State Implementation Plan

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

May 23, 2007


State Implementation Plan (SIP) for 8-Hour Ozone Standard
Prepared for:
District of Columbia Department of Environment
Maryland Department of the Environment
Virginia Department of Environmental Quality
on behalf of the Metropolitan Washington Air Quality Committee

METROPOLITAN WASHINGTON COUNCIL OF GOVERNMENTS

Alternative formats of this publication can be made available for persons with disabilities.
Phone: 202.962.3300 or 202-962.3213 (TDD)
Email: accommodations@mwcog.org.
For details: www.mwcog.org.
For Virginia: Phone: (804) 698-4070
Email: abbanks@deq.virginia.gov

## TABLE OF CONTENTS

**List of Appendices**

## List of Tables

## List of Figures

# 1.0 EXECUTIVE SUMMARY

The Washington metropolitan area plans to meet federal requirements for reducing ground-level ozone, a principal component of smog, by 2009. 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.

In 1997 EPA issued a revised ozone health standard based on an 8-hour measurement to protect against longer exposure periods. Since the late 1980's more than 3,000 published health studies indicated that health effects occur at levels lower than the previous standard and that exposure times longer than one hour are of concern. EPA established an 8-hour standard at 0.08 parts per million (ppm) and defined the new standard as a "concentration-based" form, specifically the 3-year average of the 4$^{th}$ highest daily maximum 8-hour ozone concentrations.

EPA designated the metropolitan Washington region as moderate nonattainment for the 8-hour ozone standard in April 2004. The region has a deadline of June 15, 2010, to meet the 8-hour ozone standard.[1] The geographic scope of the region includes the Metropolitan Washington Region defined as follows: Montgomery, Prince George's, Frederick, Charles, Calvert Counties in Maryland; Fairfax County, Arlington County, City of Alexandria, City of Falls Church, City of Fairfax, Prince William County, Loudoun County, City of Manassas and City of Manassas Park in Virginia; and the District of Columbia.

This document, the 8-Hour Ozone Attainment Plan for the Metropolitan Washington, DC-MD-VA Nonattainment Area, is a plan to improve air quality in the Washington region to meet the National Ambient Air Quality Standard (NAAQS) for ozone. The Plan consists of a Reasonable Further Progress Plan, 2002-2008; an attainment plan; an analysis of reasonably available control measures; an attainment demonstration; contingency plans for RFP and attainment; and mobile budgets for 2008, 2009, and 2010. The plan presents a Base-Year Inventory for 2002 and projected inventories for 2008 and 2009.

The 8-Hour Ozone 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 2009. The plan has been prepared by the Metropolitan Washington Air Quality Committee (MWAQC)

[1] *Federal Register, Vol.69, no. 84, April 30, 2004, 23951-24000.*

to comply with the Clean Air Act Amendments of 1990 and with EPA requirements for the Washington region as stated in EPA's 2004 reclassification of the Washington region, and Phase 1 and Phase 2 of EPA's 8-Hour Implementation Guidance, issued in April 2004 and November 2005.

**TABLE A**
**SUMMARY OF CONTROL STRATEGIES**
**VOC and NOx Benefits of Control Measures**
**(2002-2009)**

| *Ref No.* | *Control Measure* | **VOC Reductions tons/day** *2008*[b] | *2009*[c] | **NOx Reductions tons/day** *2008*[b] | *2009*[c] |
|---|---|---|---|---|---|
| **MEASURES INCLUDED IN THE FUTURE CONTROLLED SCENARIO** | | | | | |
| **POINT SOURCE MEASURES** | | | | | |
| 6.1.2 | State NOx RACT and Regional NOx Transport Requirement (RACT, NOx SIP Call, CAIR, HAA) | 0.00 | 0.00 | 12.65 | 128.76 |
| **SUBTOTAL** | | **0.00** | **0.00** | **12.65** | **128.76** |
| **AREA SOURCE MEASURES**[(a)] | | | | | |
| 6.2.11 | Mobile Equipment Repair and Refinishing Rule | 3.49 | 3.59 | 0 | 0 |
| 6.2.12 | Portable Fuel Containers Rule: Phase I | 7.34 | 9.30 | 0 | 0 |
| 6.2.13 | Architectural and Industrial Maintenance Coatings Rule | 10.62 | 10.82 | 0 | 0 |
| 6.2.14 | Reformulated Consumer Products Rule: Phase I | 6.23 | 0.76 | 0 | 0 |
| 6.2.15 | Solvent Cleaning Operations Rule | 2.91 | 2.99 | 0 | 0 |
| 6.2.16 | Industrial Adhesives and Sealants Rule | - | 2.42 | 0 | 0 |
| 6.2.17 | Portable Fuel Containers Rule: Phase II | - | 0.75 | 0 | 0 |
| 6.2.18 | Reformulated Consumer Products Rule: Phase II | 0.39 | 6.34 | 0 | 0 |
| **SUBTOTAL** | | **30.98** | **36.97** | **0** | **0** |
| **NON-ROAD MEASURES** | | | | | |
| 6.3.1 | EPA Non-Road Gasoline Engines Rule | 36.91 | 42.44 | 11.68 | 14.76 |
| 6.3.2 | EPA Non-Road Diesel Engines Rule | | | | |
| 6.3.3 | Emissions standards for spark ignition marine engines | | | | |
| 6.3.4 | Emissions standards for large spark ignition engines | | | | |
| 6.3.5 | Reformulated Gasoline (off-road) | | | | |
| 6.3.6 | Standards for Locomotive | 0.05 | 0.06 | 2.54 | 2.74 |
| **SUBTOTAL** | | **36.96** | **42.50** | **14.22** | **17.50** |
| **ON-ROAD MEASURES** | | | | | |
| 6.4.2 | High-Tech Inspection/Maintenance (updated cutpoints) | | | | |
| 6.4.4 | National Low Emission Vehicle Program | | | | |
| 6.4.5 | Tier 2 Motor Vehicle Emission Standards | | | | |
| 6.4.6 | Heavy-Duty Diesel Engine Rule | 6.19 | 7.17 | 29.67 | 37.63 |
| 6.4.7 | Transportation Control Measures and Vehicle Technology, Fuel, or Maintenance Measures | 0.19 | 0.18 | 0.49 | 0.45 |
| **SUBTOTAL** | | **6.38** | **7.35** | **30.16** | **38.08** |
| **VOLUNTARY MEASURES (Multiple Source Sectors)** | | | | | |
| 6.5 | Voluntary Bundle | 0.19 | 0.19 | 0.28 | 0.30 |
| **TOTAL REDUCTIONS** | | **74.51** | **87.01** | **57.31** | **184.64** |

Notes:

[a] The Area Source reductions do not include the District of Columbia. The District's OTC VOC rules on all the applicable area source categories are or will be fully adopted, submitted to EPA, and federally enforceable measures. However, the emission reductions of 3.38 tpd VOC in 2008 and 3.80 tpd VOC in 2009 arising from these measures in the District are not applied to the emissions inventories presented in this RFP/attainment modeling/contingency demonstration of the Washington DC-MD-VA regional SIP. The District of Columbia's measures are expected to provide additional enhancements to the air quality improvement in the region.

[b] Reductions included in the 2008 Reasonable Further Progress demonstration, occurring between 2002 and 2008.

