the two metropolitan areas, the EPA combined the modeling effort through the creation of a single modeling domain. A domain is the geographic area for which a model is designed. The Policy Committee, chaired by MDE and including representatives from VADEQ, DC, COG and EPA directs the modeling efforts for the entire Baltimore-Washington domain. The actual modeling is conducted in two modeling centers: one at VADEQ which is focused on the 1999 attainment for the Washington Region, and one at the University of Maryland which is focused on the 2005 attainment for the Baltimore Region. This joint effort will continue until the regions have met both the one-hour ozone standard and the newly adopted eight-hour standard.

The EPA continues to develop and refine the modeling tools that can be used for this effort. However at the time when this photochemical modeling was being undertaken, the EPA had recognized both UAM-IV and UAM -V as appropriate modeling tools for use in predicting ozone levels.

A detailed description of the modeling tools, approaches, and assumptions is contained in the Appendix D of this document (See Section on "Protocol for Regulatory Photochemical Air Quality Modeling of the Baltimore-Washington, DC Region"). The protocol documents the procedures for conducting the modeling study including:

- background, objectives and organizational structure for the study;
- methods for developing the input databases;
- techniques for quality assurance and diagnostic model analyses; and,
- model performance evaluations and interpreting model results.

11.3 Inputs to the Local Model

To use the UAM to perform the modeling study, the modelers must first address the following questions:

Where:	What geographic area is the model being applied to?	Domain
When:	What meteorological conditions should be tested?	Episodes
What:	What emissions are in the air?	Inventory
How:	How does air coming into the area affect air quality?	Boundary Conditions

Once a domain and base case (real) episodes are selected, the modelers input the weather conditions, emissions inventories and boundary conditions during those episodes and compare the model results with the actual monitor readings (real air quality observations). In this way they can test the model performance or accuracy. If the model can faithfully reproduce actual episode conditions, then the amount and type of emissions in the inventory can be modified to test the effect such changes might have on air quality.

Domain

The Baltimore and Washington metropolitan areas are in close physical proximity (40 miles separate the city centers) and their suburban communities overlap. Using 1990 census data the Office of Management and Budget (OMB) classified the Baltimore-Washington region as a single Consolidated Metropolitan Statistical Area (Washington-Baltimore CMSA). Observations of wind motions in the region indicate that emissions from one city travel enough to affect air quality in the other, often within one day. Therefore, the District of Columbia Department of Health(DC DOH), the Virginia Department of Environmental Quality (VADEQ), and the Maryland Department of the Environment (MDE), in consultation with the Metropolitan Washington Council of Governments (MWCOG), the Baltimore Metropolitan Council (BMC), and the Tri-County Council for Southern Maryland (TCC), acceded to the U.S. Environmental Protection Agency (EPA) request for a single modeling domain including Baltimore, Washington and their surrounding nonattainment counties.

Strategy and attainment analysis were performed for each nonattainment area separately. However, the selected final strategies for both areas were modeled jointly in the modeling attainment demonstration based upon the year for which the prediction is prepared. The modeling results for the Washington area are reported based upon a Washington Subdomain. This subdomain is formed by a rectangle around Washington which incorporates most of the nonattainment area and all of the highest ozone readings observed and predicted.

Each modeling center used the same inventories, episodes, base inventories and procedures. The center at the Virginia Department of Environmental Quality prepared the modeling study for the Washington nonattainment area. The Maryland Department of the Environment prepared the study for the Baltimore nonattainment area.

Episodes

When determining what weather conditions to use in the model, the University of Maryland Department of Meteorology reviewed the historical record of days when ozone exceeded the one-hour ozone standard to understand what weather led to high levels of ozone. Their analysis identified four distinct weather patterns associated with high ozone events:

Northerly Transport - High pressure south and west of the domain, typically centered in western Virginia or West Virginia. Often coupled with an offshore low pressure system. Surface winds are light and variable. Upper level winds are from the north. (Type 1)

Westerly Transport - Surface conditions are similar to Northerly Transport but upper-level winds are from the west. High pressure centered to the south and west of the domain. Commonly, a frontal zone is located just to the north of the domain, and a lee trough is present in or near the domain during some period of the episode. (Type 2)

Along Corridor - High pressure center located south and east of the domain, often along the North Carolina coast. Winds are from the south and southwest. (Type 3)

Frontal Zone - A cold or stationary frontal zone is in or just south of the domain. Upper

air winds are from the west or northwest. High ozone levels may be caused by convergence of surface winds along the frontal zone or when very stable conditions trap local emissions beneath an inversion.

Episodes to model were chosen to represent the ozone forming potential of each type of weather condition after considering the amount an quality of available data. The episodes selected for modeling were:

July 5-7, 1988	Northerly Transport
July 29-30, 1988	Westerly Transport
July 18-20, 1991	Along Corridor
July 12-14, 1988	Northerly Transport
July 15-16, 1991	Along Corridor

No Frontal Zone episodes were modeled because the existing models are not able to adequately resolve local strong gradients in temperature, moisture and wind associated with these weather patterns.

An episode from July 1995 was added in recent months because so much more data is available on that episode than is available on any others. This is an episode modeled by the Ozone Transport Assessment Group (OTAG) and therefore there is better boundary condition information than on any other episode.

For each episode, weather conditions are entered into the model. Examples of information include wind patterns at various elevations, temperature, barometric pressure and moisture, hours of sunlight, and ultraviolet radiation

Inventory

The estimate of ozone forming emissions (emissions inventory) is a third component of the inputs to the model exercise. In this case, the information for the emissions inventory comes from a number of sources, depending on the type of emissions.

Biogenics - plant and animal sources of VOC's and NOx. To estimate these, EPA has developed another model, BEIS. Like most models it has a number of versions, reflecting improvements over the years. In this case modeling began with BEIS I, and then EPA released BEIS II. BEIS II shows a much larger inventory of biogenic emissions, highly reactive VOC's which add to ozone levels. This new inventory is based upon recent studies of emissions in the southeastern U.S. and is more accurate than any earlier biogenics estimate. Unfortunately, when BEIS II is used with UAM IV, the EPA regulatory model for attainment demonstrations, the limitations of UAM IV are exaggerated and the overall model performance deteriorates.

Inside Domain Anthropogenic (Man-made) Emissions - These come from the official 1990 inventories prepared by MDE and MWAQC for the Baltimore and Washington metropolitan areas respectively. For areas outside the nonattainment areas but inside Maryland and Virginia, modelers use MDE and VADEQ generated information. For areas outside the MWAQC states, the modelers use the inventories prepared to support the OTAG process.

For each episode the modelers modified the actual emissions in 1990 to reflect conditions as close to the dates in question as possible using a variety of estimating techniques. For future years - 1999 and 2005 - the 1990 area, point and non-road mobile inventories were projected to grow based upon growth in population or employment into the projection year. Then the projections are modified to reflect the implementation of the control strategies shown in the 15% and Phase I Attainment Plans as they existed in 1997.

Tables 11-1 summarizes 1990 and the projection inventories used as the basis for the model analysis. This description of inventory data is of necessity very simplified. The details of inventory preparation and use are contained in Section 11-6.

Table 11-1
1990 and Projection Anthropogenic Emissions Inventories in Tons per Day
Washington Nonattainment Area used for Modeling

Emissions Type	**VOC (tpd)**		**NOx (tpd)**	
	1990	**Projection**	**1990**	**Projection**
Point	14.6	15.6	334.8	171.1
Area	191.2	153.8	47.3	54.3
Mobile	251.1	123.5	261.7	196.8
Non-road	70.4	66.8	85.0	93.1
Total	527.3	359.7	728.8	515.3
Change		168.6 (32.0%)		213.5 (29.3%)

Boundary Conditions

The final input into the model is the boundary conditions, the assumptions about air quality coming into the domain. Sources for this data are large-scale regional modeling efforts such as OTAG and an earlier exercise called ROM (Regional Oxidant Model) conducted by EPA for the Ozone Transport Commission on behalf some of the northeast states. The model also allows the assumption that all air coming into a domain is clean (40 ppb ozone), to determine how much of the existing problem is the result of sources entirely within the domain.
The base model runs described below for 1991 use boundary conditions from the ROM analysis prepared by EPA and from OTAG. These boundary conditions estimate ozone, VOC and NOx transport into the Baltimore-Washington Domain based upon emissions levels and meteorological conditions in place during July 1991.

The second model result for each day shown below assumes full implementation of the measures considered in Run I of the modeling work completed by OTAG, including [3]:

- Utility NOx controls (85% reduction from 1990 levels)

- Non-utility point source controls (55-70% reduction from 1990 levels
- Architectural & maintenance coating reformulations
- Consumer & commercial products reformulation
- Changes in autobody refinishing
- Reformulated gasoline
- Small engine improvements
- Marine engine improvements
- Heavy duty highway engine improvements
- New standards for non-road diesel engines
- New standards for locomotives

EPA has directed the States to assume boundary conditions consistent with the proposed NOx SIP call for all future year model runs including 1999 and 2005. No boundary conditions exist which directly correlate to the EPA NOx SIP call. OTAG Run I boundary conditions were chosen by all of the states within the Ozone Transport Region because they more closely approximate the boundary conditions likely to be created by the SIP call than any others available. The final selection of days to be included in the modeling program was strongly influenced by the availability of OTAG-generated boundary conditions.

11.4 Local Model Results

The Virginia Department of Environmental Quality (VADEQ) performed the model runs for the episodes selected using the 1990 (base) inventories and the projection emissions inventories. The results of that work are contained in *Attainment Demonstration Modeling Report for the Washington DC-MD-VA Ozone Nonattainment Area* (Appendix D).

Initially, the model predicts that the 26% decrease in local anthropogenic NOx emissions and 32% decrease in local anthropogenic VOC emissions coupled with the most stringent boundary conditions recommended by OTAG will generate a 10% reduction in peak ozone levels within the Washington metropolitan area. The model further predicts that the geographic area with one-hour ozone levels above the federal standard will shrink by 43-53% with projection inventory.

The results summarized in Table 11-2 predict relatively small declines in ozone levels, even with substantial decreases in emissions. This suggests that the model is either over-predicting ozone levels or underestimating the impact of changes to the emissions inventory. Other analysis of the UAM-IV suggest that the model over-predicts ozone levels by at least 20 ppb in such cases.

Table 11-2
Predicted Daily Maximum Ozone Concentrations in ppb and Number of Cell Hours above 124 ppb Washington Subdomain

Conditions	July 16, 1991		July 20, 1991	
	ppb	cell hours* >124 ppb	ppb	cell hours >124 ppb
Observed Level	137		178	
Model prediction using 1991 emissions inventory and boundary conditions	167	503	198	642
Model prediction using projection emissions inventory and OTAG Case I boundary conditions	150	237	178	365
Difference in model predictions	-17 (10%)	-266 (53%)	-20 (10%)	-277 (43%)

* Model results are reported for each hour in a 24-hour period using grid squares (cells) for areas of 5 X 5 kilometers.

Detailed descriptions of the results for two days, July 16 and 20, 1991 are included. These two days, from separate episodes, were selected for detailed review because on July 16, 1991 ozone levels were largely a function of local emissions while ozone transport played an important role on July 20, 1991. Both days were the subject of OTAG modeling which provided appropriate boundary conditions for future year evaluations.

11.4.1 July 16, 1991

Tuesday, July 16, 1991 was the third and final day of an episode lasting from July 14-16. Temperatures throughout the region reached 96 degrees and the air was stagnant, with light winds from the south/southeast. A high pressure system was centered over Pennsylvania. The highest ozone monitor readings in the Washington area were 137 ppb at the Rockville and Lewinsville monitors. Ozone levels were the product of local air pollution emissions and transport from outside the domain was minimal. This episode is characterized as Type 3 (Along Corridor) but is atypical of episodes in this category because of low amount of transport.

Figure 2 shows the UAM-IV simulation of that episode with a predicted high of 167 ppb and the actual monitor readings from the day with a recorded high of 137 ppb. The model creates two ozone plumes, associated with Washington and Baltimore. In general, the higher ozone levels occur in the Washington nonattainment area. Model performance statistics for the entire episode are shown in Table 11-4 using both BEIS 1 and 2. Figure 2 is prepared using BEIS2.

Figure 3 is the prediction of the peak ozone levels throughout the domain under the weather

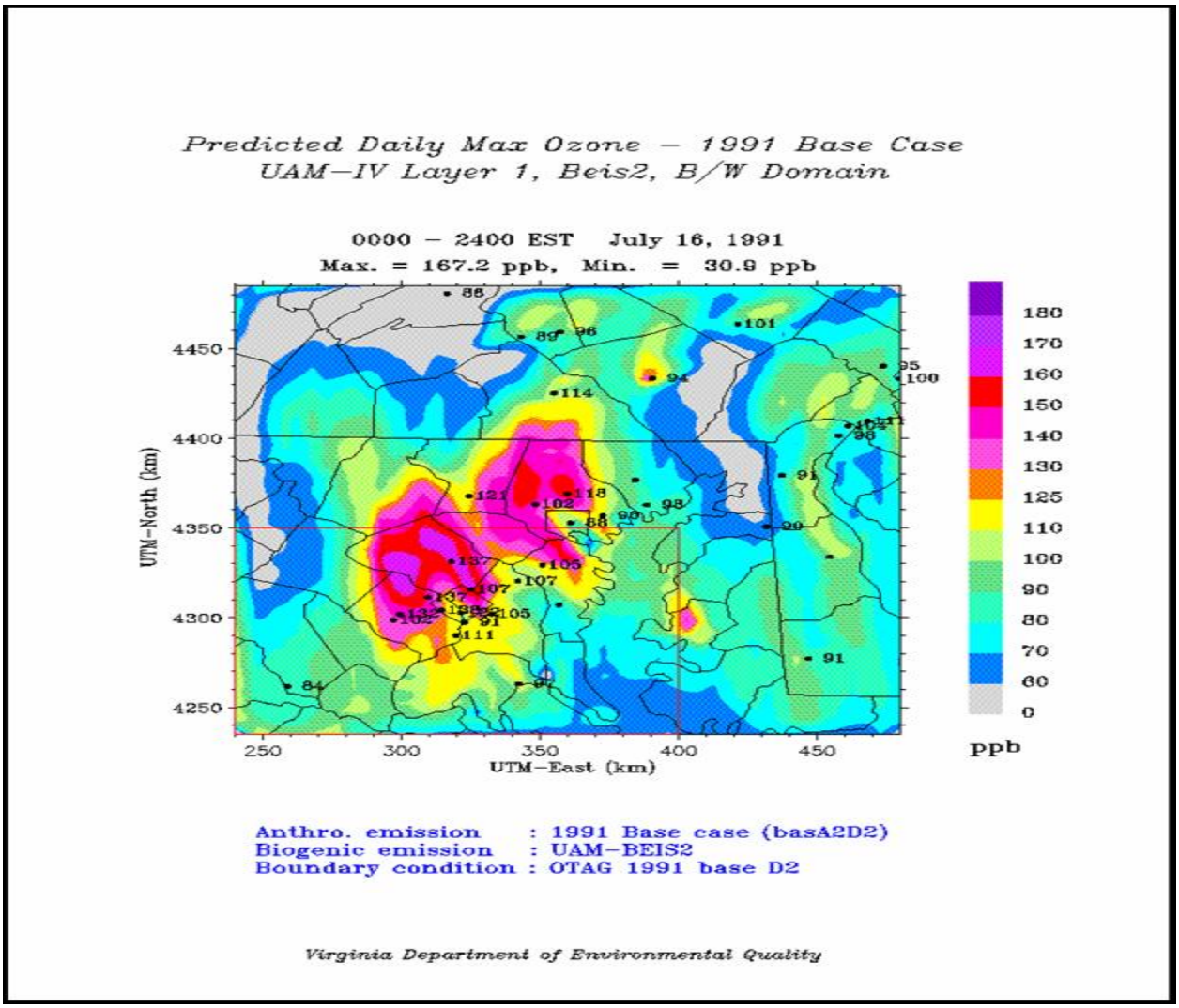
conditions which occurred on July 16, 1991 with the projection inventory emissions levels and the full reductions in boundary conditions recommended by OTAG. The predicted peak is 150 ppb, which is higher than the 137 ppb recorded at the monitors in the region in 1991. The high predicted levels of ozone are indicative of the inherent over-prediction of the UAM-IV especially when used with the BEIS2 inventory of emissions from plants and other natural sources.

Nevertheless, the peak ozone levels predicted by the model show a reduction of 17 ppb (10%) after the effects of the emission reduction strategies are taken into account. A reduction of 10% in the peak monitored ozone levels would reduce ozone levels to 123 ppb, below the federal one-hour ozone standard. Table 11-3 shows projected ozone levels if the model performance statistics are applied to the model results. This analysis shows attainment of the one-hour ozone standard.