[c] Reductions included in the attainment demonstration, occurring between 2002 and 2009.

## 1.1 Background

In April 2004 EPA designated the Washington area as a "moderate" nonattainment area for the 8-hour ozone standard under Subpart 2 of part D, Title I. The boundaries of the Washington nonattainment areas are defined in the *Federal Register, Vol. 69, No. 84, 4/30/04.* The Washington nonattainment area includes the District of Columbia, Arlington, Fairfax, Loudoun, Prince William 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 Chapter 2.

To meet the federal 8-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) or Nitrogen Oxides (NOx) by at least 15 percent between 2002-2008, and to reduce all ozone precursor emissions to a level sufficient to attain the federal 8-hour standard by June 15, 2010. However, the region is required to demonstrate attainment of the standard by the end of the last ozone season before that date, which is September 2009. The actual attainment date for planning purposes is 2009; the photochemical modeling to demonstrate attainment and the inventories used to determine reduction benefits use 2009 as the attainment date.

The 8-Hour Ozone 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 a 15 percent emissions reduction by 2008 and attainment by 2009. EPA's ozone guidance calls for demonstration of steady progress in improving air quality by 2009.

Overall, the 2009 attainment plan for the Metropolitan Washington region includes total reductions by 2009 of 87.10 tons per day of VOC and 184.64 tons per day of nitrogen oxides (NOx). The plan may be summarized as follows:

- 128.76 tons per day of NOx reductions through the regulation of point sources of pollution, such as factories and power plants;
- 36.97 tons per day of VOC reductions from regulating area sources of pollution such as architectural coatings, portable fuel containers, automobile repair, and consumer products;
- 42.50 tons per day of VOC reductions and 17.50 tons per day of NOx reductions from non-road sources such as nonroad gasoline and nonroad diesel rules, emissions standards for large spark ignition engines, reformulated gasoline, and marine engines;
- 7.35 tons per day of VOC reductions and 38.08 tons per day of NOx reductions from initiatives relating to cars and trucks, the "on-road" or "mobile" sources of pollution; and
- 0.19 tons per day of VOC reductions and 0.30 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 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 VOCs and 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 and industrial processes, 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 remain 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, the 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. For the most recent scientific findings about ozone, see Appendix G Attachment 1, "The Conceptual Model."

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 VOC and NOx controls that 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 the NOx SIP call in 1998. EPA promulgated the Clean Air Interstate Rule (CAIR) in 2005 as a regional transport rule to help the states towards meeting the 8-hour ozone and $PM_{2.5}$ standards. Both the NOx SIP call and CAIR apply to the Midwestern states as well as eastern states and require them to reduce emissions from stationary sources and were intended to reduce pollution transported aloft.

## 1.3 SIP Process

The Act requires states to develop and implement ozone reduction strategies in the form of a SIP. The SIP is the state's "master plan" for attaining and maintaining the 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 EPA finds the SIP inadequate to attain the NAAQS in all or any regions of the state, and if the state fails to make the requisite amendments, the EPA administrator may issue binding amendments under Section 110(c)(1).

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 the withholding of 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 transportation grant or fund, license, or permit any other transportation project that does not conform to the most recently approved SIP.

## 1.4 Rate of Progress Demonstrated in Previous 1-Hour Ozone SIPs

The Clean Air Act requires that serious nonattainment areas ensure progress toward the attainment goal by achieving a 15 percent reduction in volatile organic chemicals (VOCs) by 1996, and an additional 9 percent 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. The Washington region was classified as a serious nonattainment area for the 1-hour ozone standard in 1992, the standard in place at the time. EPA now uses a different measurement for the 8-hour ozone standard. In 2003 EPA reclassified the metropolitan Washington region as severe nonattainment for ozone when the region did not meet the attainment deadline for serious nonattainment areas by November 1999. In March 2004 MWAQC approved a SIP to meet the requirements for a severe nonattainment area. The “Severe Area SIP” demonstrated rate of progress of 9 percent from 1999-2002, and 9 percent from 2002-2005. EPA approved the states’ SIPs and Rate of Progress (RFP) plans in 2005.[2]

[2] *Approval and Promulgation of Air Quality Implementation Plans, District of Columbia, Maryland, Virginia, 1-Hour Attainment Plans, Rate-of-Progress Plans, Contingency Measures, Transportation Control Measures, VMT Offset, and 1990 Base Year Inventory, Federal Register, Vol. 70, No. 92, May 13, 2005, pp. 25688-25716 and Approval and Promulgation of Air Quality Implementation Plans; Maryland; Metropolitan Washington, DC 1-Hour Ozone Attainment Plan, Lifting of Earlier Rules Resulting in Removal of Sanctions and Federal Implementation Clocks, Federal Register, Vol.70, No. 220, November 16, 2005, pp.69440-69443.*

## 1.5 Base Year 2002 Emission Inventories and Future Year 2008 and 2009 Emissions Inventories

A comparison of future year inventories 2008 and 2009 to the base year inventory 2002 demonstrate dramatic reductions in emissions. Between the base year 2002 and the attainment year 2009, volatile organic compound emissions (VOC) will decrease by 22.2 percent and emissions of nitrogen oxide (NOx) will decrease by 39.4 percent. The 8-hour ozone SIP presents revisions to the 2002 base year inventory using MOBILE 6.2.03, Travel Demand Model version 2.1d#50, including corrections to nonroad, area and stationary source emissions. A description of the 2002 Base Year inventory is included in Chapter 3 and complete documentation for the Base Year 2002 inventory is in Appendix B. Future year projected inventories for 2008 and 2009 were developed using MOBILE6.2.03 and Travel Demand Model Version 2.1d#50. The future year inventories are discussed in SIP Chapter 4.