Table 11-3
1999 Predicted Ozone Levels Adjusted for Model Performance
July 16, 1991 with Projection Inventory and OTAG Washington Subdomain

Observed Peak July 16, 1991	137 ppb
Unadjusted Predicted Peak	150 ppb
Predicted Peak Adjusted by Unpaired Peak Accuracy (22%)	117 ppb
Observed Peak Reduced by Projected Reduction (10%)	123 ppb

Figure 11-2
Predicted Daily Ozone Maximum
1991 Emissions Base Case - July 16, 1991



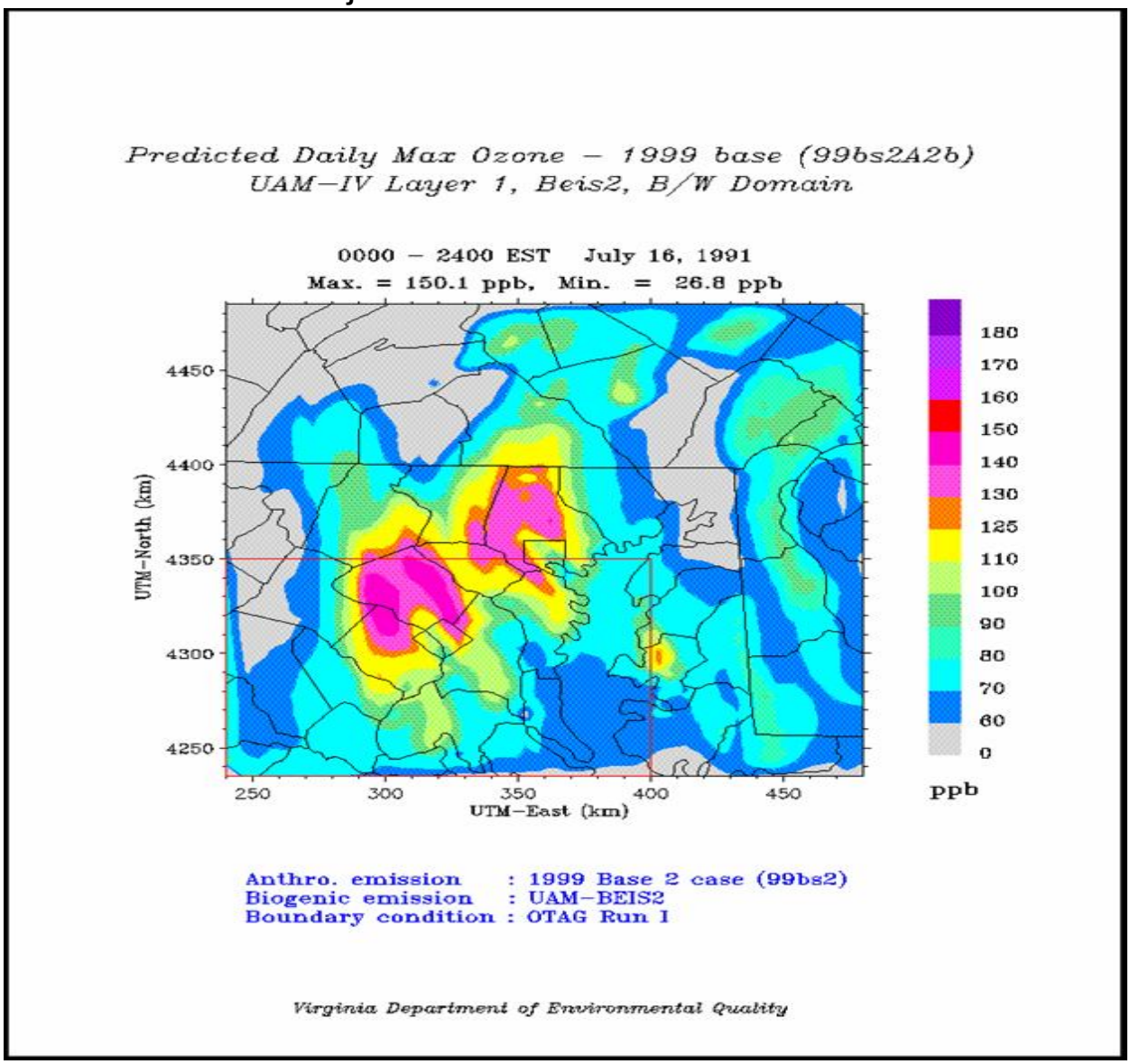
Man-made emissions model used: Urban Airshed Model, version IV (UAM IV)
Biogenic Emissions Model: Biogenic Emissions Inventory System, version 2 (BEIS2)
Conditions inside the Domain: No 1990 Clean Air Act controls
Conditions outside the Domain (Boundary Conditions): Same
Period: 24 hours Domain Max: 167.2 ppb Wash. Subdomain Max: 167 ppb

Table 11-4
July 14-16, 1991 Episode (3b)
UAM-IV Model Performance Statistics
Baltimore - Washington Domain

Statistical Measures	**July 14, 1991**		**July 15, 1991**		**July 16, 1991**		**EPA Criteria**
	BEIS1	BEIS2	BEIS1	BEIS2	BEIS1	BEIS2	
Observed Peak	82	82	102	102	137	137	
Predicted Peak	109	123	115	126	154	167	
Number of Cells > 124 ppb	0	0	0	1	113	245	
Recommended Performance Measures							
Unpaired Peak Accuracy (%)	33	50	13	24	13	22	∀ 20%
Normalized Bias > 60 ppb (%)	-.7	-12	5	.1	-5	-5	∀ 15%
Gross Error > 60 ppb (%)	13	17	14	19	18	23	35%
Additional Performance Measures							
Average Station Peak Accuracy (%)	15	17	15	21	15	21	
Bias of All Pairs > 60 ppb	-.6	-8	3	.1	-5	-4	
Bias of All Station Peaks (ppb)	1.5	-7	2	-3	-11	-10	

Note: Negative sign indicates under-prediction.

Figure 11-3
Predicted Daily Ozone Maximum
Projection Emissions Base Case



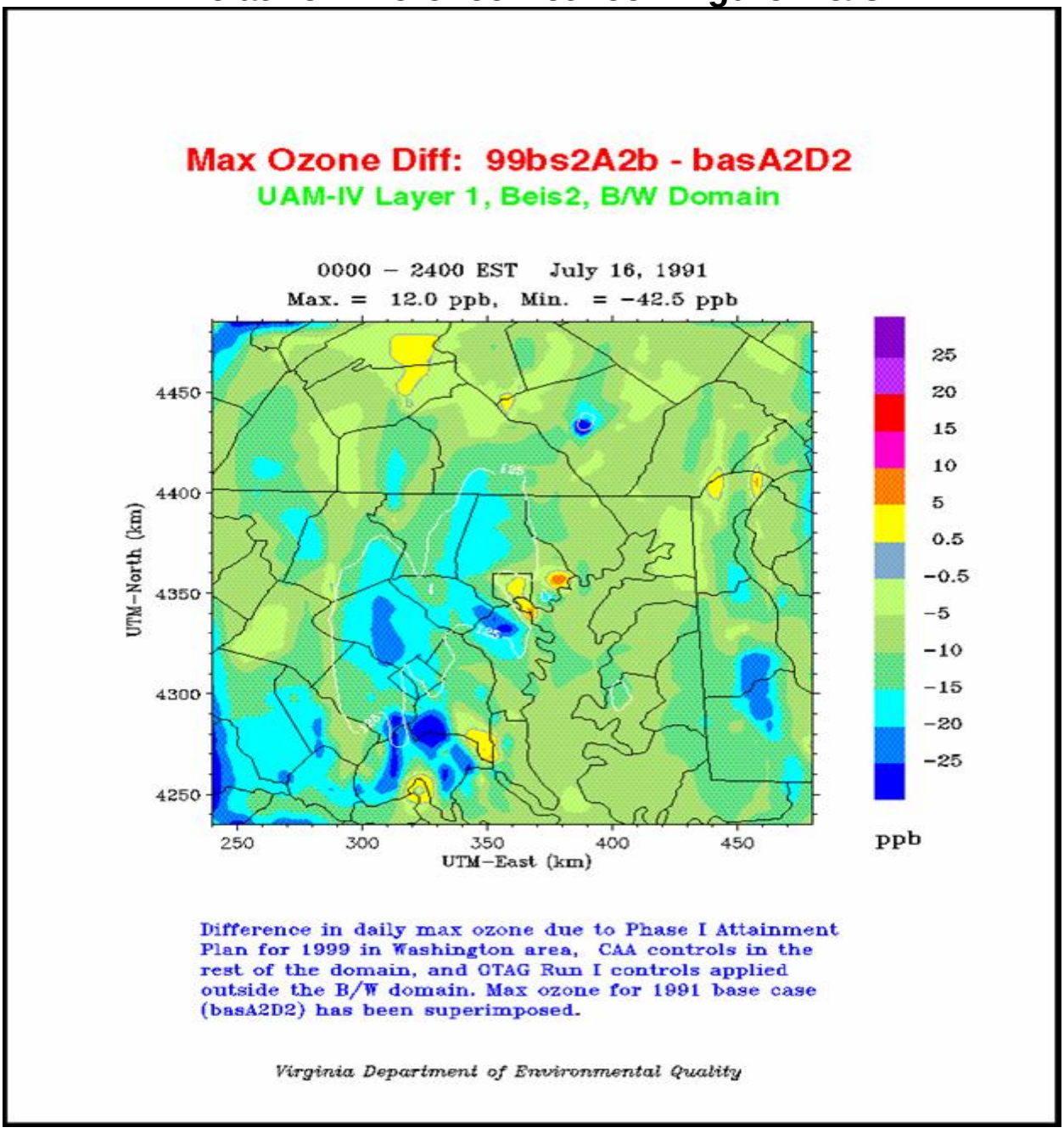
Meteorology: July 16,1991
Man-made emissions model used: UAM IV
Biogenic Emissions Model: BEIS2
Conditions inside the Domain: All CAA controls through 1999
Boundary Conditions: OTAG Case I
Period: 24 hours Domain Max: 150.42 ppb Wash. Subdomain Max: 150

Figure 4 shows the difference in predicted peak ozone levels throughout the domain once the projection inventory and OTAG reductions are achieved. The largest reductions in peak levels are experienced in the areas which have the highest levels of modeled ozone.

Figures 5 and 6 predict ozone levels assuming the projection inventory and clean boundary conditions (ozone at 40 ppb at the boundary of the domain). Figure 5 predicts ozone levels assuming the projection inventory using the BEIS2 biogenic inventory. The model continues to predict levels above the one-hour ozone standard. If adjusted for performance as shown above, the conclusion would be attainment of the one-hour ozone standard. Figure 6 predicts ozone levels assuming the projection inventory using the BEIS1 biogenic inventory. This figure demonstrates attainment without any adjustment for model performance.

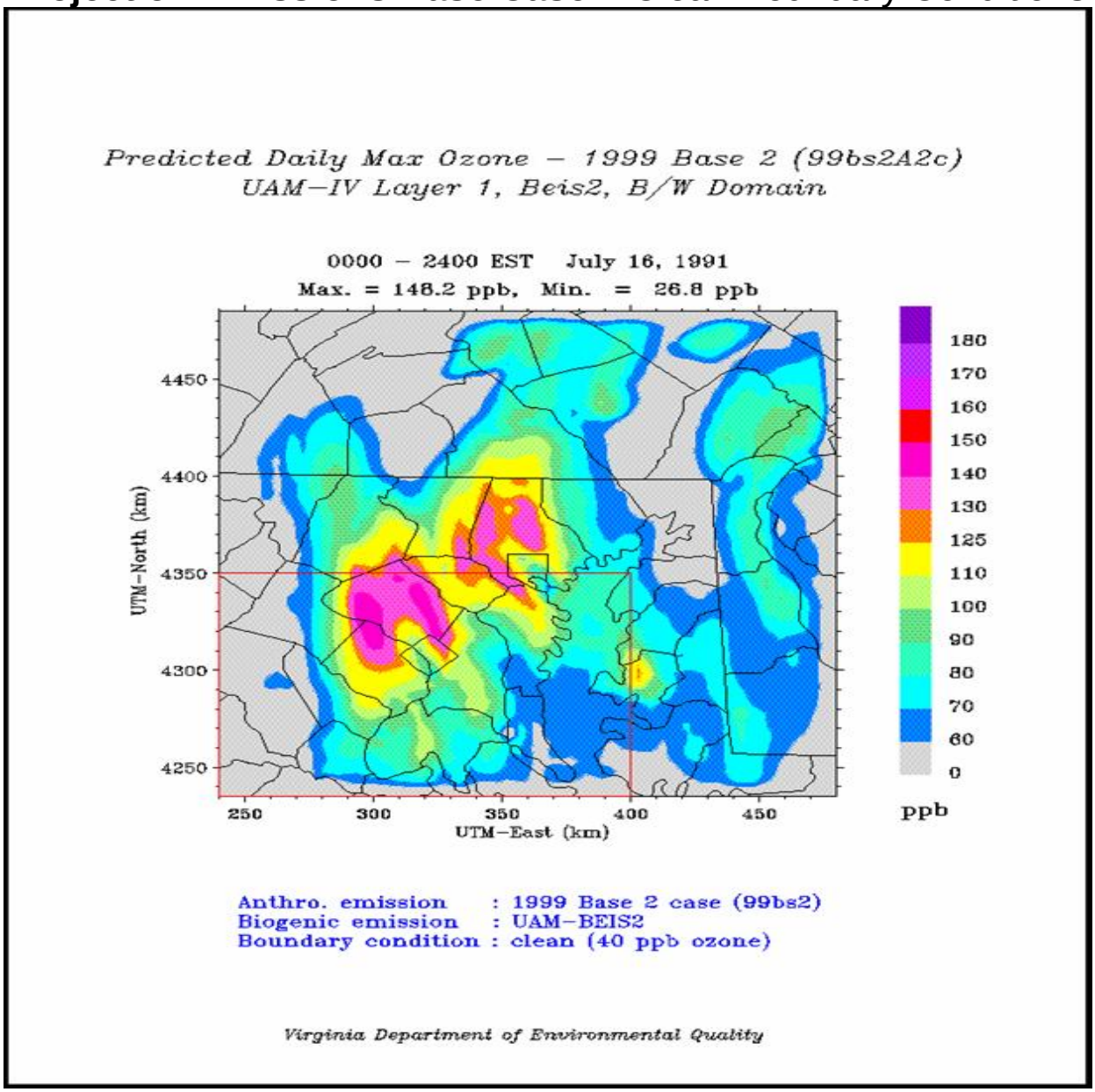
Comparing the results shown in Figures 4-5 illustrates that the model is more sensitive to large changes in biogenic emissions than to the smaller reductions in anthropogenic emissions produced by the measures in the Phase I Plan. It is not clear that this model result is an accurate portrayal of the real behavior of ozone and its precursors, making it difficult to ascertain with certainty the full impact of the regulatory measures by relying on model results alone. For this reason, a separate section of this Severe Area Plan considers the potential for reaching attainment of the one-hour ozone standard using Weight-of-Evidence tests.

Figure 11-4
Relative Difference Between Figure 2 & 3



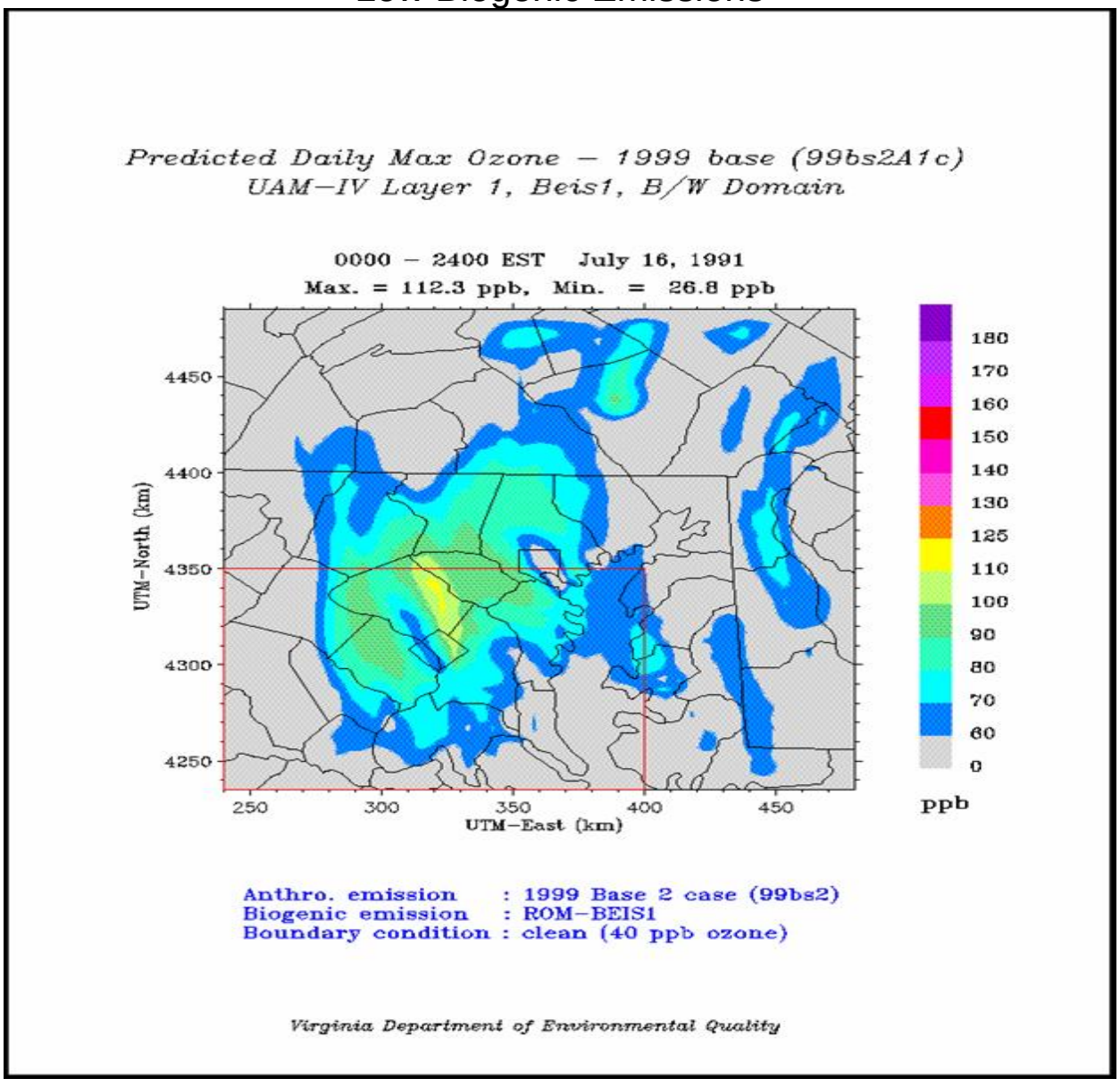
Meteorology: July 16,1991
Man-made emissions model used: UAM IV
Biogenic emissions model: BEIS2
Conditions inside the Domain: All CAA controls through 1999
Boundary Conditions: OTAG Case I
Period: 24 hours Domain Max: N/A Wash. Subdomain Max: N/A

Figure 11-5
Predicted Daily Ozone Maximum
Projection Emissions Base Case - Clean Boundary Conditions



Meteorology: July 16,1991
Man-made emissions model used: UAM IV
Biogenic Emissions Model: BEIS2
Conditions inside the Domain: All CAA controls through 1999 plus OTC NOx controls
Boundary Conditions: Assumed to be clean - only 40 ppb (background level)
Period: 24 hours Domain Max: 148.2 ppb Wash. Subdomain Max: N/A

Figure 11-6
Predicted Daily Ozone Maximum
Projection Emissions Base Case - Clean Boundary Conditions
Low Biogenic Emissions



Meteorology: July 16,1991
Man-made emissions model used: UAM IV
Biogenic Emissions Model: BEIS1
Conditions inside the Domain: All CAA controls through 1999 plus OTC NOx controls
Boundary Conditions: Assumed to be clean - 40 ppb transported in from outside
Period: 24 hours Domain Max: 112.3 ppb Wash. Subdomain Max: N/A

11.4.2 July 20, 1991

Saturday, July 20, 1991 was the third and final day of an episode lasting from July 18-20. The high pressure system present on the 16th had moved south to the South Carolina/ Georgia coast. Temperatures throughout the region reached 102 degrees and the wind direction varied from the south, through west, to north from 4-8 mph. Transport of ozone was significant. The highest ozone monitor reading in the Washington area was 178 ppb at the West End monitor. Figure 7 shows the UAM-IV simulation of that episode with a high of 198 ppb and the actual monitor readings from the day. The model creates one ozone plume with two high ozone bubbles, associated with Washington and Baltimore. In general, the higher ozone levels occur in the Washington nonattainment area. Model performance statistics for the entire episode are shown in Table 11-5 using both BEIS 1 and 2. Figure 7 is prepared using BEIS2.

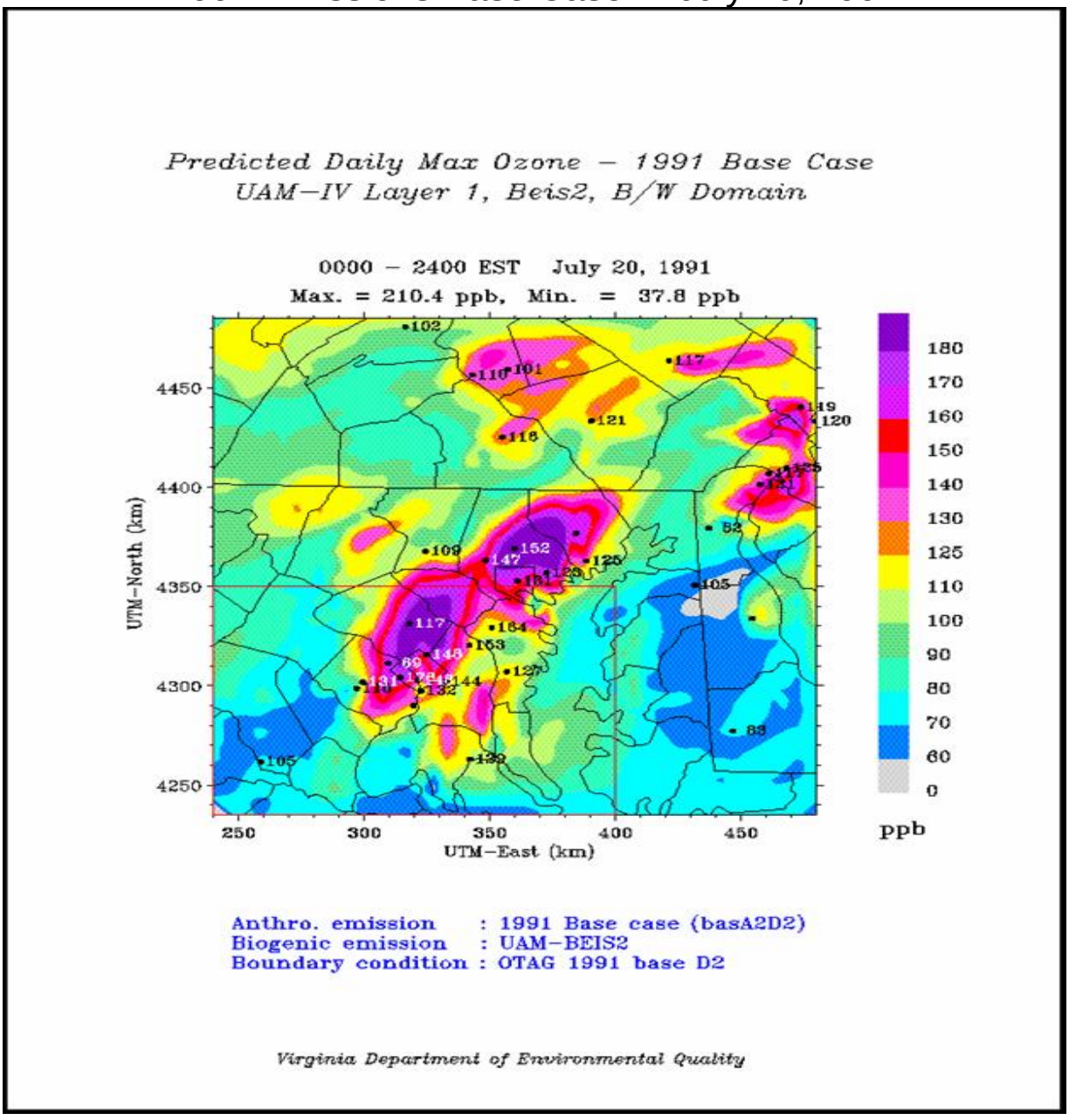
Figure 8 is the model's prediction of the peak ozone levels throughout the domain under the weather conditions which occurred on July 20, 1991 with projection inventory and the full reductions in boundary conditions recommended by OTAG. The predicted peak is 198 ppb, higher than the 178 ppb maximum recorded at the monitors in the region in 1991. The high predicted levels of ozone are a indicative of the inherent over-prediction of the UAM-IV especially when used with the BEIS2 inventory of emissions from plants and other natural sources.

The peak ozone levels predicted by the model show a reduction of 20 ppb (10%) after the effects of the emissions reduction strategies are taken into account. A reduction of 10% in the peak monitored ozone levels would reduce ozone levels to 160 ppb, still above the one-hour ozone standard. Table 11-5 shows projected ozone levels if the model performance statistics are applied to the model results. This analysis shows exceedances of the one-hour ozone standard.

Table 11-5
Predicted Ozone Levels Adjusted for Model Performance
July 20, 1991 with Projection Inventory and OTAG Washington Subdomain

Observed Peak July 20, 1991	178 ppb
Unadjusted Predicted Peak	198 ppb
Predicted Peak Adjusted by Unpaired Peak Accuracy (18%)	162 ppb
Observed Peak Reduced by Projected Reduction (10%)	160 ppb

Figure 11-7
Predicted Daily Ozone Maximum
1991 Emissions Base Case - July 20, 1991



Man-made emissions model used: Urban Airshed Model, version IV (UAM IV)
Biogenic Emissions Model: Biogenic Emissions Inventory System, version 2 (BEIS2)
Conditions inside the Domain: No 1990 Clean Air Act controls
Conditions outside the Domain (Boundary Conditions): Same
Period: 24 hours Domain Max: 210.4 ppb Wash. Subdomain Max: 198 ppb

Table 11-6
July 18-20, 1991 Episode (3a)
UAM-IV Model Performance Statistics
Baltimore - Washington Domain

Statistical Measures	**July 18, 1991**		**July 19, 1991**		**July 20, 1991**		**EPA Criteria**
	BEIS1	BEIS2	BEIS1	BEIS2	BEIS1	BEIS2	
Observed Peak	127	127	132	132	178	178	
Predicted Peak	133	151	151	168	168	210	
Number of Cells > 124 ppb	24	111	100	203	213	394	
Recommended Performance Measures							
Unpaired Peak Accuracy (%)	5	19	15	28	-6	18	∀ 20%
Normalized Bias > 60 ppb (%)	-8	-10	4	8	10	.6	∀ 15%
Gross Error > 60 ppb (%)	22	22	18	24	24	24	35%
Additional Performance Measures							
Average Station Peak Accuracy (%)	21	22	14	21	23	21	
Bias of All Pairs > 60 ppb	-9	-11	2	6	-12	-1	
Bias of All Station Peaks (ppb)	-18	-17	-2	.8	-19	-6	

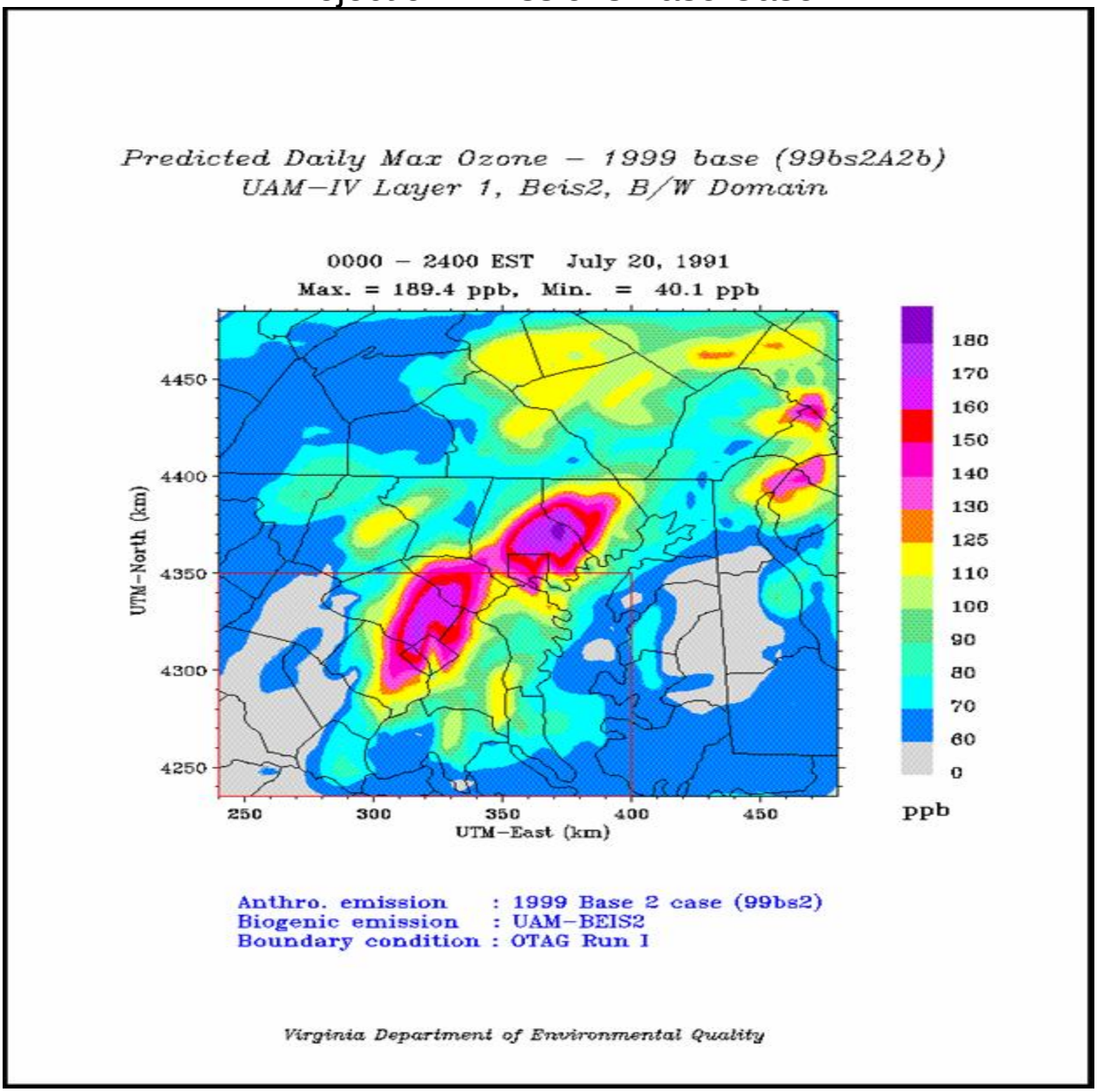
Note: Negative sign indicates under-prediction.

Figure 9 shows the difference in predicted peak ozone levels throughout the domain with the projection inventory and OTAG reductions. The largest reductions in peak levels are experienced in the areas which have the highest levels of modeled ozone.

Figures 10 and 11 predict ozone levels assuming the projection inventory and clean boundary conditions (ozone at 40 ppb at the boundary of the domain). Figure 10 predicts ozone levels assuming the projection inventory using the BEIS2 biogenic inventory. Figure 11 predicts ozone levels and attainment assuming the projection inventory using the BEIS1 biogenic inventory.