**Figure 1-1.**
**VOC Emissions by Source, 2002-2009**

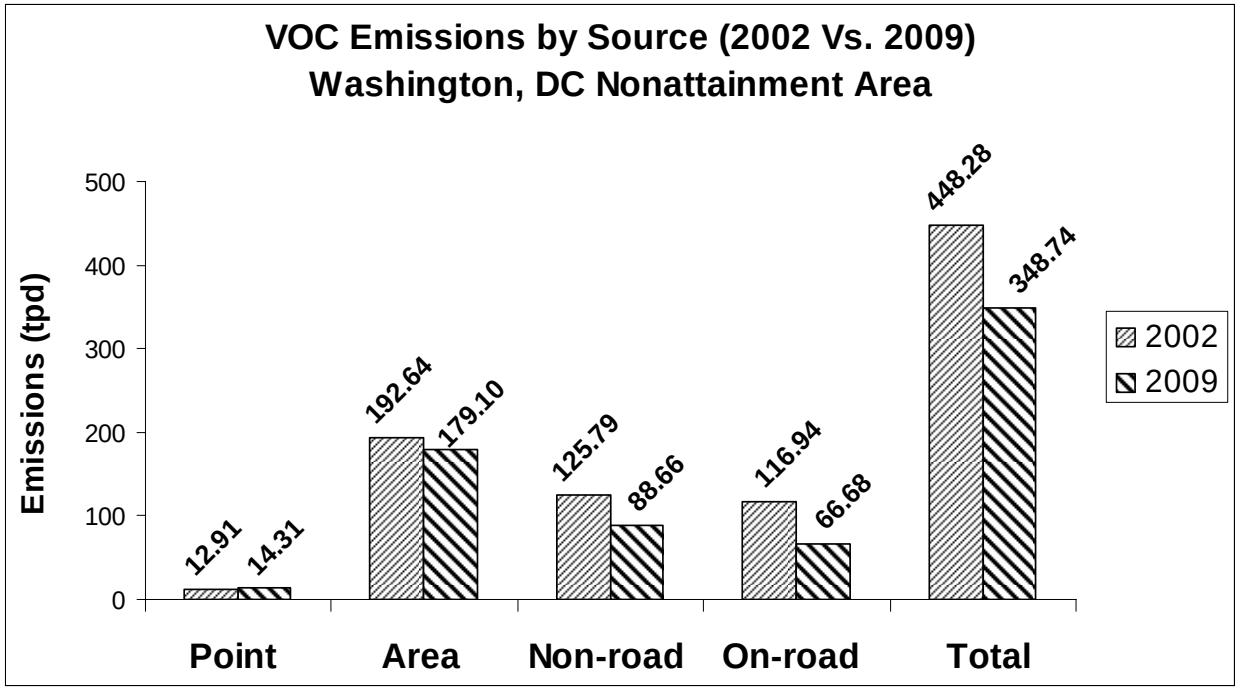
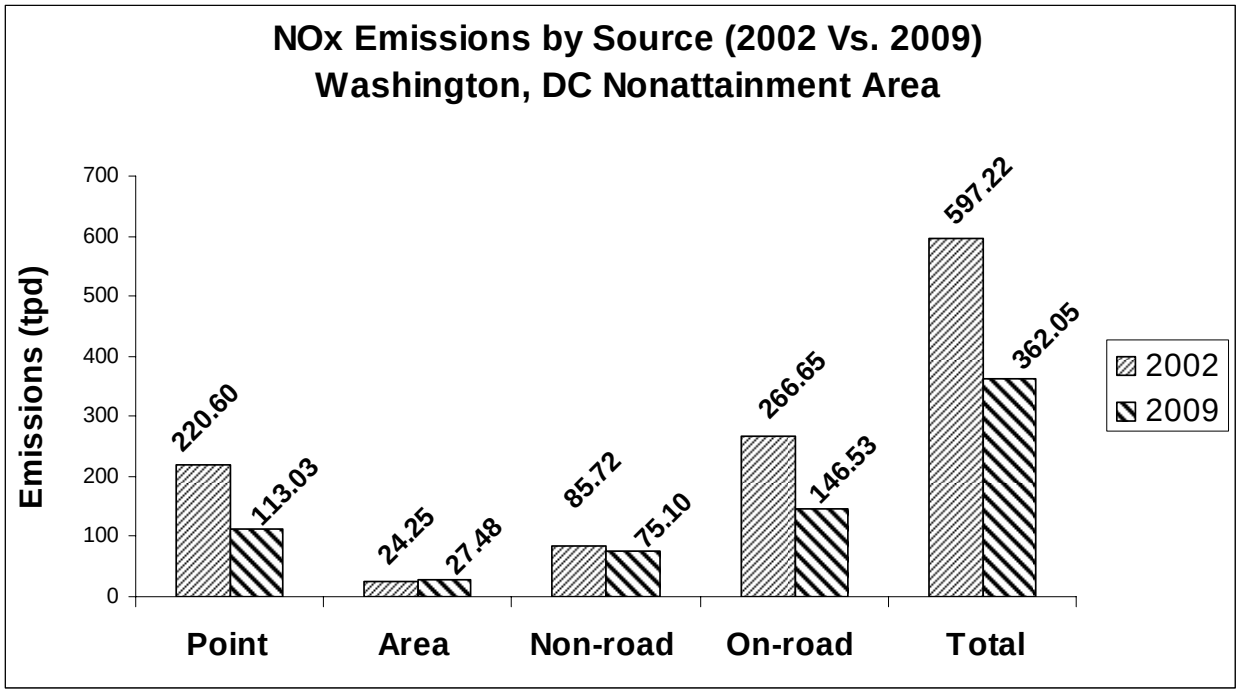



**Figure 1-2.**

**NOx Emissions by Source, 2002-2009**




## 1.6 2002-2008 Reasonable Further Progress Plan

EPA's *Final Rule To Implement the 8-Hour Ozone National Ambient Air Quality Standard – Phase II* mandates that to meet the Reasonable Further Progress (RFP) requirement, the Washington, DC-MD-VA 8-hour ozone nonattainment area needs to reduce its emissions by 15 percent between 2002 and 2008 using either reduction in VOC or NOx or any combination of the two. This SIP explains that the Washington region is able to demonstrate reasonable further progress for the period 2002-2008 using a 15 percent VOC reduction. The Washington region's controlled VOC emissions in 2008 of 358.84 tons per day (tpd) VOC are below the target level of VOC reductions of 370.45 tpd VOC, demonstrating that the region meets its 15 percent Reasonable Further Progress (RFP) requirement.

## 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 mobile source emissions budgets or maximum allowable levels of VOC and NOx. These budgets will be the benchmark used to determine if the region's long range transportation plan, known as the Constrained Long-Range Plan, (CLRP) and six year transportation improvements program (TIP) conform with the CAAA of 1990. Under EPA regulations the projected mobile source emissions for 2008 and 2009 -- minus the Transportation Control Measures (TCM) and vehicle technology, fuel, or maintenance-based measures -- become the mobile emissions budgets for the region unless MWAQC takes actions to set another

budget level. The mobile emissions budgets were developed using computer models MOBILE6.2.03 and Travel Demand Model version 2.1d#50.

**Reasonable Further Progress Mobile Budgets**

The mobile emissions budgets for the 2008 Reasonable Further Progress are based on the projected 2008 mobile source emissions accounting for all the mobile control measures, including TCMs and vehicle technology, fuel, or maintenance-based measures. The mobile emissions budgets for the 2008 Reasonable Further Progress are 70.8 tons/day VOC and 159.8 tons/day NOx.

2008 Mobile Budgets:

VOC = 70.8 tons/day NOx = 159.8 tons/day

**Attainment Year Mobile Budgets**

The mobile emissions budgets for the 2009 attainment year are based on the projected 2009 mobile source emissions accounting for all the mobile control measures, including TCMs and vehicle technology, fuel, or maintenance-based measures. The mobile emissions budgets for the 2009 Attainment Year are 66.5 tons/day VOC and 146.1 tons/day NOx.

2009 Mobile Budgets:

VOC = 66.5 tons/day NOx = 146.1 tons/day

The mobile emissions budgets for the 2010 year are based on the projected 2009 mobile source emissions accounting for all the mobile control measures, including TCMs and vehicle technology, fuel, or maintenance-based measures, minus the reductions required for the contingency plan discussed in Chapter 11. The mobile emissions budgets for the 2009 Attainment Year are 66.5 tons/day VOC and 146.1 tons/day NOx. The required reduction amount to satisfy the contingency plan is 1.8 tpd NOx.