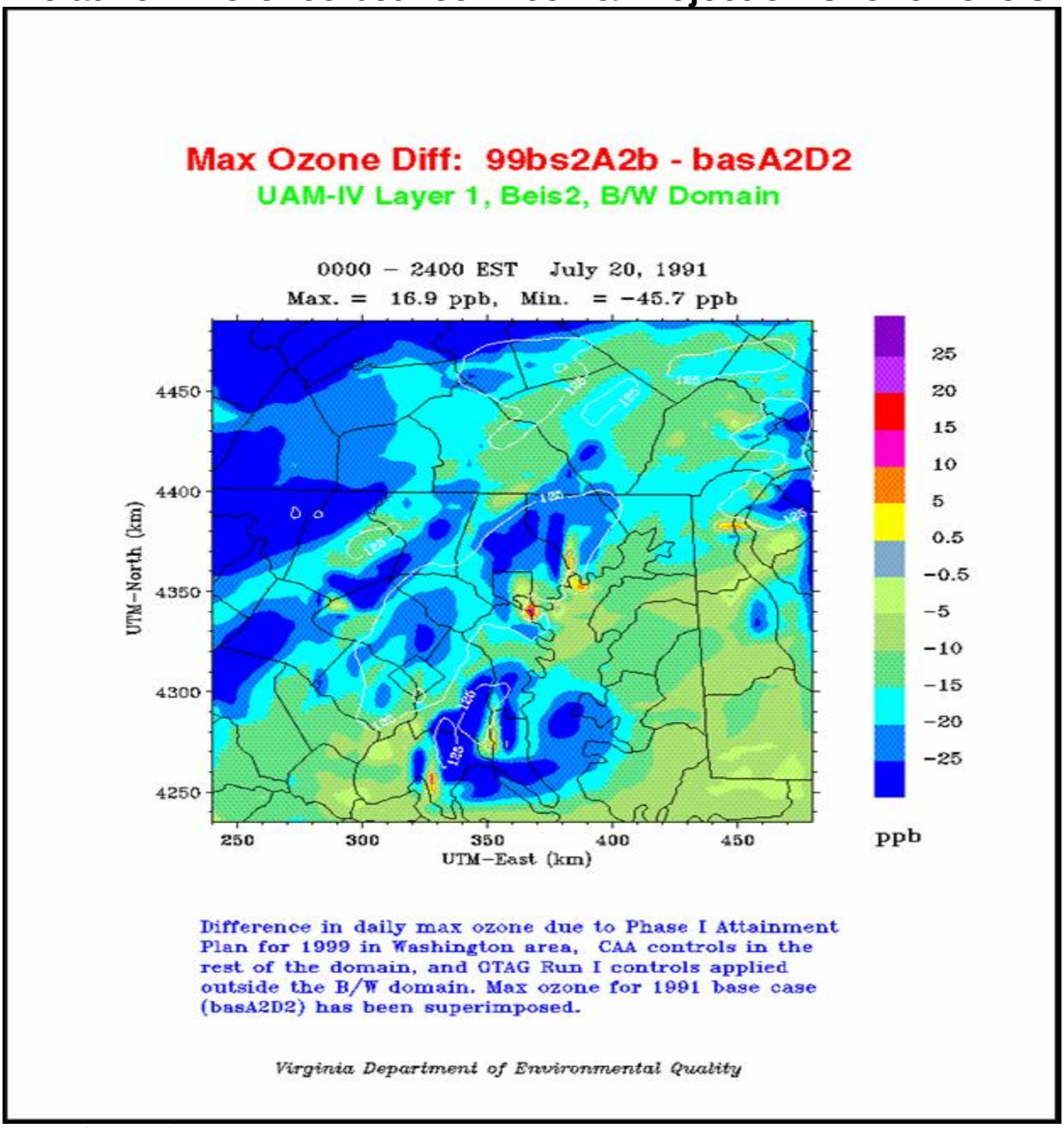
Comparing the results shown in Figures 7-11 illustrates that the model is more sensitive to reductions in biogenic emissions than to the smaller reductions in anthropogenic emissions produced by the measures in the Phase I Plan. It is not clear that this model result is an accurate portrayal of the real behavior of ozone and its precursors, making it difficult to ascertain with certainty the full impact of the regulatory measures by relying on local model results alone.

Figure 11-8
Predicted Daily Ozone Maximum
Projection Emissions Base Case



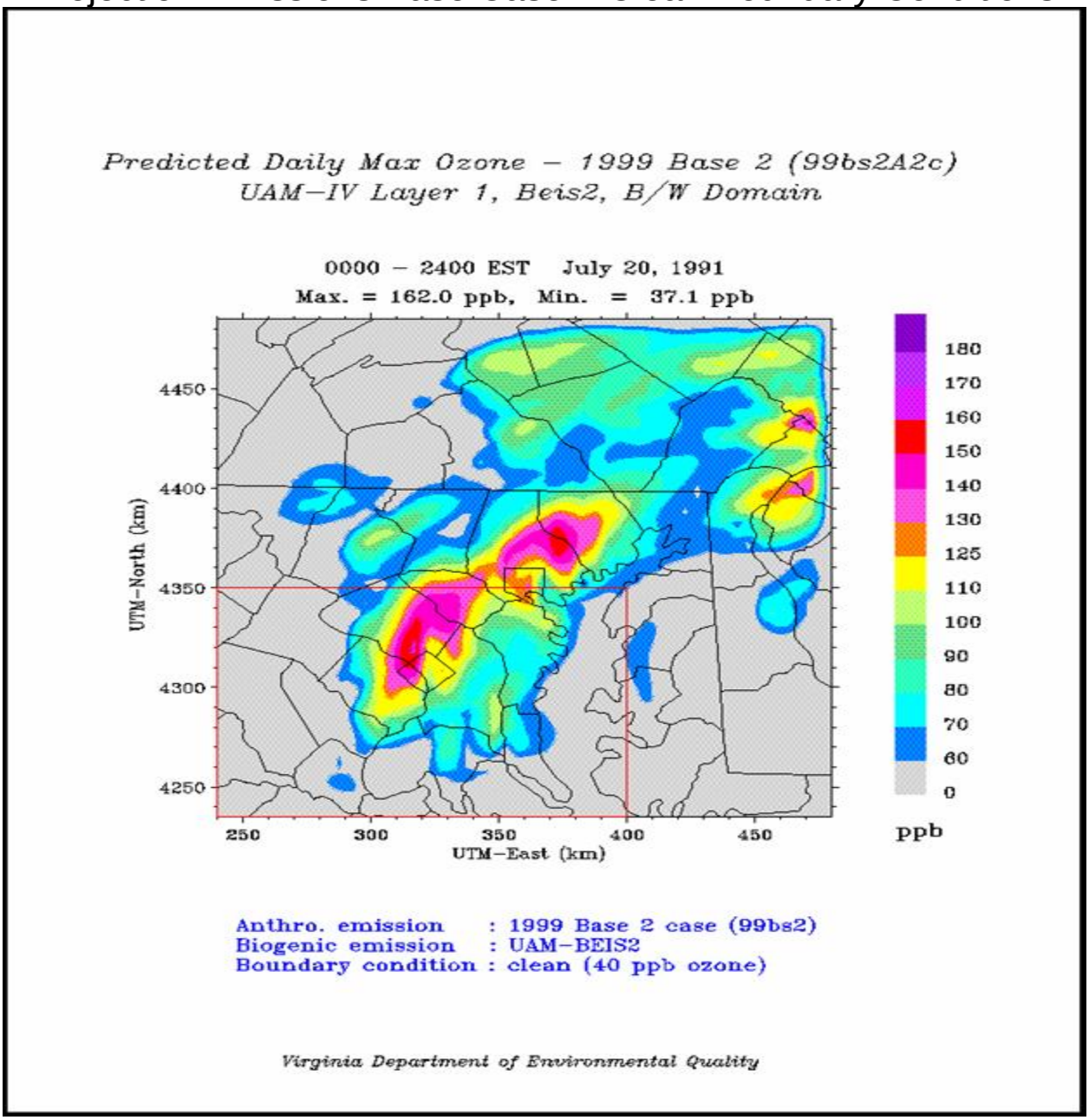
Meteorology: July 20,1991
Man-made emissions model used: UAM IV
Biogenic Emissions Model: BEIS2
Conditions inside the Domain: All CAA controls through 1999 plus OTC NOx controls
Boundary Conditions: OTAG Case I
Period: 24 hours Domain Max: 189.4 ppb Wash. Subdomain Max: 178.5

Figure 11-9
Relative Difference between 1991 & Projection Ozone Levels



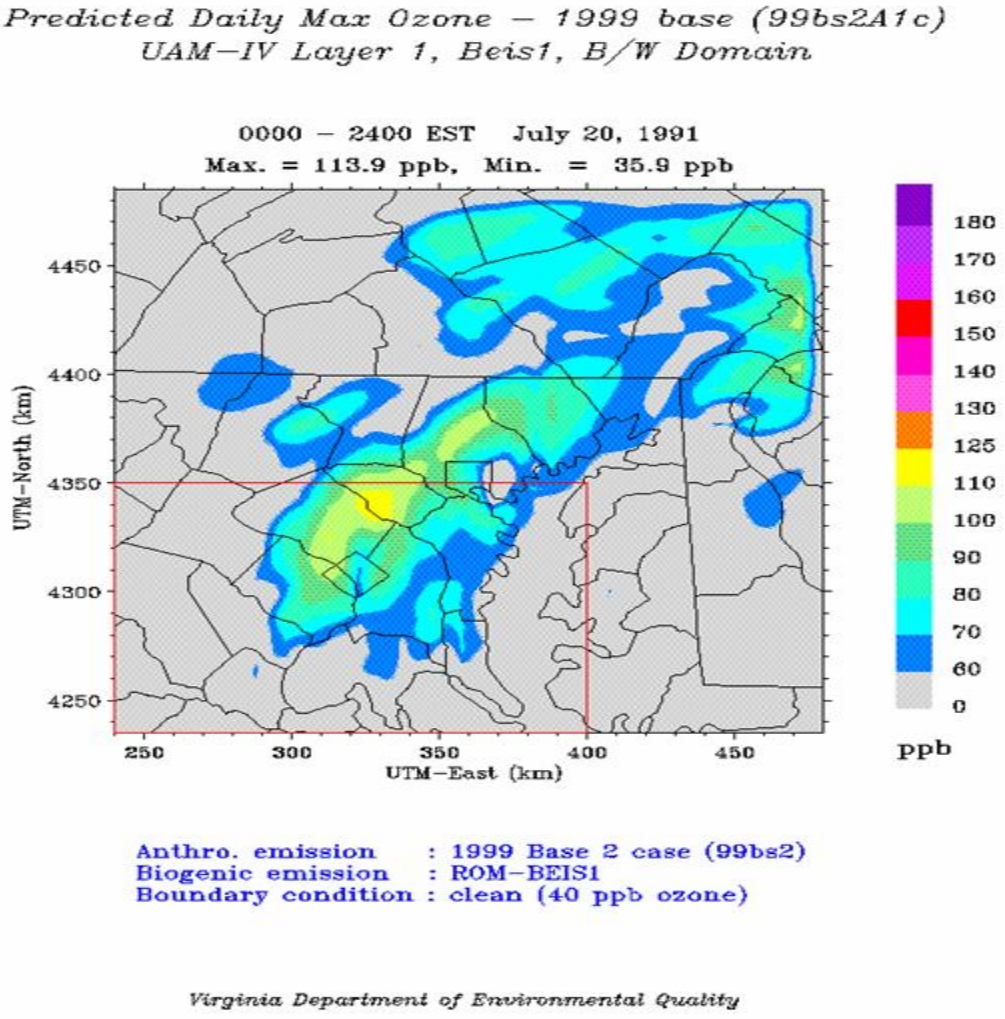
Meteorology: July 20,1991
Man-made emissions model used: UAM IV
Biogenic emissions model: BEIS2
Conditions inside the Domain: All CAA controls through 1999
Boundary Conditions: OTAG Case I
Period: 24 hours Domain Max: N/A Wash. Subdomain Max: N/A

Figure 11-10
Predicted Daily Ozone Maximum
Projection Emissions Base Case - Clean Boundary Conditions



Meteorology: July 20,1991
Man-made emissions model used: UAM IV
Biogenic Emissions Model: BEIS2
Conditions inside the Domain: All CAA controls through 1999 plus OTC NOx controls
Boundary Conditions: Assumed to be clean - only 40 ppb (background)
Period: 24 hours Domain Max: 162.0 ppb Wash. Subdomain Max: N/A

Figure 11-11
Predicted Daily Ozone Maximum
Projection Emissions Base Case - Clean Boundary Conditions
Lower Biogenic Emissions



Meteorology: July 20,1991
Man-made emissions model used: UAM IV
Biogenic Emissions Model: BEIS1 (under-predicts contribution of biogenics)
Conditions inside the Domain: All CAA controls through 1999 plus OTC NOx controls
Boundary Conditions: Assumed to be clean, 40 ppb (background level)
Period: 24 hours Domain Max: 113.9 ppb Wash. Subdomain Max: N/A

11.5 Regional Modeling: Tools and Results

In addition to the local modeling, efforts have been underway to model ozone formation at a multi-state regional level. In the early 1990's EPA in cooperation with the Ozone Transport Commission began examining the movement of ozone affecting the states from Virginia to Maine. Those earlier efforts led EPA and many states to the understanding that ozone in one state could be the result of ozone-causing emissions in other states many miles away.

To assist states east of the Mississippi River in better understanding and reducing ozone transport which led to nonattainment of the one-hour ozone standard, EPA, the National Governors Association (NGA) and the Environmental Council of the States (ECOS) formed the Ozone Transport Assessment Group (OTAG). This national workgroup, composed of representatives from 37 eastern states and the District of Columbia with other interested stakeholders from industry and environmental groups, worked to develop consensus solutions to the problem. For over two years, this informal association conducted modeling, reviewed ozone monitor readings and studied measures which would enable attainment and maintenance of the ozone standard in the OTAG region.[4] In June 1997 OTAG released its final report and forwarded recommendations to EPA on how best to reduce the effect of ozone transport on the Northeastern states.

After studying the recommendations of OTAG, EPA proposed a series of state-by-state limits on the emission of NOx (NOx budgets). These budgets, which are to be implemented by 2004, are intended to reduce the ozone transport and permit most nonattainment areas to achieve the one-hour ozone standard. Using a combination of monitored data and OTAG model results, EPA predicted the new ozone levels in nonattainment areas in the eastern states once the proposed regulations are implemented. This analysis predicts that the Washington area will attain the one-hour ozone standard once transport is reduced.

In summary, using monitored data for the period 1994-1996, EPA determined the design value for each county in the Washington Nonattainment Area.[5] The highest county design value becomes the design value for the region. The change in this design value after implementation of measures to reduce transport was then predicted using the results of the OTAG modeling efforts. Basically, the average reduction in ozone levels modeled under three different high ozone weather episodes was applied to the monitored design value to predict the new design value. A more detailed description of the methodology is contained in Appendix I. Since the predicted design value for the Washington nonattainment area is below 125 ppb, the area is predicted to be in attainment. The monitored and predicted design values are shown in Tables 11-7 and 11-8.

Table 11-7
Predicted 1-Hour Ozone Design Value for the Washington Nonattainment Area After Addressing Ozone Transport

Design Value 1994-1996	126 ppb
Predicted Design Value	108 ppb

Source: EPA Worksheet, 3-6-98 as adjusted by COG, Appendix D

Table 11-8
Predicted 1-Hour Ozone Design Value for Each County in the Washington Nonattainment Area After Addressing Ozone Transport

State/County	**Design Value 1994-1996**	**Predicted Design Value**
District of Columbia	125 ppb	107 ppb
Maryland		
Calvert	94 ppb	79 ppb
Charles	109 ppb	90 ppb
Montgomery	119 ppb	100 ppb
Prince George's	124 ppb	110 ppb
Virginia		
City of Alexandria	118 ppb	99 ppb
Arlington	126 ppb	108 ppb
Fairfax	120 ppb	106 ppb
Prince William	109 ppb	92 ppb
Stafford	109 ppb	92 ppb

Source: EPA Worksheet, 3-6-98 as adjusted by COG, Appendix D

11.6 Development of the Modeling Emissions Inventory

Developing emissions inventories for the modeling domain is a crucial step in the modeling process. This chapter presents the steps followed to obtain base case and projected ozone precursor emission inventories. The projection inventory was prepared in 1997 based upon then available information on 1999 conditions. This inventory differs from the estimate of the 1999 inventory contained in the April 1999 Revised Phase I Plan.

The first step was to develop a 1990 base case inventory of ozone precursor emissions. Then the 1990 emissions were backcasted to 1988 and forecasted to 1991 using growth factors from the Bureau of Economic Analysis (BEA). The BEA data used in the growth factor development were found in the EPS 2.0 system. Growth factors were then applied to the 1990 inventory to project future year (e.g., 1999) emissions if no controls had been implemented. Next, emission reductions resulting from implementation of control measures are determined, and subtracted from the future year uncontrolled emissions to determine the projected level of emissions for that year. The resulting emission inventory reflects expected emissions in the projected year given a historic base year, growth assumptions that have been adopted by the region, and control measures expected to be in place in the projected year.

Tables 11-9 and 11-10 below present a summary of the VOC and NOx emission inventories for the 1990 base case year and the projected uncontrolled inventory, the emission reductions expected (in 1997) due to control measures implemented by the Phase I Attainment plan, and the resulting projected controlled inventory. These figures represent anthropogenic ozone precursor emissions in the Washington DC-MD-VA nonattainment area. The figures serve as the basis for the modeling inventories used in preparation of this document. Following the tables is a detailed explanation of each of the inventories.

Table 11-9
Summary of VOC Emissions (tons/day)
Washington DC-MD-VA Nonattainment Area

	1990 Base Case Emissions	Projected Uncontrolled Emissions	Projected Emission Reductions	Projected Controlled Emissions
Point	14.6	17.2	1.6	15.6
Area	191.2	211.9	58.1	153.8
Non-Road	70.4	83.1	16.3	66.8
On-Road	251.1	205.7	82.2	123.5
Total	527.3	517.9	158.2	359.7

Source: Original Phase II attainment Plan (April 10, 1998)

Table 11-10
Summary of NOx Emissions (tons/day)
Washington DC-MD-VA Nonattainment Area

	1990 Base Case Emissions	Projected Uncontrolled Emissions	Projected Emission Reductions	Projected Controlled Emissions
Point	334.8	346.1	175.0	171.1
Area	47.3	55.7	1.4	54.3
Non-Road	85.0	99.4	6.3	93.1
On-Road	261.7	261.8	65.0	196.8
Total	728.8	763.0	247.7	515.3

Source: Original Phase II attainment Plan (April 10, 1998)

11.7 The 1990 Inventory

As required by the CAAA, a 1990 base-year emissions inventory was created for the Washington, DC-MD-VA nonattainment area. This document, titled "1990 Base Year Emissions Inventory for Stationary Anthropogenic, Biogenic Sources and Highway Vehicle Emissions of Ozone Precursors in the Washington, DC-MD-VA Metropolitan Statistical Nonattainment Area," (Sept. 22, 1993), was prepared for the District of Columbia, Maryland and Virginia by COG under the auspices of MWAQC. The document addresses emissions of volatile organic compounds (VOCs), oxides of nitrogen (NOx), and carbon monoxide (CO) on a typical summer ozone season weekday. Included in the inventory are stationary, area, non-road and mobile anthropogenic (man-made) sources and biogenic (naturally occurring) sources of ozone precursors.

The emissions inventory covers the Washington DC-MD-VA nonattainment area (identical to the Metropolitan Statistical Area, or MSA, which is classified as a serious nonattainment area for ozone by the U.S. Environmental Protection Agency (EPA.) The 1990 emissions inventory is the starting point for calculating the emissions reduction requirement needed to meet the rate-of-progress reduction requirements for man-made sources of emissions through 1999, as prescribed for serious nonattainment areas by the 1990 CAAA.

In 1997 and 1998, after publication of the 1990 inventory, modifications were made to the emissions estimates for VOCs and NOx for point, area, mobile, and non-road sources. These changes were due to improvements in inventory estimation techniques, the availability of more accurate data, revised estimates of population and employment, and other technical improvements. Changes to the 1990 base-year inventory are important to the air quality planning process, since any changes will thread their way through the chain of calculations that ultimately determines the magnitude of emission reductions that will be required in future target

years.

This 1990 inventory, as revised in 1997 (prior to the start of modeling), was used as a benchmark for creating a 1990 inventory used for modeling purposes. (Note: Changes made for the 1998 revisions to the 15% Plan occurred too late to be used for the UAM model). More specifically, development of the base case point, area, off-road, and mobile source modeling inventories for the Washington DC-MD-VA ozone nonattainment area were derived by extracting 1990 SIP emissions from the USEPA Aerometric Information Retrieval System (AIRS). This produced an emission inventory that is readable by the UAM. Next, these figures were verified for consistency with the inventory documented in the region's Phase I Attainment Plan (1997), and corrections were made to the modeling inventory as necessary to achieve consistency. The result is a 1990 modeling inventory that differed from the Phase I Attainment Plan (1997) inventory by no more than ten percent.

The 1990 base-year inventories for VOC and NOx in the Washington DC-MD-VA area are reported in Tables 11-11 and 11-12. For areas outside the nonattainment area, the OTAG emission inventories were used. Following the tables is a discussion of emissions by source category.

Table 11-11
1990 Anthropogenic Base-Year VOC Inventory (Tons/Day)
Used for Modeling

	District of Columbia	Maryland	Virginia	Total
Point	1.0	5.5	8.1	14.6
Area	20.0	94.2	77.0	191.2
Non-Road	5.5	32.1	32.8	70.4
Mobile	33.6	110.1	108.4	251.1
Total	59.1	240.2	228.0	527.3

Source: Original Phase II attainment Plan (April 10, 1998)

Table 11-12
1990 Anthropogenic Base-Year NOx Inventory (Tons/Day)
Used for Modeling

	District of Columbia	Maryland	Virginia	Total
Point	7.6	267.4	59.8	334.8
Area	3.4	15.8	28.1	47.3
Non-Road	5.5	43.5	36.0	85.0
Mobile	25.8	129.1	106.8	261.7
Total	42.3	455.8	230.7	728.8

Source: Original Phase II attainment Plan (April 10, 1998)

11.7.1 Point Sources

For emissions inventory purposes point sources are defined as stationary, commercial, or industrial operations that emit more than 10 tons per year (tons/year) of VOCs or 100 tons/year or more of NOx or CO. The point source inventory consists of actual emissions for the base-year 1990 and includes sources within the geographical area of the Washington DC-MD-VA nonattainment area. The states of Maryland and Virginia and the District of Columbia are responsible for compiling and submitting point source emission estimates.

11.7.2 Area Sources

Area sources are sources of emissions too small to be inventoried individually and which collectively contribute significant emissions. Area sources include smaller stationary point sources not included in the states' point source inventories such as printing establishments, dry cleaners, and auto refinishing companies, as well as non stationary sources.

Area source emissions typically are estimated by multiplying an emission factor by some known indicator of collective activity for each source category at the county (or county-equivalent) level. An activity level is any parameter associated with the activity of a source, such as production rate or fuel consumption that may be correlated with the air pollutant emissions from that source. For example, the total amount of VOC emissions emitted by commercial aircraft can be calculated by multiplying the number of landing and takeoff cycles (LTOs) by an EPA-approved emission factor per LTO cycle for each specific aircraft type.

Several approaches are available for estimating area source activity levels and emissions. These include apportioning statewide activity totals to the local inventory area and using emissions per

employee (or other unit) factors. For example, solvent evaporation from consumer and commercial products such as waxes, aerosol products, and window cleaners cannot be routinely determined for many local sources. The per capita emission factor assumes that emissions in a given area can be reasonably associated with population. This assumption is valid over broad areas for certain activities such as dry cleaning and small degreasing operations. For some other sources an employment based factor is more appropriate as an activity surrogate.

11.7.3 Mobile Sources

Emissions from mobile sources were derived from the use of the Metropolitan Washington Council of Governments' travel demand forecasting procedure, which simulates vehicle travel across the region's transportation system. Travel was simulated on all highways in the region, including both volume and speed of travel for each hour of the day. An EPA emissions model, MOBILE5a, was used to determine the emissions characteristics of the vehicle fleet in place in the year 1990. Input for this emissions model includes locally specific information such as age distribution of registered vehicles, evaporation characteristics of motor fuel, and temperature data. The general equation for the estimation of mobile sources is:

(Travel Component) x (Emission Factor) = Emissions

Emissions accounted for in the mobile source inventory include

Origin:	Emissions include excess "cold start" emissions occurring during the first few minutes of vehicle operation.
Running:	Emissions occurring on local streets and on the region's network of arterial streets and expressways.
Destination:	Evaporative or "hot soak" emissions occurring at the conclusion of a vehicle trip after the engine is turned off.
Diurnal:	Evaporative emissions occurring when the vehicle is at rest due to temperature fluctuations.
Resting Loss:	Emissions due to the permeation of fuel through hoses and fittings.
Auto Access:	Emissions attributable to auto trips to Metrorail stations or to park-and-ride lots.
Bus:	Bus emissions, i.e., Metrobus, Ride-on, etc.

Not all of the Washington DC-VA-MD MSA were covered by the regional transportation model used to generate the mobile emissions contained in the 1990 inventory. For outlying parts of the air quality planning area, more manual calculation methods were used, based on locally developed travel estimates.

11.7.4 Non-Road Vehicle and Engine Sources

Emissions from this category were obtained from a 1991 EPA contractor's report titled, "Non-Road Engine and Vehicle Emission Inventories for CO and Ozone Nonattainment Boundaries, Washington, D.C. MSA."

To construct the EPA non-road inventory, several factors were estimated: (1) equipment populations in the nonattainment area; (2) annual hours for use of each type of equipment, adjusted for geographic region and for the season of interest for each pollutant studied; (3) average rated horsepower for each type of equipment; (4) typical load factor for each type of equipment; and (5) an emission factor for each of the 79 categories of equipment.

In developing emissions inventories for non-road engines and vehicles EPA used the following formula:

M = N x HRS x HP x LF x EF, where

M	=	mass of emissions of pollutant during inventory period
N	=	source population
HRS	=	annual hours of use
HP	=	average rated horsepower
LF	=	typical load factor
EF(i)	=	average emissions of pollutant per unit of use (e.g., emission factor grams per horsepower-hour)

The product of the annual hours of use, the average rated horsepower, and the load factor is referred to as the per-source usage rate. The product of the equipment population and the per-source usage rate is referred to as the activity level, and is estimated in units of horsepower-hours. By multiplying the seasonally adjusted activity levels by the appropriate emission factor, emission estimates for an ozone season day were developed for each category of non-road equipment and vehicles in the EPA-prepared inventories.

The EPA estimates as provided in the report did not accurately reflect the 1990 summer Reid Vapor Pressure (RVP) of 8.3 psi nor the proper activity split between the weekend and weekday use of recreational boating and lawn and garden equipment. The EPA document reported that a 10.5 psi RVP was used in their analysis. The EPA estimates for the region were adjusted for the RVP and activity split by the Maryland Department of the Environment.

11.7.5 Biogenic Emissions

An important component of the modeling inventory is biogenic emissions. Biogenic emissions are those resulting from natural sources. Biogenic emissions are primarily VOCs that are released from vegetation throughout the day. Biogenic emissions of NOx include lightning and forest fires. A computer model has been used to estimate biogenic emissions in the modeling domain. Two

versions of the model have been used - BEIS1 and BEIS2. EPA has recommended that states use BEIS1 with UAM-4 for attainment demonstrations. OTAG has applied BEIS2 for its modeling due to the fact that BEIS2 is an advanced version of the model. In order to be consistent with the modeling, the most of the modeling analysis is based on the results of the BEIS2 biogenics inventory.

Biogenic emissions are not included in the emission summary tables in this section of the report. The BEIS emission inventories for the Washington nonattainment area are shown in Table 11-13.

Table 11-13
Estimated Biogenic Emissions within the Washington Nonattainment Area
tons per day

	VOC	NOx
BEIS 1	376	NA
BEIS 2	720.0	7.4

Source: Virginia Department of the Environment, Biogenic Emissions Estimates (PC-BEIS2.2 Analyses) for July 16, 1991

11.8 The Projection Inventory

Modeling simulations were conducted using the projection inventory in order to 1) evaluate the effectiveness of emission reductions adopted in the Phase I Attainment Plan; 2) examine the influence of transport across the inflow boundaries on ozone concentrations in the domain; and 3) to identify additional controls needed to bring the area into attainment with the 1-hour ozone standard.

Two future emissions scenarios were simulated to estimate the benefits of the proposed emission reduction strategies for the Washington DC-MD-VA nonattainment area. The first scenario projected 1999 emissions given all control measures identified by the Phase I Attainment Plan. The second scenario added Phase II OTC-MOU NOx controls.

To develop these projection emission inventories in 1997, local growth and control factors were applied to the base case emissions inventory discussed in the previous section. The growth factors are those used in the 1997 version of the Phase I Plan.

The Baltimore-Washington UAM domain covers six states and the District of Columbia. Local growth and control factors are not available for the portion of the domain that covers Pennsylvania, New Jersey, Delaware, and West Virginia for 1999. For these areas, OTAG 2007 base case emissions inventories were used for 1999 modeling.
For rural Virginia counties located outside the Washington DC-MD-VA nonattainment area, BEA growth factors were used to grow point, area and non-road emission inventories. No control

measures were applied to these counties. For Maryland counties outside the nonattainment area, the Maryland Department of the Environment provided growth and control factors for point, area, and non-road sources.

The remainder of this section discusses the process followed to determine the projected inventories for the Washington DC-MD-VA nonattainment area. The projected uncontrolled inventory is derived by applying the appropriate growth factors to the 1990 Base-Year Emissions Inventory. EPA guidance describes four typical indicators of growth. In order of priority, these are product output, value added, earnings, and employment.

Surrogate indicators of activity, for example population growth, are also acceptable methods. Round 5.3 Cooperative Forecasting results, which are prepared and officially adopted by the Metropolitan Washington Council of Governments (COG), were used to project emissions (population, household and employment projections) from area and nonroad sources. Earnings data based upon Bureau of Economic Analysis (BEA) factors were also used to project three area sources in Maryland: surface cleaning, industrial product coating, and graphic arts. The Economic Growth Analysis System (EGAS) model was used by all three jurisdictions to project growth in point source emissions.

11.8.1 Growth Factor Methodology

Growth rates for most area source categories are derived from the projection of population, households, and employment made by local land use planners and compiled by COG in their cooperative forecasting process. Using cooperative forecasts is consistent with EPA guidance on preparing emission projections.

11.8.1.1 Growth Projection Methodology for Point Sources - EGAS

The growth in point source emissions is projected using EGAS version 2.0 The 1990 point source emissions are provided from the state data sources and the model is run with the following options selected: projections are run by Source Classification Code; the Bureau of Labor Statistics national economic forecast; and the baseline regional economic forecast. Point source emission projection using EGAS are contained in Appendix C of the Phase I Plan.

11.8.1.2 Growth Factor Methodology- Area and Non-Road Sources

Base-year area and non-road source emissions for 1990 were calculated using 1990 population, household, and employment data. Thus, the 1990 to 1999 growth factors were derived by dividing Round 5.3 population, household, and employment forecasts for 1999 by actual 1990 population, household, and employment values for the region. This method produced the growth factors used for the projection inventory presented in Table 11-14. The growth factors were applied to emissions categories by specific jurisdictions. The states supplied gasoline sales data. These factors are also presented in Table 11-14.

Table 11-14
1990-1999 Growth Factors

Jurisdiction	Employment	Population	Household	Gas Use
District of Columbia	0.958	0.890	0.901	1.000
Calvert County	1.269	1.413	1.434	1.1
Charles County	1.110	1.323	1.313	1.1
Frederick County	1.467	1.319	1.371	1.1
Montgomery County	1.058	1.124	1.106	1.1
Prince George's County	1.120	1.102	1.131	1.1
Arlington County	1.250	1.110	1.132	1.1
City of Alexandria	1.015	1.074	1.079	1.1
Fairfax County	1.209	1.135	1.146	1.1
Loudoun County	1.468	1.617	1.563	1.1
Prince William County	1.263	1.269	1.273	1.1
Stafford County	1.695	1.229	1.269	1.1
Maryland Aggregate	1.111	1.148	1.157	1.1
Virginia Aggregate	1.217	1.180	1.183	1.1
Nonattainment Aggregate	1.101	1.121	1.123	n/a

Source: Original Phase II attainment Plan (April 10, 1998)

The 1999 emissions for area and non-road sources are calculated by multiplying the 1990 base-year area and non-road emissions by growth factors developed from the Round 5.3 Cooperative Forecasts. Each area and non-road source category was matched to an appropriate growth surrogate based on the activity used to generate the base-year emission estimates. Surrogates were chosen as follows:

Surface Coating - population growth was chosen since the 1990 emissions are based on population-based emission factors.

Commercial/Consumer Solvent Use - population was chosen as the growth surrogate since 1990 emissions are based on per capita emission factors.

Vehicle Fueling and Underground Tank Breathing - all gasoline marketing categories were based on gasoline sales projections since this is the activity level used to determine base-year emissions.

Open Burning - zero growth was applied since open burning emissions in the Washington region are predominately related to land clearing and the number of acres available for open burning will not increase between 1990 and 1999.

Dry Cleaning - population was chosen as the surrogate since base-year emissions are estimated using per capita emission factors.

Graphic Arts - population was used to estimate growth since emissions are based on per capita emission factors.

Surface Cleaning - growth in employment was chosen as the surrogate since emissions are based on employment in auto repair, manufacturing, and electronic industries.

Tank Truck Unloading - growth in gasoline sales was applied to this category since base-year emissions are calculated using gasoline sales growth factors.

Municipal Landfills - population was chosen as the surrogate for this category. Base-year emissions are estimated using data on total refuse deposited. This landfill-specific data is not available for 1999, so population was chosen as a surrogate since the deposited waste is from the general population rather than industrial facilities.

Asphalt Paving - population was chosen as the surrogate since base-year emissions are calculated using per capita emission factors.

Bakeries - population was chosen as the surrogate.

Leaking Underground Storage Tanks - zero growth was applied to this category. The number of remediations during the ozone season, used to generate base-year emissions, does not directly correlate to population, households, or employment growth. The number of underground tanks is not expected to increase between 1990 and 1999.

Commercial Aviation - projections of 1999 landing and takeoff cycles were not available. Since commercial aviation activity in the region generally increases and decreases with the level of economic activity, employment growth was chosen as the surrogate.