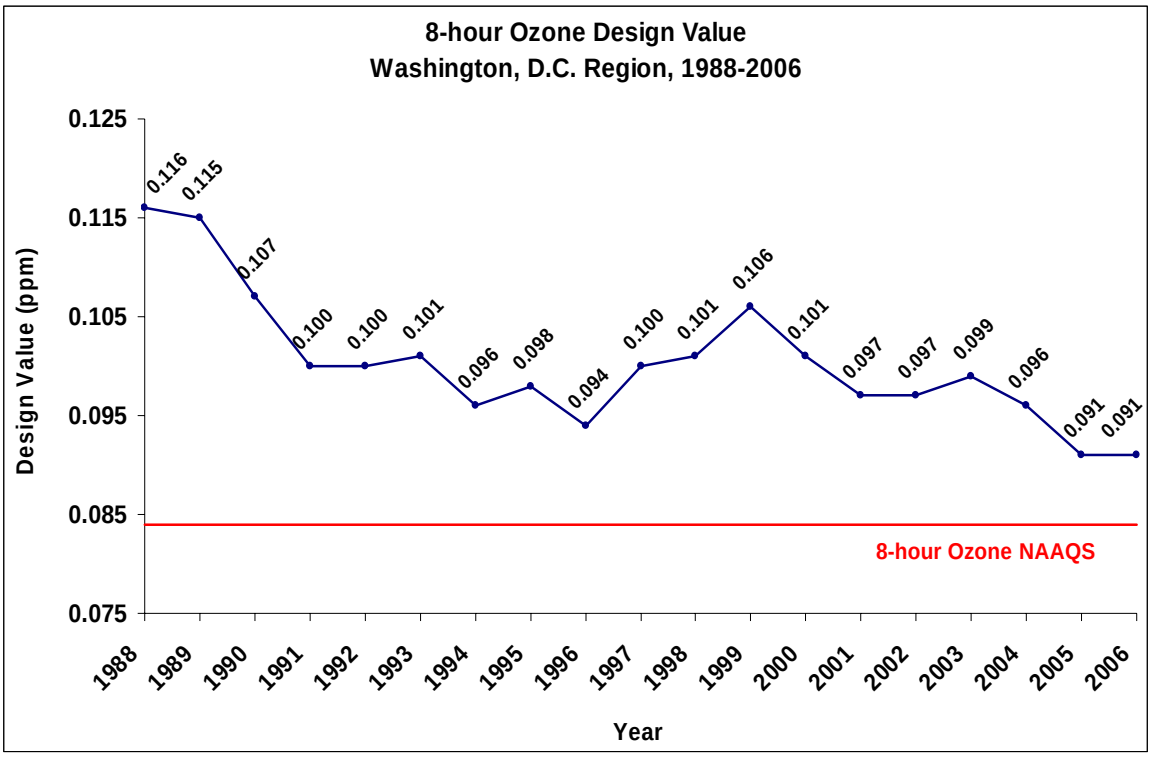
The Mobile Emissions Budget for 2010, based upon the projected 2009 mobile source emissions accounting for all the mobile control measures, including the Transportation Control Measures and vehicle technology, fuel, or maintenance-based measures, less the contingency requirement:
VOC = 66.5 tons/day NOx = 144.3 tons/day

## 1.8 Attainment Demonstration

The 8-Hour Ozone Attainment Plan analyzes the potential of the Washington metropolitan area to achieve attainment of the 8-hour ozone standard. The demonstration of achieving the 8-hour ozone standard is based on results from the Community Multiscale Air Quality Model (CMAQ) and supporting Weight of Evidence analysis. The 8-hour ozone design value is the fourth highest maximum ozone concentration at a monitoring site averaged over a continuous three-year period. Values of 85 parts per billion (ppb) and above are exceeding the 8-hour ozone health standard. CMAQ results show only two of the 18 monitoring stations in the Washington metropolitan area having a future design value at and above 85 ppb; all other monitors fall well below 85 ppb.

Air quality trends continue to improve, emissions are decreasing (Fig.1-3), and in the past three years the region has less than one Code Red Day for every day over 90$^{o}$F. The impact of air quality improvement is demonstrated in the reduced spatial extent of the attainment zone in 2005. Voluntary programs in the Washington area offer further potential for reducing ozone during the summer. Episodic programs such as teleworking and reducing electricity demand on high electric demand days may provide additional ozone reductions on the worst days of summer.
The photochemical modeling combined with supporting Weight of Evidence analysis provide strong evidence the region will attain the 8-hour ozone standard by 2009.

**Figure 1-3: 8-hour Ozone Design Value, 1988-2006.**



## 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: 1) Will reduce emissions by the beginning of the Washington region's 2008 ozone season (May 1, 2008); 2) Enforceable; 3) Technically feasible; 4) Economically feasible (proposed as a cost of $3,500-$5,000 per ton or less); 5) Would not create substantial or widespread adverse impacts within the region; and 6) Emissions from the source being controlled exceed a *de minimis* threshold, proposed as 0.1 tons per day.

If implemented collectively, any group of potential RACM measures would need to provide reductions of 20-40 tons per day of NOx and/or VOC by the 2008 ozone season. The region has reviewed all of the potential control measures to determine if collectively they could meet these criteria. Several mandatory programs are available that can provide moderate levels of emission reductions, however, none of these measures can provide benefits by the 2008 ozone season, and the total overall reduction that could be provided by these measures is below 20-40 tons per day. While there are potential voluntary measures that can be implemented before 2008, together these voluntary measures will not provide sufficient creditable emission reductions to advance the attainment date by one year. Therefore, there are no RACM appropriate for the Washington region's moderate area SIP.

## 1.10 Contingency Measures

In the event that the reductions anticipated in the 2008 RFP or 2009 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 percent reduction in baseline emissions. The contingency measures for the 2008 RFP and attainment demonstrations must total 3 percent of the 2002 adjusted base year inventory.

To satisfy the contingency requirement for the 2008 RFP, the SIP includes a 3 percent reduction, attributed to states' Clean Air Interstate Rule (CAIR) and Portable Fuel Container Rule benefits from 2008-2010. These measures deliver benefit in excess of 1.31 tpd VOC and 15.27 tpd NOx, thereby meeting the RFP contingency measure requirement.

The contingency measures for the attainment demonstration must also total 3 percent of the 2002 Adjusted Base Year Inventory. The contingency measures identified by the District of Columbia, Maryland and Virginia for the attainment demonstration deliver total benefits in excess of the required contingency emissions reductions; therefore these measures fulfill the region's attainment contingency requirement.