Lawn and Garden Equipment - employment growth was chosen since the majority of lawn and garden emissions are the result of commercial lawn and garden activities.

Airport Support Equipment - data directly related to the activity level (number of itinerant air carrier operations) were not available. Since commercial aviation activity generally increases and decreases with economic activity, employment was chosen as the surrogate.

Off-Highway Vehicles - population growth was chosen as the surrogate since projected estimates of future activity (e.g., number of motorcycle dealer establishments) are not available.

Recreational Boating - since forecasts of the future marine engine population are not available, population was chosen as the surrogate for projecting emissions.

Industrial Equipment - employment was chosen as the growth surrogate since emissions from this category are directly related to industrial activity.

Construction Equipment - emissions are related to total construction activity. Since reliable forecasts of construction equipment activity for 1999 are not readily available, total regional employment growth was chosen as the surrogate.

Agricultural Equipment - since the number of acres of land devoted to agricultural uses is not likely to increase between 1990 and 1999, a growth factor of 1.000 was applied.

Logging Activities - since the number of persons engaged in logging activities is not likely to increase between 1990 and 1999, a growth factor of 1.000 was applied.

11.8.1.3 Growth Projection Methodology- Mobile Sources

The mobile source 1990 Base-Year Inventory used for the attainment modeling was projected to 1999 by transportation modeling techniques using the MOBILE5a emissions factor model on the 1999 planned highway network. Appropriate population, household, and employment growth are input through the Round 5.3 Cooperative Forecasting techniques. After projection of the emissions without controls, emission factors for 1999 conditions are used in subsequent MOBILE5a runs to estimate sequentially the effect of each mobile source control measure on future emissions

11.8.1.4 Biogenic Emission Projections

Biogenic emission inventories for 1999 are the same as those used for the base-case for the entire domain. As discussed previously, these were derived from BEIS1 and BEIS2 processors.

11.8.1.5 Offset Provisions and Point Source Growth

The Act requires that emission growth from major stationary sources in nonattainment areas be offset by reductions that would not otherwise be achieved by other mandated controls. The offset requirement applies to all new major stationary sources and existing major stationary sources that have undergone major modifications. Increases in emissions from existing sources resulting from increases in capacity utilization are not subject to the offset requirement. For the purposes of the offset requirement, major stationary sources include all stationary sources exceeding an applicable size cutoff. In the Washington region these cutoffs equal to 50 tons per year of VOC or NOx.

11.8.2 Actual vs. Allowable Emissions in Development of the 1999 Projected Emissions Inventory

For the purposes of calculating projection emissions inventories, EPA guidance specifically outlines the circumstances under which emissions projections are to be based on actual or allowable emissions. For sources or source categories that are subject to a pre-1990 regulation and the state does not anticipate subjecting the source to additional regulation, emissions projections should be based on actual emissions levels. Actual emissions levels should also be used to project for sources or source categories that were unregulated as of 1990. For sources that are expected to be subject to post-1990 regulation, projections should be based on new allowable emissions.

To simplify comparisons between the base-year and the projected year, EPA guidance states that comparison should be made only between like emissions: actual to actual, or allowable to allowable, not actual to allowable. Therefore, all base-year and all projection-year emissions estimates are based on actual emissions.

The term "actual emissions" means the average rate, in tons per year, at which a source discharged a pollutant during a two year period, which preceded the date or other specified date, and which is representative of normal source operation. Actual emissions are calculated using the source's operating hours, production rates, and types of material processed, stored, or combusted during the selected time period.

"Allowable emissions" are defined as the maximum emissions a source or installation is capable of discharging after consideration of any physical, operations, or emissions limitations required by state regulations or by federally enforceable conditions, which restrict operations and which are included in an applicable air quality permit to construct or permit to operate, secretarial order, plan for compliance, consent agreement, court order, or applicable federal requirement.

11.9 Projection Inventory Results

The VOC and NOx projection emission inventory results with no control measures applied are summarized by component of the inventory in Tables 11-15 and 11-16 below.

Table 11-15
Projected Uncontrolled VOC Inventory (tons/day)
Used in UAM Modeling
Washington Nonattainment Area

Emission Source	Maryland	Virginia	District of Columbia	Total
Point	6.2	9.9	1.1	17.2
Area	103.7	90.1	18.1	211.9
Non-road	37.4	40.5	5.2	83.1
Mobile	91.4	91.2	23.1	205.7
Total	238.7	231.7	47.5	517.9

Source: COG and state air agencies, 1997

Table 11-16
Projected Uncontrolled NOx Inventory (tons/day)
Used in UAM Modeling
Washington Nonattainment Area

Emission Source	Maryland	Virginia	District of Columbia	Total
Point	278.6	59.9	7.6	346.1
Area	18.5	34.1	3.1	55.7
Non-road	50.4	43.8	5.2	99.4
Mobile	129.0	111.0	21.8	261.8
Total	476.5	248.8	37.7	763.0

Source: Phase I Attainment Plan, October 1997

11.10 Emission Reductions from Control Measures

The Phase I Plan describes the control measures that have been or will be implemented by 1999 that will reduce emissions to meet the rate-of-progress requirements. The control measures are required by Federal or State regulations. They serve as the basis for determining the 1999 controlled modeling inventory. A user specified control factors file was applied to the 1999 uncontrolled

modeling inventory. The file was basically a direct translation of the control regulations and emission reductions adopted in the Phase I Plan into source categories and control percentages. The result is a 1999 projected inventory assuming control measures are in place.

Table 11-17 presents the projected 1999 emission reductions resulting from implementation of the control measures. Below is a list of the measures. Chapter 5 presents detailed information on the measures and the projected reductions from each.

Non-CTG VOC RACT to 50 tons per year
State Nox RACT requirements
Expanded State VOC source regulations to 25 tons per year
Phase II Nox requirements
Stage II vapor recovery
Reformulated gasoline refueling benefits
Reformulated surface coatings
Reformulated consumer products
Surface cleaning/degreasing for machinery/auto repair
Landfill regulations
Seasonal open burning restrictions
Stage I expansion (Tank truck unloading)
Vehicle Inspection/Maintenance
Tier I vehicle standards
Reformulated gasoline (on-road)
Transportation control measures
Non-road gasoline engines rule
Non-road diesel engines rule
Reformulated gasoline (off-road)

Table 11-17
VOC Emission Reductions from Control Measures (tons/day)
Used in UAM Modeling
Washington Nonattainment Area

Emission Source	Maryland	Virginia	District of Columbia	Total
Point	0.7	0.9	0	1.6
Area	28.9	25.9	3.3	58.1
Non-road	7.4	7.9	1.0	16.3
Mobile	36.2	37.8	9.3	82.2
Total	73.0	72.5	13.5	159.2

Source: Phase I Attainment Plan, October 1997
Small discrepancies may result due to rounding.

Table 11-18
NOx Emission Reductions from Control Measures (tons/day)
Used in UAM Modeling
Washington Nonattainment Area

Emission Source	Maryland	Virginia	District of Columbia	Total
Point	136.1	35.0	3.9	175.0
Area	0.8	0.6	0.0	1.4
Non-road	3.3	2.7	0.3	6.3
Mobile	32.5	27.6	4.9	65.0
Total	172.6	42.9	9.1	247.7

Source: Phase I Attainment Plan, includes reductions from Regional NOx regulations, October 1997
Small discrepancies may result due to rounding.

11.11 Projected Controlled Emissions

The projection of controlled emissions is simply the 1999 uncontrolled emissions minus the emission reductions achieved from the control measures implemented by the Phase I Plan. This information is presented in Table 11-19 and 11-20.

Table 11-19
Projected Controlled VOC Emissions (tons/day)
Used in UAM Modeling
Washington Nonattainment Area

Emission Source	Maryland	Virginia	District of Columbia	Total
Point	5.5	9.0	1.1	15.6
Area	74.8	64.2	14.8	153.8
Non-road	30.0	32.6	4.2	66.8
Mobile	55.2	53.4	13.8	123.5
Total	165.5	159.2	33.9	359.7

Source: Phase I Attainment Plan, October 1997
Small discrepancies may result due to rounding

Table 11-20
Projected Controlled NOx Emissions (tons/day)
Used in UAM Modeling
Washington Nonattainment Area

Emission Source	Maryland	Virginia	District of Columbia	Total
Point	142.5	47.9	3.7	171.1
Area	17.7	33.5	3.1	54.3
Non-road	47.1	41.1	4.9	93.1
Mobile	96.5	83.4	16.9	196.8
Total	303.8	205.9	28.6	515.3

Source: Phase I Attainment Plan plus reductions from regional NOx controls, October 1999

11.12 EPA's Tier2 Modeling Results

EPA undertook a photochemical modeling study to estimate the effects (benefits) of Tier 2 regulations on ozone levels in 2007 and 2030.[6] This study concluded that the design value of Washington region would come down to 116 ppb in 2007 after Tier 2 regulations are implemented by that year. The study also concluded that even in the absence of Tier 2 regulations, design value would come down to 117 ppb taking into account other federal and state control measures planned to be taken by that time in this region. Since design value will be reduced by 15 ppb (131-116) in 5 years period (2002-2007), it seems plausible that by year 2005 (3 years from 2002) design value in the Washington region will be below 125 ppb (one-hour ozone NAAQS).

11.13 Weight of Evidence Tests

Urban Airshed model (UAM-IV) has inherent uncertainties. Over or under prediction may result from uncertainties associated with emission inventories, meteorological data, and representation of ozone photochemistry in the model. Previous photochemical modeling performed for the Washington region using UAM-IV model over predicted ozone levels. Therefore, EPA guidance provides for other evidence (Weight of Evidence) to address these model uncertainties so that proper assessment of the probability to attain one-hour ozone standard can be made.

There were two Weight of Evidence tests employed to test the potential of Washington region to attain the one-hour standard in 2005. They were:

- Attainment Year Design Value Test and,
- Relative Rate of Reduction Test

Details of each of these two tests are being provided below.

11.13.1 Attainment Year Design Value Test

Design value was calculated for the attainment year 2005 using a procedure suggested by EPA, which utilized previous photochemical modeling results for the region. Therefore it is a not an independent test, rather it utilizes the modeling results to project future year design value. Attainment year design value is calculated using following formulae:

Attainment Year Design Value = Base Year Design Value * RRF

Where, RRF = Relative Reduction Factor

Relative reduction factor is the ratio of modeled 1-hour maximum ozone concentrations of attainment and base case years. These two values were calculated from the previous modeling outputs referred above in the discussion. As the modeling runs were performed for three episode days in July 1991 specifically, July 16th, 19th, and 20th, there were three corresponding 1-hour maximum ozone levels modeled by the UAM-IV model. These three modeled value were averaged. Similarly, the three corresponding base case year monitored 1-hour maximum ozone levels were also averaged. The ratio of these two average values provided the RRF.

$$RRF = \frac{\text{Three day average of the attainment year 1-hour maximum ozone level (modeled)}}{\text{Three day average of the base case year 1-hour maximum ozone level (modeled)}}$$

$$= \frac{155.7}{177.7} = 0.88 \text{ (Based on July 1991 modeling)}$$

July 1991 modeling utilized inventories, which had Mobile5a based mobile source inventories in it. Severe Area SIP mobile inventories are created based on the Mobile6 model and so there are differences in both base case and attainment year inventories for mobile sources. Besides this emissions from other source categories were also changed based on the latest information available. This has led to differences in the total Severe Area SIP inventory for both base case and attainment years. While the new total base case year inventory is higher compared to the one used in the modeling study, attainment year inventory is lower in comparison (See Table 11-21 below).

Table 11-21
Comparison of Photochemical Model and Severe Area SIP Inventories for Base Case and Attainment Years

Base Case Year Controlled Emissions- VOC					Attainment Year Controlled Emissions- VOC			
Source	**Photo Chemical Model Inventory (Base Case Year)**	**Severe Area Emissions (Base Case Year)**	**Diff (%)**		**Source**	**Photo Chemical Model Inventory (Attainment Year)**	**Severe Area Emissions (Attainment Year)**	**Diff (%)**
Point	14.6	15.0	2.7		Point	15.6	16.2	3.8
Area	191.2	191.1	-0.1		Area	153.8	147.3	-4.2
Nonroad	70.4	73.4	4.3		Nonroad	66.8	68.2	2.1
On-road	251.1	299.2	19.2		On-road	123.5	97.4 *	-21.1
Total	**527.3**	**578.7**	**9.7**		**Total**	**359.7**	**325.8****	**-9.4**
Base Case Year Controlled Emissions- NOx					**Attainment Year Controlled Emissions- NOx**			
Point	334.8	361.4	7.9		Point	171.1	109.8	-35.8
Area	47.3	47.7	0.8		Area	54.3	60.4	11.1
Nonroad	85.0	79.5	-6.5		Nonroad	93.1	82.8	-11.1
On-road	261.7	380.8	45.5		On-road	196.8	234.7 *	19.3
Total	**728.8**	**869.4**	**19.3**		**Total**	**515.3**	**487.5****	**-5.4**

* Includes TCM benefits.
** Includes benefits from Voluntary Bundle.

Even though ozone levels do not change proportionately with the change in NOx and/or VOC, any increase or decrease in emission levels of these pollutants is expected to cause an increase or decrease in ozone levels. This can be understood very clearly when looking at the results of the emissions sensitivity runs for the photochemical model for the three days (July 16, 19, and 20) of July 1991 episode provided in the Table 7-4 of the Appendix D of this document (See Section on "Attainment Demonstration Modeling Report for the Washington DC-MD-VA Ozone Nonattainment Area"). Results of this sensitivity analysis have been used in the calculation of new base case and attainment year ozone levels in light of recently updated emissions for these two years using new Mobile6 model and latest information on other source categories. A new RRF has been calculated based on the new base case and attainment year ozone levels, which was used to calculate new Attainment Year Design Value. A portion of the Table 7-4 has been reproduced below to depict the effect of emissions changes in different source categories on maximum ozone concentrations (shown here in ppb) during the three episodic days in Washington non-attainment area.

Runs	16-Jul-91	19-Jul-91	20-Jul-91
bs2A2b	150.07	138.82	178.49
s1A2b	148.67	137.44	172.69
s2A2b	139.93	125.32	160.08
s3A2b	145.62	135.3	170.51

bs2A2b: Base Case Run
s1A2b: Run with 60% NOx reduction in point sources
s2A2b: Run with 60% NOx reduction in point sources and 30% NOx reduction in area and mobile sources (mobile sources include both onroad and nonroad sources) each
s3A2b: Run with 60% NOx reduction in point sources and 30% VOC reduction in area and mobile (mobile sources include both onroad and nonroad sources) sources each

Steps in the calculation of new base case and attainment year ozone levels

1. Calculation of change in ozone levels as seen in emissions sensitivity results discussed in the Appendix D of this document (See Section on "Attainment Demonstration Modeling Report for the Washington DC-MD-VA Ozone Nonattainment Area") in response to following changes in emissions:
    i. 60% NOx reduction from point sources
    ii. 30% NOx reduction from area and mobile sources each
    iii. 30% VOC reduction from area and mobile sources each

Example calculation for July 16, 1991:

Step i: bs2A2b – s1A2b = 150.07 – 148.67 = 1.4 ppb
Step ii: s1A2b – s2A2b = 148.67 – 139.93 = 8.74 ppb
Step iii: s1A2b – s3A3b = 148.67 – 145.62 = 3.05 ppb

Calculations have been performed for July 19th and 20th in the same way as described above and have been shown below.

Ozone level change due to change in emissions from different sources			
	16-Jul-91	19-Jul-91	20-Jul-91
bs2A2b-s1A2b	1.4	1.38	5.8
s1A2b-s2A2b	8.74	12.12	12.61
s1A2b-s3A2b	3.05	2.14	2.18

2. Calculation of actual change in base case and attainment year ozone levels using emissions sensitivity results above:

Example calculation for July 16, 1991:
Step i: 60% NOx reduction in point source emission leads to 1.4 ppb decrease in ozone level.
Therefore,
7.9% increase in base case year will lead to (1.4 * 7.9) / 60 = 0.18 ppb increase and,
35.8% decrease in attainment year will lead to (1.4 * 35.8) / 60 = 0.84 ppb decrease.

Step ii: 60% NOx reduction in area and mobile source emission leads to 8.74 ppb decrease in ozone level.
Therefore,
28.9% increase in base case year will lead to (8.74 * 28.9) / 60 = 4.21 ppb increase and,
9.8% increase in attainment year will lead to (8.74 * 9.8) / 60 = 1.43 ppb increase.

Step iii: 60% VOC reduction in area and mobile source emission leads to 3.05 ppb decrease in ozone level.
Therefore,
9.9% increase in base case year will lead to (3.05 * 9.9) / 60 = 0.5 ppb increase and,
9.1% decrease in attainment year will lead to (3.05 * 9.1) / 60 = 0.46 ppb decrease.