## 1.11 Document Contents

| | |
|---|---|
| Chapter 2 | presents a detailed overview of the Clean Air Act, the region's reclassification to moderate nonattainment area, the requirements for moderate 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 2002 base year inventory using MOBILE 6.2.03, Travel Demand Model version 2.1d#50 including corrections to nonroad, area and stationary source emissions. |
| Chapter 4 | presents the 2008 and 2009 projected inventories using MOBILE 6.2.03 and Travel Demand Model Version 2.1d#50 to revise 2008 and 2009 projected and a discussion of the growth projection methodology. |
| Chapter 5 | presents 2008 RFP 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 reasonable further progress target level of reductions and also describes the control strategy and associated target emissions levels for the 15 percent reduction requirement. |
| Chapter 6 | Outlines the control strategies that the states will implement to achieve the reductions in VOC and NOx. |
| Chapter 7 | discusses the analysis of Reasonably Available Control Measures (RACM). |
| Chapter 8 | discusses mobile source conformity issues and establishes 2008 and 2009 mobile emissions budgets for the Metropolitan Washington region. |
| Chapter 9 | presents the states' schedules and adoption of regulations to meet requirements for severe nonattainment areas and presents the states' commitments to EPA. |
| Chapter 10 | presents the Metropolitan Washington region's demonstration of attainment based on CMAQ modeling and weight of evidence. |
| Chapter 11 | presents contingency measures for the 2008 Reasonable Further Progress and for the 2009 attainment demonstration. |

## 2.0 INTRODUCTION AND OVERVIEW

This document presents the regional air quality plan for attainment of the federal 8-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 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. In 1979 EPA promulgated the 0.12 ppm, 1-hour ozone standard. In 1997 EPA issued a revised ozone standard of 0.08 parts per million (ppm) or 84 parts per billion (ppb) measured over an 8-hour period. The 1-hour ozone standard was revoked on June 15, 2005. The Metropolitan Washington, DC-MD-VA nonattainment area met the 1-hour ozone standard by the November 15, 2005 deadline. The CAAA also sets National Ambient Air Quality Standards (NAAQS) for five other criteria pollutants, carbon monoxide, particulate matter, lead, sulfur dioxide and nitrogen dioxide.

In April 2004 EPA designated the Washington area as a “moderate” nonattainment area for the 8-hour ozone standard under Subpart 2 of part D, Title I . The boundaries of the Washington nonattainment areas are defined in the *Federal Register, Vol.; 69, No. 84, 4/30/04).* The Washington nonattainment area includes the District of Columbia, Arlington, Fairfax, Loudoun, Prince William 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 2-1.

To meet the federal 8-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 % between 2002-2008, and to reduce all ozone precursor emissions to a level sufficient to attain the federal 8-hour standard by June 15, 2010. However, the region is required to demonstrate attainment of the standard by the end of the last ozone season before that date, which is September 2009. The actual attainment date for planning purposes is 2009; the photochemical modeling to demonstrate attainment and the inventories used to determine reduction benefits use 2009 as the attainment date.

## 2.2 8-hour Ozone Standard

In 1997 EPA issued a revised ozone health standard based on an 8-hour measurement to protect against longer exposure periods. Since the late 1980's more than 3,000 published health studies indicated that health effects occur at levels lower than the previous standard and that exposure times longer than one hour are of concern. EPA established an 8-hour standard at 0.084 parts per million (ppm) and defined the new standard as a "concentration-based" form, specifically the 3-year average of the 4$^{th}$ highest daily maximum 8-hour ozone concentrations.

EPA changed the form of the standard to a concentration-based form because it more directly relates to ozone concentrations associated with health effects. Based on recent studies, the 8-hour ozone standard was designed to reduce exposure to ambient ozone concentrations that have been linked to increased hospital admissions for respiratory ailments such as asthma. Long term exposures to ozone can cause repeated inflammation of the lung, impairment of lung defense mechanisms, and irreversible changes in lung structure, which could lead to premature aging of the lungs and/or chronic respiratory illnesses such as emphysema and chronic bronchitis.

## 2.3 SIP Requirements for Moderate Nonattainment Areas

The Clean Air Act Section 182 (b) and EPA's implementation rule, 40 CFR Part 51, Subpart X, requires moderate nonattainment areas to submit revisions to the state implementation plan that meet the following planning requirements:

- Reasonable Further Progress (RFP): 15% VOC reduction from baseline within 6 years of enactment
- Attainment demonstration: Due 3 years after designation (6/15/07)
- New Source Review (NSR) and Reasonably Available Control Technology (RACT) major source applicability: 100 TPY for NOx and 50 tpy for VOC (CAAA Section 184)
- NSR offsets: 1.15 to 1
- NSR permits: required for new or modified major stationary sources
- NOx control for RACT: requirement for major stationary VOC sources also applies to major NOx sources
- RACM/RACT: RACT required for all CTG sources and all other major sources
- Basic Inspection and Maintenance (I/M): for vehicles
- Stage II vapor recovery: required for gas stations with a throughput of at least 10,000 gallons per month.
- Contingency measures: required for failure to meet RFP milestones or attain

Before designation as a moderate nonattainment area for the 8-hour standard, the Washington, DC-MD-VA region was classified as a "severe" nonattainment area for the 1-hour ozone standard. The Clean Air Act Section 182 (d) requirements for severe nonattainment areas include a number of planning requirements that are more stringent than those required for a moderate nonattainment area. The more stringent lower permitting thresholds remain in force in Maryland and the District of Columbia.

The more stringent regulations remaining in force in Maryland and the District are the following:

- Lower permit threshold for point sources to 25 tpy
- Lower NSR threshold for definition of "Major" source requiring controls to 25 tpy
- Require new or expanding sources to offset increased emissions by 1.3:1

## 2.4 Rate of Progress Demonstrated in Previous SIPs

For the previous 1-hour ozone health standard, MWAQC approved several SIPs to meet Rate of Progress requirements (ROP) for serious nonattainment areas. The Act required that serious nonattainment areas ensure progress toward the attainment goal by achieving a 15% reduction in VOCs by 1996, and an additional 9% by 1999. MWAQC approved the "15% Plan" in January 1994.[1] MWAQC approved the Phase I Attainment Plan, which includes the 9% ROP requirements, in October 1997 and revised it in April 1999.[2] The plan outlined how the region would reduce pollutants by the additional 9% requirement from 1996–1999 and discussed efforts to identify attainment requirements.

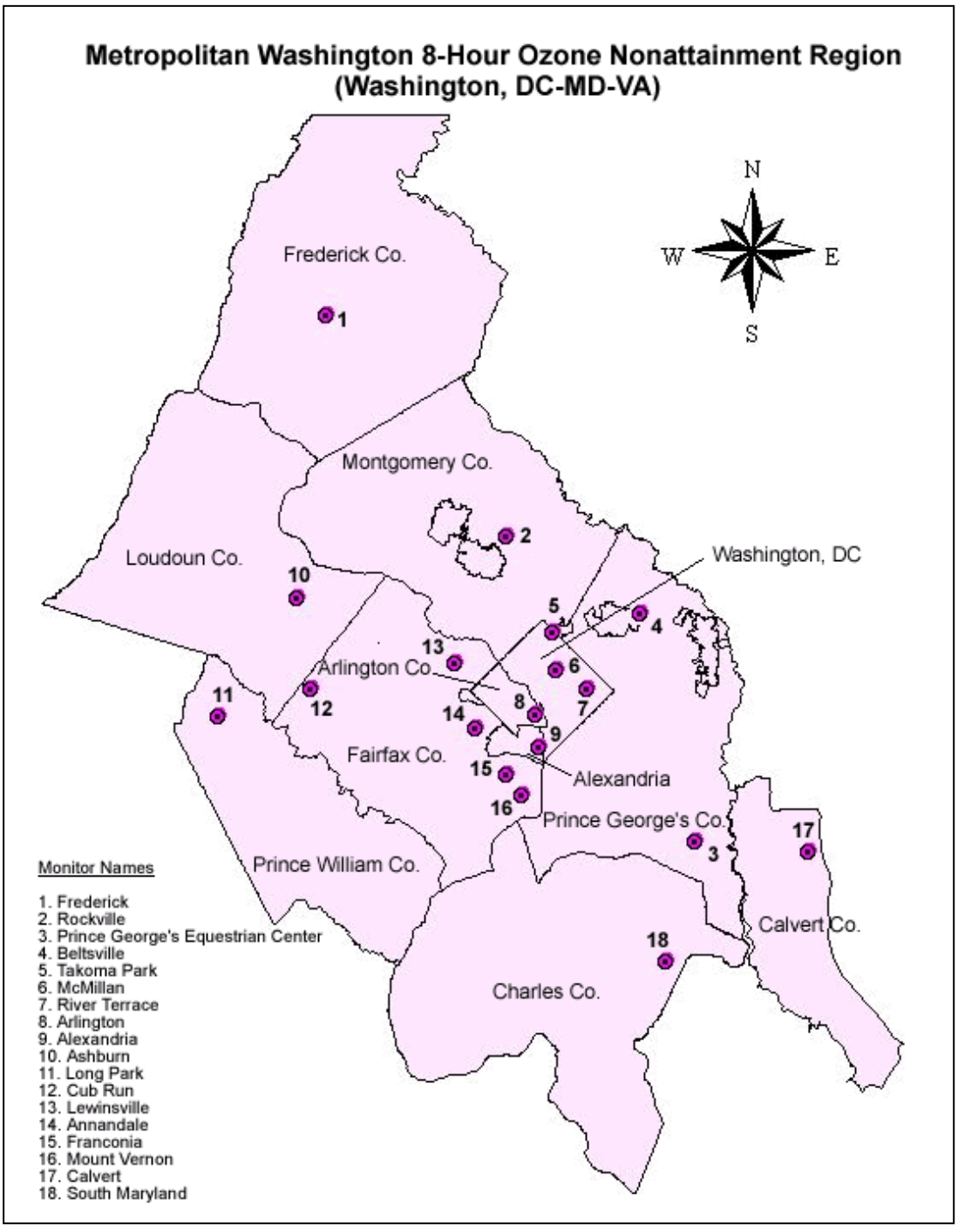
MWAQC approved the Attainment Plan (Phase II) in April 1998 and revised it in January 2000.[3] The Phase II plan summarized the results of photochemical air quality modeling and provided information on trends in actual measured ozone levels. The plan predicted that the Washington metropolitan region would attain the federal 1-hour standard for ozone in 2005. The monitoring data demonstrates that the region attained the 1-hour ozone standard as predicted.

In 2003, EPA reclassified the metropolitan Washington region as severe nonattainment for ozone when the region did not meet the attainment deadline for serious nonattainment areas by November 1999. In March 2004, MWAQC approved a State Implementation Plan to meet the requirements for a severe nonattainment area. The "Severe Area SIP" demonstrated rate of progress of 9% from 1999-2002, and 9% from 2002-2005. The states submitted the plan to EPA, which approved the states' SIPs and ROP plans in 2005.[4]

## 2.5 Comparability of 8-hour Inventories to Previous State Implementation Plans

In 1997 EPA issued a revised ozone standard of 0.080 parts per million (ppm) or 84 parts per billion (ppb) measured over an 8-hour period. The 1-hour ozone standard was revoked on June 15, 2005. EPA designated the metropolitan Washington region as moderate nonattainment for the 8-hour ozone standard in January 2004.The area source and point source inventories in the 8-hour ozone SIP are comparable to the previous 1-hour ozone SIP and are generally consistent with the methodologies used for those inventories, although the most recent version of the models were used. The 8-hour ozone SIP's mobile source inventory was estimated using MOBILE6.2.03 and Travel Demand Model version 2.1d#50. Both models are newer, revised versions of the models used for the Severe Area SIP.

**Figure 2-1. Washington, DC-MD-VA 8-Hour Ozone Nonattainment Region**




Additionally, the Reasonable Further Progress and attainment demonstration for 8-hour ozone standard uses a new model, EPA's Nonroad Model, to calculate emissions from the nonroad sector. In previous SIPs the nonroad emissions were calculated using a spreadsheet-based

projection of an inventory developed by EPA. Changes in the estimating techniques for nonroad emissions have changed, so it is not possible to compare them with previous calculations.

## 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 reactive 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 by-produce of combustion. Principal sources of NOx, which is produced by combustion and industrial processes, 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 2-2.

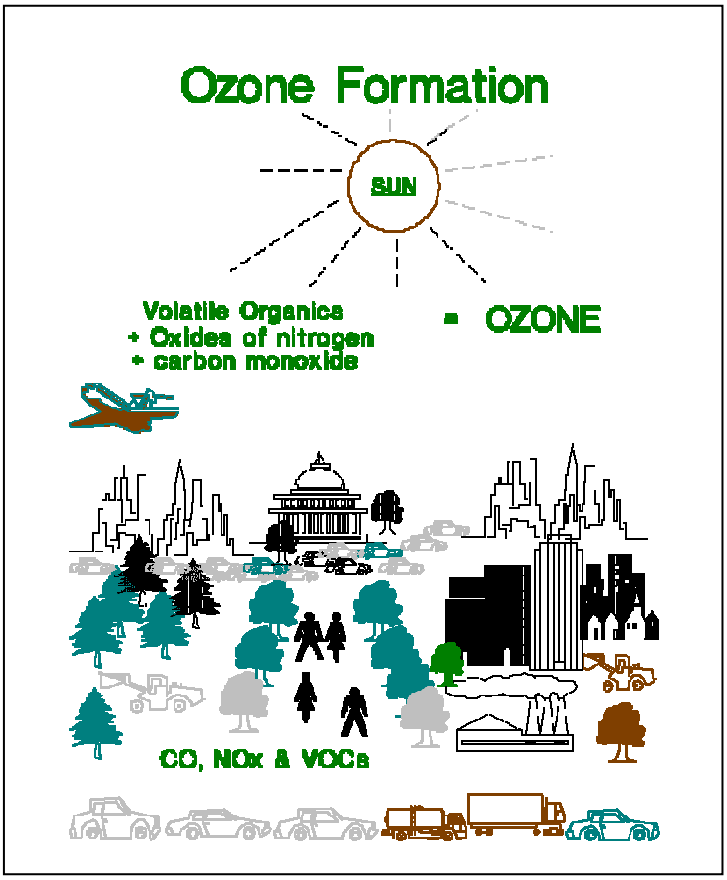



**Figure 2-2. Conditions for Ozone Formation**

Typically, ozone levels escalate rapidly before noontime, peak in the afternoon, and taper off when the sun goes down. Figure 2-3 shows hourly ozone concentrations for a typical 24-hour period in our region.