Therefore, cumulative change in ozone level as a result of change in emissions from point, area and mobile sources will be calculated as follows:

For Base Case Year (BY):
0.18 + 4.21 + 0.5 = 4.9 ppb
and, for Attainment Year (AY):
(-0.84) + 1.43 + (-0.46) = 0.13 ppb

Cumulative changes calculated in this way for all three dates are given below:

	16-Jul-91	**19-Jul-91**	**20-Jul-91**
Cumulative change (BY) =	4.90	6.36	7.19
Cumulative change (AY) =	0.13	0.83	-1.73

3. Calculation of new RRF:

Episode Day	**Observed**	**Base Case**	**Future Att.Yr**
	(ppb)	(ppb)	(ppb)
07/16/91	137	(167) + 4.90 = 171.9	(150) + 0.13 = 150.13
07/19/91	132	(168) + 6.36 = 174.36	(139) + 0.83 = 139.83
07/20/91	178	(198) + 7.19 = 205.19	(178) –1.73 = 176.27
Average	**149**	**(177.7) 183.8**	**(155.7) 155.4**

The Table above shows observed and modeled base case and attainment year ozone levels for three episode days during July 1991. Numbers in bracket are based on July 1991 modeling performed with old Mob5a based inventory. These numbers were modified to include changes in

ozone levels resulting from emissions changes in base case and attainment years calculated above in the first two steps. As expected, new ozone levels are higher for the base case and lower for the attainment year. A new RRF has been calculated using these two new ozone levels.

New RRF = Three day average of the attainment year 1-hour maximum ozone level (modeled)
Three day average of the base case year 1-hour maximum ozone level (modeled)

= 155.4 / 183.8 = 0.845

4. Calculation of new Attainment Year Design Value:

Attainment Year Design Value = Base Year Design Value * New RRF

Base Year Design Value = Average of design values for three years (1991-93). Design values for these three years (1991, 1992, and 1993) include consideration of monitored data for 1991, which was the base case year for modeling.

Therefore, new Attainment Year Design Value = 136 * 0.845 = 114.9 ppb

Since this value is below 125 ppb (1-hour ozone NAAQS), possibility of attaining 1-hour ozone standard in the attainment year 2005 is strongly indicated.

11.13.2 Relative Rate of Reduction Test

EPA guidance memorandum suggests using a Relative Rate of Reduction (RRR) test to demonstrate if the Severe Area SIP still shows attainment. The RRR test consists of two sub-tests:

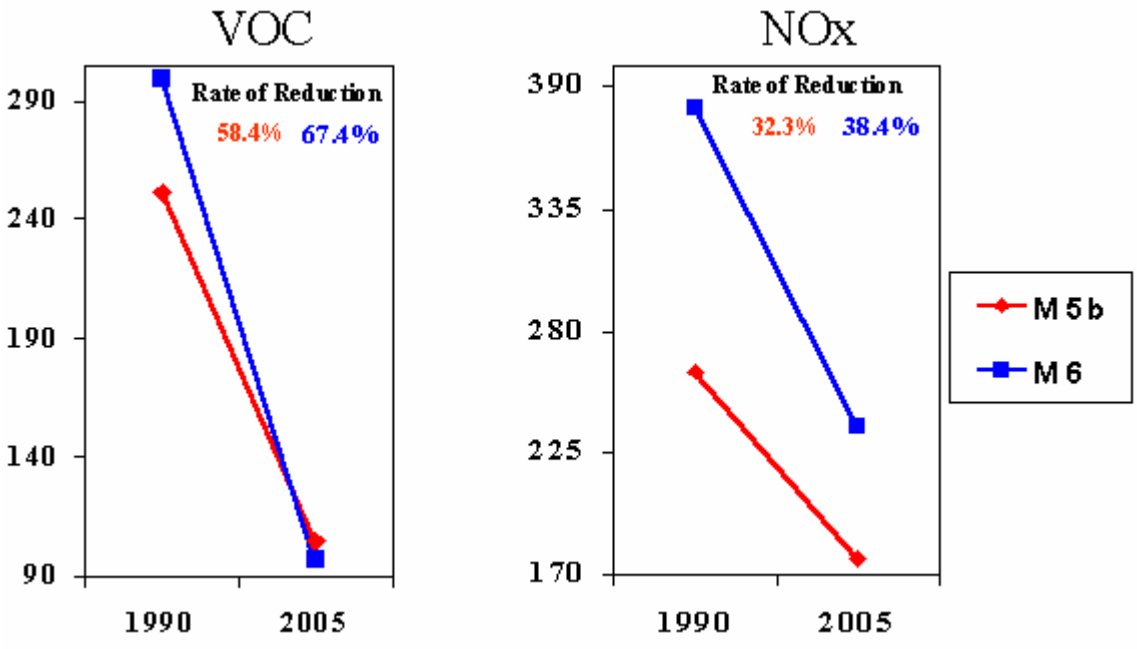
- Comparison of rates of reduction of Mobile6 and Mobile5b based mobile emissions only between 1990 and 2005.
  - If Mobile6 RRR is greater than the Mobile5b RRR, then the attainment is demonstrated.
- Comparison of rates of reduction of total emissions (including Mobile6 and Mobile5b based mobile emissions) for Severe Area SIP and Phase II Plan SIP between 1990 and 2005.
  - If the RRR of total emissions of the Severe Area SIP is greater than the corresponding RRR of total emissions of the Phase II Plan SIP, then the attainment is demonstrated.

Results:

Comparison of rates of reduction of Mobile6 & Mobile5b based mobile emissions only between 1990 and 2005

Rates of reduction of Mobile6 and Mobile5b based mobile emissions between 1990 and 2005 were compared. Mobile6 RRR was found to be greater than the Mobile5b RRR and this demonstrates that the Washington region is still able to show attainment of the 1-hour ozone standard.
Figure 12 shows the same results in graphical form.

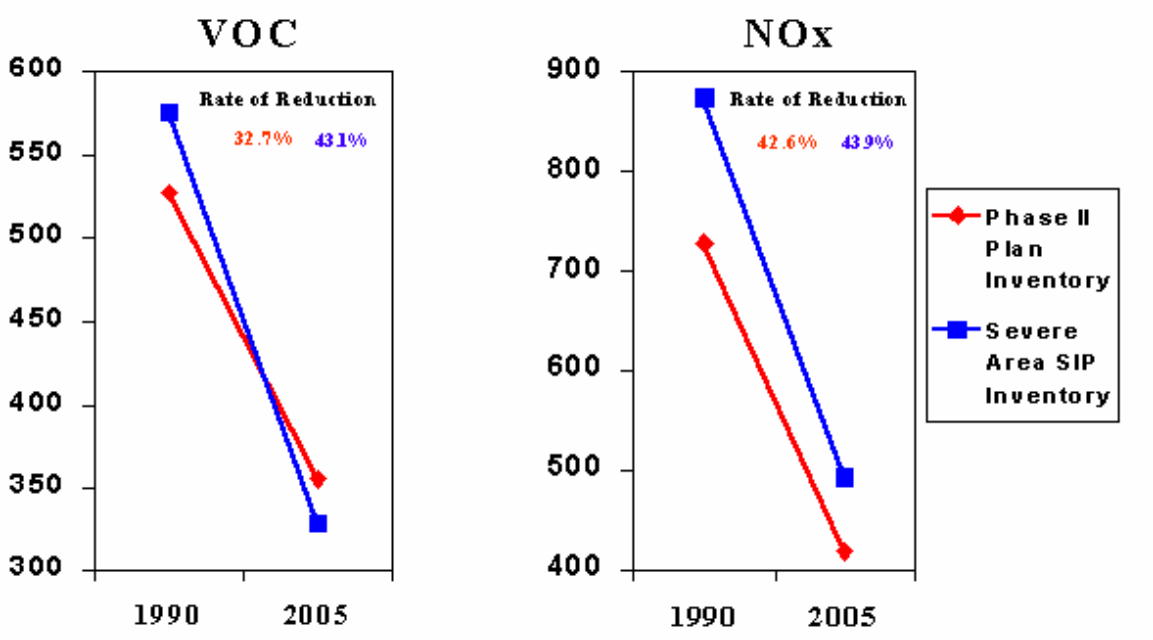
Figure 11-12
Comparison of MOBILE5b and MOBILE6 based Mobile Emissions



Comparison of rates of reduction of total emissions (including Mobile6 and Mobile5b based mobile emissions) for Severe Area SIP and Phase II Plan SIP between 1990 and 2005

Rates of reduction of Severe Area SIP and Phase II Plan SIP emissions between 1990 and 2005 were compared. The RRR for Severe Area SIP emission was found to be greater than the Phase II Plan SIP emission RRR and this once again demonstrates that the Severe Area SIP is still able to show attainment of the 1-hour ozone standard. Figure 13 shows the same results in graphical form.

Figure 11-13
Comparison of Rates of Reduction of Total Emissions for Severe Area SIP and Phase II Plan SIP



Note: 2005 VOC and NOx emissions inventories do not include benefits from voluntary control measures.

11.14 Comparison of Modeled Vs. Controlled 2005 Inventories Test

The projected emissions in the attainment year (now projected for 2005) must be equal to or less than the total of the local emissions used in the previous July 1991 modeling study in order to still demonstrate attainment of the 1-hour ozone standard.

The current projected emissions for 2005 are compared with the modeled emissions inventory in Table 11-2.

Table 11-22
Projected Controlled 2005 Emissions vs. Modeled Attainment Emissions

Emissions Type	VOC	NOx	VOC	NOx
	Modeled (tpd)	Modeled (tpd)	Controlled 2005 (tpd) (Round 6.3)	Controlled 2005 (tpd) (Round 6.3)
Point	15.6	171.1	16.2	109.8
Area	153.8	54.3	147.3	60.4
Mobile	123.5	196.8	97.4 [a]	234.7
Non-road	66.8	93.1	68.2	82.8
Total	**359.7**	**515.3**	**325.8**[b]	**487.5** [b]

*Small discrepancies may result due to rounding
[a] Includes TCM benefits.
[b] Includes benefits from Voluntary Bundle.

It is clear from the Table 11-2 that both NOx and VOC projected controlled emissions in the attainment year 2005 are lower than the modeled attainment inventories and thus attainment is demonstrated in the year 2005.

11.15 Additional Weight of Evidence: Voluntary Action Campaigns

11.15.1 Clean Air Partners

Clean Air Partners is a bi-regional public-private partnership in the Baltimore Washington region created to develop and implement voluntary action programs to reduce emissions on the days when ozone levels are expected to be high.

The partnership was created in 1994 by the Metropolitan Washington Air Quality Committee (MWAQC), the Transportation Planning Board of the National Capitol Region (TPB) and the Baltimore Metropolitan Council (BMC). The partnership, originally known as ENDZONE Partners, has conducted an air quality public education campaign in the Washington and Baltimore metropolitan areas since 1995. The purposes of the campaign are to raise public awareness of air quality issues and to promote voluntary actions to improve air quality. The campaign is funded by public funds from Maryland, Virginia, the District of Columbia, and receives staff support from the state air management agencies. In 1997 the partnership formed a new formal public-private partnership, hired a Managing Director, and in 1999 changed its name to Clean Air Partners.

Clean Air Partners runs a campaign throughout the ozone season, May to September, to educate the public about the effects of ground-level ozone and what people can do to improve air quality. Daily forecasts of ozone pollution are distributed widely by fax and email to the media and Ozone Action Days participants. The air quality forecast is color-coded for ease of communication, following EPA's regulation for the Air Quality Index for ozone. The Ozone Action Days participants include 500 businesses and government agencies, which encourage clean commute options on Ozone Action Days.

During the ozone season, in addition to communicating daily with television and radio meteorologists in the regions, Clean Air Partners places radio and television ads to advise about the health risks and to promote less polluting behaviors on Ozone Actions Days. The ad messages target four categories for behavior modification: use of aerosol consumer products, use of cars and other light duty vehicles, use of lawn and garden equipment, and use of paints.

11.15.1.1 Evaluation of Voluntary Action Campaign

Clean Air Partners conducts surveys to determine the effectiveness and reach of its message. Two types of surveys are conducted, an "end of season" survey and an "episodic survey," taken on the evening of a forecasted Code Red Day. Surveys have been conducted by the partnership since 1995.

The end-of-season survey, conducted seven times since 1995, is to estimate the potential for behavior change and to help target the right messages. Episodic surveys began in the summer of 1999. The objective of the episodic survey is to determine if the Clean Air Partners' message is being heard and if the potential for behavior change is being realized. During each summer, multiple surveys have been conducted, except for 2000 when no survey was conducted.

A recent study looking at trends in results of surveys taken over eight years indicates that the episodic survey, conducted on the evening of a forecasted Code Red Day, provides the most reliable measure of behavior in response to the campaign.

11.15.1.2 Trends in Survey Results

Data from the two types of surveys indicate that general knowledge levels about air quality and its measurement systems increased substantially in both metropolitan areas during the five years, 1996-2001. Knowledge that Code Red indicates unhealthy air when activity should be limited increased significantly during the period. Over 90% surveyed knew that today was a "Code Red/Bad Air Day," in 2002, and 67% said the phrase Code Red means "air is unhealthy."

Over the period, 1996-2001, the end-of-season survey results for the Washington metropolitan region show the percentage of residents willing to act grew from 35% to 44% in 2001. The percentage of people reporting changing their behavior or limiting someone else's (child) was 66% in 2001, an increase from 40% in 1996. In Washington, seventeen percent of all respondents said they took action to reduce air pollution.

Results:

- Increase in knowledge about ground-level ozone and color-code rating system
- Steady increase in "willingness to act" from 35% in 1996 to 44% in 2001.
- Behavior change in response to bad air days is common

Avoidance of health risk is most common reason for behavior change (66%); second reason is to reduce emissions (17%).[7]

11.15.1.3 Other Voluntary Actions

In addition to participating in Clean Air Partners programs, the local governments and state agencies in the Washington region have taken a coordinated, proactive approach to reducing emissions attributable to their organizations on an episodic basis. These actions reduce VOC and NOx emissions from a variety of source sectors. Shutdowns of county waste-to-energy facilities reduce stationary source emissions. State agencies and county governments ban refueling of non-emergency fleet vehicles and application of traffic paint and pesticides, eliminating area source emissions. Many of these organizations also ban operation of lawn and garden equipment to reduce non-road emissions. Mobile emissions are reduced through liberal leave policies and support for teleworking on Code Red Days. Though the benefits of these episodic programs are not reflected in the region's 2005 controlled inventory, the programs are an important part of the region's attainment strategy and provide additional evidence that the region will attain the ozone standard in 2005.

11.16 Overall Conclusion

Based on the results from the July 1991 modeling, EPA's Tier 2 modeling, comparison of projected controlled 2005 and modeled attainment inventory, and the two Weight of Evidence tests; there is evidence that the Washington region will attain the 1-hour ozone standard in the year 2005.

References:

1. OTAG version

2. EPA and a contractor have subsequently developed a revised version, UAM-V, which is a nested grid model with other processing enhancements. Among the enhancements is an improved chemical processor which more appropriately responds to the biogenic emissions levels measured through recent research. While the UAM-V is likely a superior tool to UAM -IV, it requires model inputs which are not currently available at the scale of the Baltimore-Washington domain. Once those inputs become available, the performance of UAM-V within the domain will be evaluated to determine if it provides a superior product.

3. *Ozone Transport Assessment Group Executive Report 1997*, Environment Council of the States (ECOS) pp. 53-55. (http://www.epa.gov/ttn/otag)

4. Ibid., p. ii

5. The design value is the fourth highest daily maximum value of the ozone data collected at a monitoring site over a three-year period. This value is used to determine attainment status and the classification of the nonattainment area (marginal, serious, severe, extreme).

6. Technical Support Document for the Tier 2/Gasoline Sulfur Ozone Modeling Analyses, EPA420-R-99-031, December 1999.

7. "An Analysis of Air Pollution-Related Knowledge, Attitudes, and Behaviors Across Time: The End of Season and Episodic Surveys," Fox, J. Clifford and Mousumi Sarkar, Virginia Commonwealth University, December 2002, prepared for Clean Air Partners.

12.0 CONTINGENCY PLAN

The General Preamble defines the requirements for identification of contingency measures for rate-of-progress and attainment demonstrations. For post-1996 rate-of-progress and attainment demonstrations, contingency measures may reduce emissions of either VOC or NOx. One set of contingency measures is required for each milestone year. The same set of measures can be used for both a rate-of-progress demonstration and an attainment demonstration, if the two demonstrations involve the same milestone year. Air quality plans must include sufficient contingency measures to account for up to 3% of the VOC base-year inventory adjusted to the appropriate milestone year.