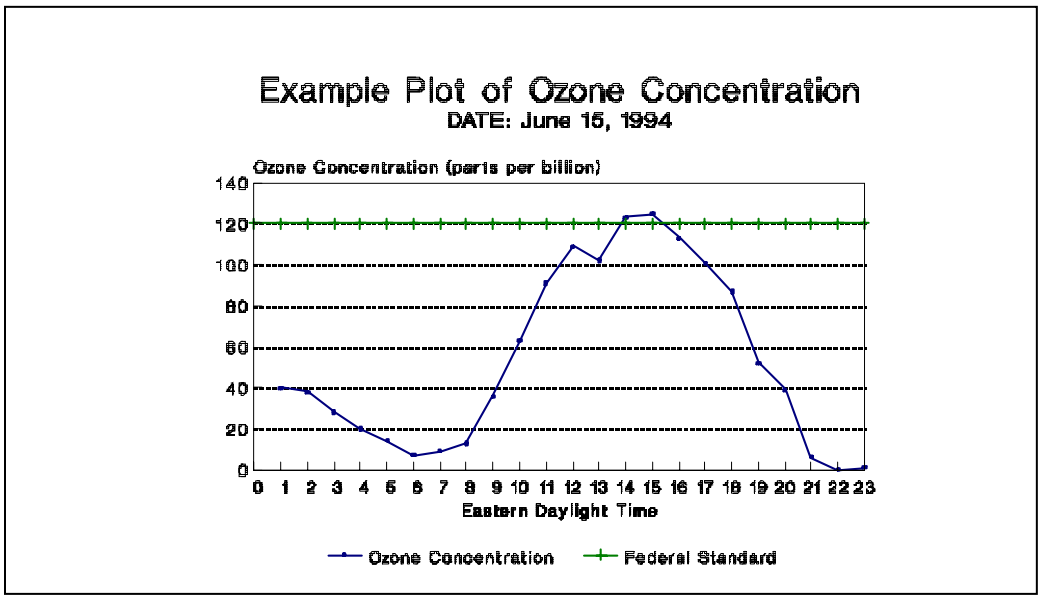



**Figure 2-3. Gradual build-up of ozone levels on a typical summer day. Ozone peaks in the afternoon, then tapers off to lower levels in the evening.**

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 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 2002 and in 2009.

**Table 2-1**
**TOP TEN SOURCES OF MAN-MADE VOLATILE ORGANIC COMPOUNDS (VOCs)**
**IN THE WASHINGTON AREA IN 2002 and 2009 EMISSIONS LEVELS**

| # | SOURCE CATEGORY | SOURCE | VOCs* TONS/ DAY | |
|---|---|---|---|---|
| | | | 2002 | 2009 |
| 1 | On-Road Mobile | CARS, BUSES, TRUCKS | 116.9 | 66.7 |
| 2 | Non-Road | LAWN & GARDEN EQUIPMENT | 81.6 | 52.2 |
| 3 | Area | SURFACE COATING | 62.7 | 57.5 |
| 4 | Area | COMMERCIAL CONSUMER SOLVENT USE | 58.5 | 57.3 |
| 5 | Area | PORTABLE FUEL CONTAINERS | 25.6 | 17.9 |
| 6 | Nonroad | PLEASURE CRAFT | 20.7 | 15.0 |
| 7 | Area | GASOLINE STORAGE | 13.7 | 15.0 |
| 8 | Stationary | UTILITIES AND OTHER SOURCES | 12.9 | 14.3 |
| 9 | Area | PESTICIDES | 11.8 | 9.7 |
| 10 | Area | SURFACE CLEANING | 11.6 | 10.3 |

**The emissions estimates above are rounded to the nearest whole number, listed in order for 2002 emissions. They are MWAQC's best estimates. Total VOC emissions in the Washington area were 448.28 tons per day in 2002 and 348.74 tons per day in 2009. Biogenic emissions account for 314.74 tons/day of VOC emissions in the Washington region. The 2009 inventories include the final attainment control strategy.*

**Table 2-2**
**TOP TEN SOURCES OF NITROGEN OXIDES (NOx) IN THE WASHINGTON AREA IN 2002 and 2009 EMISSIONS LEVELS**

| # | SOURCE CATEGORY | SOURCE | NOx* TONS/ DAY | |
|---|---|---|---|---|
| | | | 2002 | 2009 |
| 1. | On-Road Mobile | ALL VEHICLES | 266.7 | 146.5 |
| 2. | Stationary | UTILITIES AND OTHER SOURCES | 220.6 | 113.0 |
| 3. | Non-Road | CONSTRUCTION AND MINING | 45.8 | 38.3 |
| 4. | Non-Road | LAWN AND GARDEN EQUIPMENT (RES) | 12.6 | 10.6 |
| 5. | Area | INDUSTRIAL FUEL COMBUSTION | 9.3 | 11.1 |
| 6. | Non-Road | RAILROAD LOCOMOTIVES | 7.2 | 5.7 |
| 7. | Non-Road | INDUSTRIAL EQUIPMENT | 6.7 | 4.6 |
| 8. | Area | COMMERCIAL/INSTITUTIONAL FUEL COMBUSTION | 6.4 | 7.1 |
| 9. | Area | RESIDENTIAL FUEL COMBUSTION | 4.8 | 5.3 |
| 10. | Area | AIRCRAFT EMISSIONS | 3.8 | 5.9 |

**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 597.22 tons per day in 2002 and 362.05 tons per day in 2009. The 2009 inventories include the final attainment control strategy.*

## 2.7 The Effects of Ozone

Specific groups that are most likely to feel adverse effects from ozone are people with respiratory problems, asthmatic children and the elderly. Healthy individuals who engage in moderate to heavy exercise during the summer when ambient ozone concentrations are high may also be affected. EPA cites the following health effects:

> When inhaled, even at very low levels, ozone can cause acute respiratory problems; aggravate asthma; cause significant temporary decreases in lung capacity of 15 to over 20 percent in some healthy adults; cause inflammation of lung tissue; lead to hospital admissions and emergency room visits [10 to 20 percent of all summertime respiratory-related hospital visits in the northeastern U.S. are associated with ozone pollution]; and impair the body's immune system defenses, making people more susceptible to respiratory illnesses, including bronchitis and pneumonia.[5]

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, 2004, populations at increased risk in the Washington metropolitan region include

- 1,143,573 children 18 years of age and younger;
- 369,633 asthmatics, including 94,721 children with asthma and 277,912 adults;
- 191,510 residents with other chronic or persistent respiratory diseases, such as chronic bronchitis and emphysema;
- 423,373 residents over the age of 65

Figure 2-4 shows a breakdown of some of the categories of sensitive populations by sub-region.

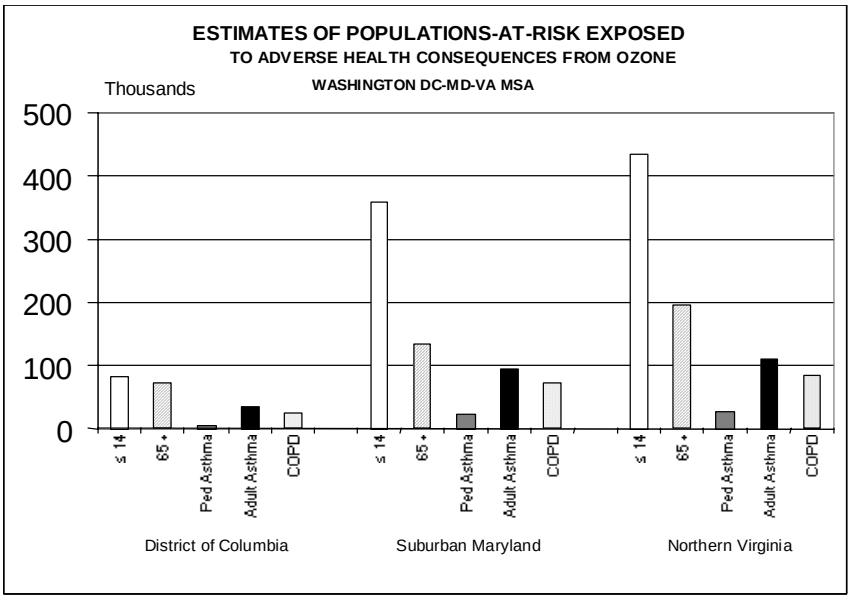



Figure 2-4. Approximately one-third of the residents of Metropolitan Washington area are: children; asthmatics over 65; have chronic respiratory diseases; and/or are especially sensitive to ozone. These individuals are more vulnerable to ill effects from air pollution. Source: American Lung Association [6]