12.1 Contingency Measures for the 1999 Rate of Progress Demonstration

12.1.1 Background

In its January 2003 Determination of Nonattainment and Reclassification, EPA determined that the Washington region failed to attain the one-hour ozone standard by November 15, 1999. This finding of failure to attain triggered a requirement to adopt contingency measures for the 1999 attainment demonstration, as explained in the April 2003 approval of the region's severe area SIP. The Revised Phase I Attainment Plan, submitted in May 1999, included contingency measures to fulfill the 1996-1999 rate-of-progress requirement. However, EPA deemed these contingency measures inadequate. It its April 17, 2003 conditional approval of the Washington region's attainment plan, EPA required the Washington region to revise the 1996-1999 portion of the severe area ROP plan to include a contingency plan containing adopted measures that qualify as contingency measures for the 1996-1999 rate-of-progress and the 1999 attainment demonstration. This section fulfills that requirement.

The region was first notified of the need to identify additional contingency measures in early 2003, via EPA's finding of failure to attain and approval of the severe area SIP. In the approval, EPA required the states to submit adopted contingency measures keyed to the 1999 ROP and attainment demonstrations by April 17, 2004. As a result, the adopted contingency measures must be able to deliver benefits by this date. The contingency measures identified by the Washington region delivered benefits in 2002, fulfilling this requirement.

12.1.2 Required Reductions

The contingency measures for the 1999 rate-of-progress and attainment demonstrations must total 3% of the 1990 base year inventory adjusted to 1999. The inventory is calculated as described in Section 5.3.2. Table 12-1 shows the calculation of the necessary reductions.

Table 12-1
Calculation of 1999 Contingency Measures
(Ozone Season tons per day)

Description	VOC	NOx	Reference
1990 Inventory Adjusted to 1999	433.7	778.5	(V8), (N8)
3% Reduction for Contingency Measure Requirement	0.03	0.03	
Total Contingency Measures Required (VOC or NOx)	13.0	23.4	

12.1.3 Identified Contingency Measures

Implemented contingency measures identified for 1999 must deliver the required benefits in calendar year 2000. The Phase II Reformulated Gasoline (RFG) program was implemented in the Washington region on January 1, 2000. See Section 7.7.2. In calendar year 2000, the benefits of this program totaled 19.1 tons per day of VOC and 8.5 tons per day NOx. See Appendix I for details of this calculation. The benefits from this program exceed the required 13.0 tons per day VOC; therefore this measure fulfills the region's contingency measure requirement for 1999.

In addition to Phase II RFG, the Washington region has also implemented a number of VOC control measures that could serve as contingency measures for the 1996-1999 rate-of-progress and the 1999 failure to attain. A combination of either control measures 7.4.11 (OTC Portable Fuel Containers) and 7.4.12 (OTC AIM Coatings) or measures 7.4.12 and 7.4.14 (OTC Solvent Cleaning) could fulfill the requirement of 13.0 tpd VOC. All of these control measures will be effective by January 2005.

12.2 Contingency Measures for the 2002 Rate of Progress Demonstration

12.2.1 Background

The Washington region must identify contingency measures to be implemented in the event that measures included in the 2002 Rate of Progress Plan fall short of their projected emission reductions. As discussed in Chapter 5, the Washington area was reclassified as a severe nonattainment area in January 2003. As a severe area, the region is required to submit rate of progress demonstrations for the periods 1999-2002 and 2002-2005. As the deadline for achieving the 2002 ROP had already elapsed when the region was reclassified, EPA extended the deadline for the region to fulfill the 2002 ROP requirements. The region must meet the requirements as expeditiously as practicable, but no later than November 15, 2005. As discussed in Section 5.7, the region plans to meet these requirements by January 2005. In its January 2003 Reclassification Notice, EPA notes that it is allowing the region to "key contingency measures for the 2002 ROP milestone to this new date" (68 Federal Register 3412). Therefore a determination that

the Washington region failed to meet the 2002 ROP requirements would be made no earlier than November 15, 2005, and contingency measures would be implemented in 2006. As a result, the evaluation year for contingency measures for the 2002 ROP is 2006.

12.2.2 Required Reductions

The contingency measures for the 2002 rate-of-progress demonstration must total 3% of the 1990 base year inventory adjusted to 2002. The 2002 adjusted inventory is calculated as described in Section 5.4. Table 12-2 shows the calculation of the necessary reductions.

Table 12-2
Calculation of 2002 Contingency Measures
(Ozone Season tons per day)

Description	VOC	NOx	Reference
1990 Inventory Adjusted to 2002	420.5	756.7	(V13), (N13)
3% Reduction for Contingency Measure Requirement	0.03	0.03	
Total Contingency Measures Required (VOC or NOx)	12.6	22.7	

As Table 12-2 shows, the Washington region must identify 12.6 tons per day of VOC or 22.7 tons per day of NOx reductions to satisfy the contingency requirement.

12.2.3 Identification of Contingency Measures

Table 12-3 lists the contingency measures identified by the District of Columbia, Maryland and Virginia for the 2002 Rate-of-Progress. These measures deliver total benefits of 12.8 tpd VOC, exceeding the 12.6 tpd VOC or 22.7 tpd NOx contingency measure requirement calculated in Table 12-2.

Table 12-3
Contingency Measures for 2002 Rate-of-Progress
(Ozone Season tons per day)

Ref. No.	Contingency Measure	VOC (tons/day)	NOx (tons/day)
12.2.3.1	Ozone Transport Commission (OTC) Portable Fuel Containers	3.5	0
12.2.3.2	Ozone Transport Commission (OTC) Mobile Repair and Refinishing	2.6	0
12.2.3.3	Ozone Transport Commission (OTC) Solvent Cleaning	2.7	0
12.2.3.4	Ozone Transport Commission (OTC) Consumer Products	4.0	0
TOTAL REDUCTIONS		**12.8**	**0**

In accordance with EPA's guidance encouraging early implementation of contingency measures to guard against failure to either meet a milestone or attain, the District of Columbia, Maryland and Virginia will implement the contingency measures identified in Table 12-3 according to the timetable indicated in Chapter 10. EPA's guidance on early implementation of control measures is as follows (see Reference 2):

> *The EPA encourages the early implementation of required control measures and of contingency measures as a means of guarding against failures to meet a milestone or to attain. Any implemented measures (that are not needed for the rate-of-progress requirements or for the attainment requirements) would need to be backfilled only to the extent they are used to meet a milestone.*

The reductions from the designated contingency measures are surplus vis-à-vis the attainment demonstration and both rate-of-progress demonstrations contained in this SIP. They will not be used to meet any milestone requirements. As a result, the states will not be required to backfill any contingency measures that they choose to implement in advance of requirements.

12.2.3.1 Ozone Transport Commission (OTC) Portable Fuel Containers Rule

This measure introduces performance standards for portable fuel containers and spouts. The standards are intended to reduce emissions from storage, transport and refueling activities. The rule also included administrative and labeling requirements. Compliant containers must have: only one opening for both pouring and filling, an automatic shut-off to prevent overfill, an automatic sealing mechanism when not dispensing fuel and specified fuel flow rates, permeation rates and warranties.

Source Type Affected

Any person or entity selling, supplying or manufacturing portable fuel containers, except containers with a capacity of less than or equal to one quart, rapid refueling devices with capacities greater than or equal to four gallons, safety cans and portable marine fuel tanks operating with outboard motors, and products resulting in cumulative VOC emissions below those of a representative container or spout.

Control Strategy

Maryland and Virginia adopting the Ozone Transport Commission (OTC) Model Rule for Portable Fuel Containers in January 2002 and November 2003, respectively. The District of Columbia expects to adopt this rule no later than March 1, 2004. The rule applies to all counties in the nonattainment area. Reductions from this rule will accrue with time beginning with implementation in the State of Maryland in calendar year 2004. Because the Washington region expects to demonstrate the 1999-2002 rate of progress in January 2005, only reductions expected to occur by January 1, 2005 are credited towards the 2002 rate-of-progress. Reductions expected to occur by November 15, 2005 are credited towards the 2005 rate-of-progress. Reductions occurring after the November 15, 2005 attainment and rate-of-progress deadlines are surplus to the rate of progress and attainment demonstrations and are therefore credited towards the 2005 rate-of-progress.

Implementation

Maryland - Air and Radiation Management Administration
Virginia - Department of Environmental Quality
District of Columbia - Environmental Health Administration

Projected Reductions

	VOC Emission Reductions (tons per day)			
	District of Columbia	**Maryland**	**Virginia**	**Total**
VOC Reductions	0.3	1.5	1.7	3.5

Emission Benefit Calculations

Emission benefits are based upon the calculations for Measure 7.4.11, OTC Portable Fuel Containers. As these benefits accrue over time, benefits from the implementation of Measure 7.4.11 will continue to build after the November 15, 2005 rate-of-progress deadline. The benefits accruing subsequent to November 15, 2005 are designated as a contingency measure.

Should the Washington fail to meet the 2002 Rate-of-Progress by the November 15, 2005 deadline, the region would be notified by EPA in April 2006 of a need to implement contingency measures. The region would have 18 months from the date of notification to implement those measures. Therefore, this measure includes benefits accrued from the Portable Fuel Containers measure between November 16, 2005 and October 1, 2007.

State	Assumed Compliance Date	Pechan Estimate (assumes 1/1/03 implementation)[1]	Reductions Per Year	11/15/05-10/1/07 Reductions
District of Columbia	Jan 2005	0.4	0.17	0.32
Virginia	Jan 2005	2.0	0.80	1.50
Maryland	Jan 2004	1.8	0.91	1.71
Total (tpd VOC)				**1.53**

The Maryland Air and Radiation Management Administration provided an estimate of benefits for the Maryland portion of the Washington nonattainment region, based on E.H. Pechan calculations. The EH Pechan estimate was for the entire State of Maryland, not for Washington nonattainment area. See Table IV-6 of E.H. Pechan's report for documentation of Northern Virginia reductions. Reductions for District of Columbia and Maryland are detailed in Appendix C.

[1] MDE estimate for benefits from Jan 1 2004 through Dec 31 2005.

12.2.3.2 Ozone Transport Commission (OTC) Mobile Repair and Refinishing Rule

This rule establishes VOC limits for paints using in mobile repair and refinishing. The VOC limits are consistent with Federal limits for mobile equipment refinishing materials. The rule also requires improved transfer efficiency application equipment, enclosed spray gun cleaning, and minimal training.

Source Type Affected

All manufacturers of paints used in mobile repair and refinishing and operators of mobile repair and refinishing facilities.

Control Strategy

Virginia adopted the Ozone Transport Commission (OTC) Model Rule for Mobile Repair and Refinishing in November 2003. The District of Columbia plans to adopt this rule no later than March 1, 2004. The rule will apply to all counties in the nonattainment area. The State of Maryland had rules in place by 1996 that contain limits comparable to the OTC model rule. The reductions resulting from implementation of this rule are surplus with respect to the 2002 and 2005 rate of progress and 1999 contingency measure requirements and are therefore eligible for use as contingency measures.

Implementation

District of Columbia - Environmental Health Administration
Virginia - Department of Environmental Quality

Projected Reductions

	VOC Emission Reductions (tons per day)			
	District of Columbia	Maryland	Virginia	Total
VOC Reductions	0.6	0	2.0	2.6

Emission Benefit Calculations

E.H. Pechan calculated state-by-state emission benefits from the consumer products rule for the OTC region. Further details are available from Reference 1.

12.2.3.3 Ozone Transport Commission (OTC) Solvent Cleaning Rule

This rule establishes hardware and operating requirements and alternative compliance options for vapor cleaning machines used to clean metal parts. These machines are used in manufacturing operations to clean grease, wax, oil and other contaminants from parts when a high level or cleanliness is necessary. The rule also affects cold cleaners, which are used in automobile and maintenance facilities and industrial maintenance shops.

Source Type Affected

Manufacturers and operators of vapor cleaning or cold cleaning machines

Control Strategy

The District of Columbia plans to adopt the Ozone Transport Commission (OTC) Model Rule for Solvent Cleaning Operations no later than March 1, 2004. This rule will apply to all counties in the nonattainment area. Implementation of this measure by the Commonwealth of Virginia appears as control measure 7.4.13. The State of Maryland had rules in place by 1996 that contain limits comparable to the OTC model rule. The reductions resulting from implementation of this rule are surplus with respect to the 2002 and 2005 rate of progress and 1999 contingency measure requirements and are therefore eligible for use as contingency measures.

Standards for vapor cleaning machines are based on Federal Maximum Available Control Technology (MACT) standards for chlorinated solvent vapor degreasers. Cold cleaner solvent volatility provisions are based on regulatory programs in place in several states, primarily Maryland and Illinois.

Implementation

District of Columbia - Environmental Health Administration

Projected Reductions

	VOC Emission Reductions (tons per day)			
	District of Columbia	**Maryland**	**Virginia**	**Total**
VOC Reductions	2.7	0	0	2.7

Emission Benefit Calculations

E.H. Pechan calculated state-by-state emission benefits from the consumer products rule for the OTC region. Further details are available from Reference 1.

12.2.3.4 Ozone Transport Commission (OTC) Consumer Products Rule

This measure requires reformulation of approximately 80 types of consumer products to reduce their VOC content. It uses more stringent VOC content limits than the existing Federal consumer products rule. The rule also contains requirements for labeling and reporting.

Source Type Affected

Manufacturers of various specialty chemicals named in the rule, such as aerosol adhesives, floor wax strippers, dry cleaning fluids and general purpose cleaners.

Control Strategy

The District of Columbia and the State of Maryland expect to adopt the Ozone Transport Commission (OTC) Model Rule for Reformulated Consumer Products no later than March 1, 2004. As the Commonwealth of Virginia is implementing this rule on a voluntary basis, as described in Measure 7.6, the rule will apply to all counties in the nonattainment area. Reductions from this rule are expected to first occur in calendar year 2005. The reductions resulting from implementation of this rule are surplus with respect to the rate of progress and contingency measure demonstrations and are therefore eligible for use as contingency measures.

Manufacturers are expected to demonstrate compliance with the rule primarily through a California Air Resources Board (CARB) test method. If complying with the VOC contents becomes difficult, flexibility options are provided.

Implementation

Maryland - Air and Radiation Management Administration
District of Columbia - Environmental Health Administration

Projected Reductions

	VOC Emission Reductions (tons per day)			
	District of Columbia	**Maryland**	**Virginia**	**Total**
2002 VOC Reductions	1.1	2.9	0	4.0

Emissions Benefits Calculations

E.H. Pechan calculated state-by-state emission benefits from the consumer products rule for the OTC region. Further details are available from Reference 1.

12.3 Contingency Measures for the 2005 Rate of Progress and Attainment Demonstrations

12.3.1 Required Reductions

The Washington region must also identify contingency measures to be implemented in the event that the region does not attain the one-hour ozone standard in 2005, or measures included in the 2005 Rate of Progress Plan fall short of their projected emission reductions. The contingency measures for the 2005 rate-of-progress and attainment demonstrations must total 3% of the 1990 base year inventory adjusted to 2005. The 2005 adjusted inventory is calculated as described in Section 6.1.2. Table 12-4 shows the calculation of the necessary reductions.

Table 12-4
Calculation of 2005 Contingency Measures
(Ozone Season tons per day)

Description	Tons/day VOC	Tons/day NOx	Reference
1990 Inventory Adjusted to 2005	412.1	735.6	(V23), (N23)
3% Reduction for Contingency Measure Requirement	0.03	0.03	
Total Contingency Measures Required (VOC or NOx)	12.4	22.1	

12.3.2 Identified Contingency Measures

Because the Washington region expects to fulfill the requirements of the 2002 rate-of-progress, the same contingency measures identified for the 2002 rate-of-progress can be used to fulfill the contingency measure requirement for the 2005 rate-of-progress and attainment demonstrations.

As detailed in Table 12-3, the contingency measures identified for the 2002 rate-of-progress will reduce 12.8 tons per day of VOC. These reductions exceed the 2005 rate-of-progress and attainment requirement of 12.4 tons per day VOC or 22.1 tons per day NOx. Therefore, the measures identified in Table 12-3 also fulfill the region's contingency measure requirements for 2005.

References

1. E.H. Pechan, “Control Measure Development Support Analysis for the Ozone Transport Commission Model Rules”, March 31, 2001.

2. U. S. EPA, “State Implementation Plans; General Preamble for the Implementation of Title I of the Clean Air Act Amendments of 1990”, Proposed Rule, 57 *Federal Register* 13498 (April 16, 1992).

3. U.S. EPA, “Guidance on the Post-1996 Rate-of-Progress Plan and the Attainment Demonstration,” Corrected Version as of February 18, 1994, p. 50.