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

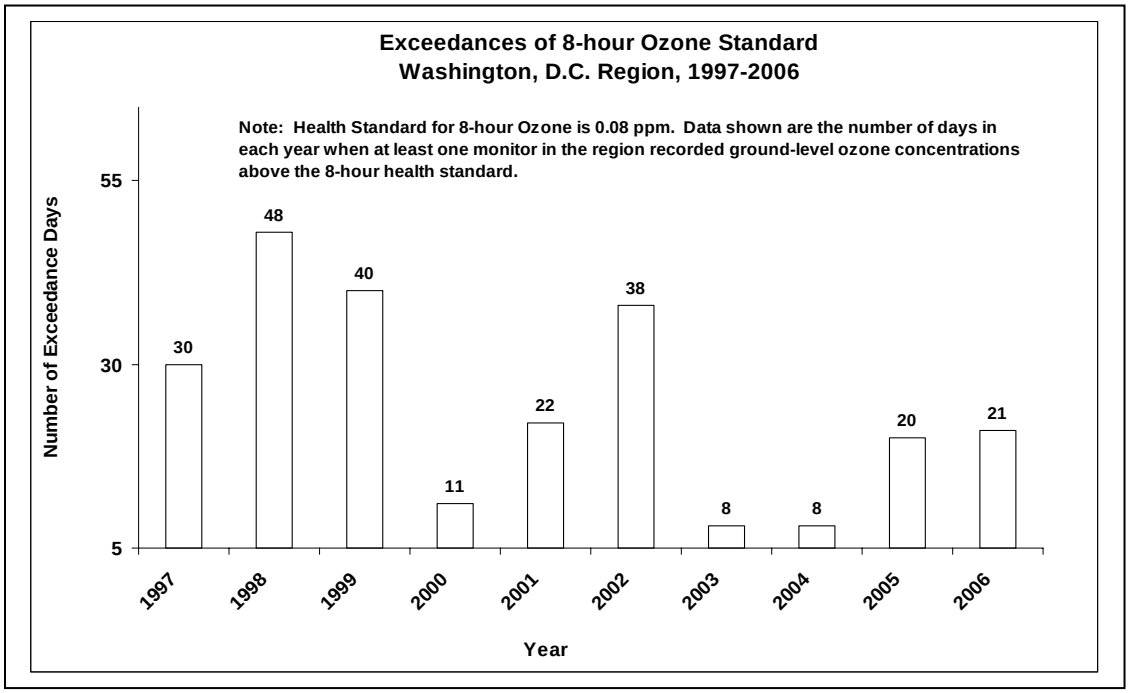
The Washington area has exceeded the federal 8-hour health standard for ozone since the standard was introduced in 1997. The number of ozone exceedance days in a season ranged from a low of 8 to a high of 48. In an average summer from 1997 - 2006, there were 25 days when Washington's air exceeded the ozone standard.

The federal standard is 0.08 ppm (84 ppb) of ozone averaged over eight hours. Figure 2-5 shows the number of days that the Washington region has violated the ozone standard since 1997. 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. The agreement was renewed in 2004.

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 City of 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, and Prince William 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.

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.

Representatives of the following state air management agencies are members of MWAQC: District of Columbia Department of Environment, Air Quality Division; Air and Radiation Management Administration of the State of Maryland's Department of the Environment (MDE); and the Commonwealth of Virginia's Department of Environmental Quality (VDEQ). Representatives of the following state transportation agencies are members of MWAQC: District Department of Transportation (DDOT), Maryland Department of Transportation (MDOT), and the Virginia Department of Transportation (VDOT).

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 Interstate Air Quality Council (IAQC) (see Section 2.10) and 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 Virginia Department of Environmental Quality on behalf of the governor.

## 2.10 Interstate Air Quality Council

The Interstate Air Quality Council (IAQC) is a cabinet-level collaboration between the District of Columbia, the State of Maryland and the Commonwealth of Virginia, comprised of the secretaries of the environment and transportation. The purpose of the IAQC is to address issues of interstate transport of air pollutants and to provide a sound process for improving regional air quality. IAQC transmits air quality planning proposals and materials to MWAQC for review and consideration. MWAQC transmits proposed plans and reports to the IAQC for submittal by the Governors and the Mayor to EPA.

## 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 SIPs to meet the requirements of the CAAA. After MWAQC approves the SIP and the Interstate Air Quality Council approves, each of the states and the District of Columbia will submit the document, along with specific commitments, schedules for adoption 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 Reasonable Further Progress (RFP) Requirements

The Washington region is required to demonstrate continued reductions of 15% in VOC or VOC with NOx substitution from 2002 and 2008. This SIP explains that the Washington region is able to demonstrate reasonable further progress for the period 2002-2008 using a 15% VOC reduction

(see chapters 5 and 11 for detail). MWAQC has taken the following steps in development of the regional air quality plan:

- Recalculation of 2002 base-year emissions inventory

The recalculated 2002 base year inventory of man-made pollution sources is 448.28 tons per day VOC and 597.22 tons per day of NOx. Chapter 3 provides complete documentation of the revised 2002 base year inventory.

- Recalculation of adjusted base-year inventories for 2002, and 2008 with MOBILE6.2

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 2002 base-year inventory to eliminate reductions that would occur in 2008 due to pre-1990 rules and regulations. The RFP adjusted base-year 2002 inventory is 497.89 tons per day VOC and 638.81 tons per day NOx. The RFP adjusted year 2008 inventory is 485.44 tons per day VOC and 607.20 tons per day NOx.

- Recalculation of 2008 VOC emission target level and actual 2008 inventory

Difference of RFP adjusted years 2002 and 2008 VOC inventories is the non-creditable VOC emission reduction that would occur during the period 2002 through 2008. Non-creditable VOC emission reduction was estimated to be 12.45 tpd and is subtracted from the base-year 2002 inventory to develop adjusted base-year 2002 inventory, which is the basis for calculating the RFP target level. 15% VOC (or 65.38 tpd) emission reduction during the period 2002 though 2008 was required from the adjusted base-year 2002 inventory to meet the RFP requirement. Actual VOC target level is the difference of adjusted base-year 2002 inventory (435.83 tpd) and emission reduction required (65.35 tpd) and therefore was estimated to be 370.45 tpd. Since the actual estimated 2008 inventory was 358.84 tpd of VOC, which is well below the target level, RFP requirement was met.

## 2.15 2009 Attainment Demonstration

The objective of the photochemical modeling study is to enable the air agencies to analyze the efficacy of various control strategies, and to demonstrate that the measures adopted as part of the State Implementation Plan will result in attainment of the ozone standard by 2009. The modeling exercise predicts future 2009 air quality conditions based on the entire ozone season in the base year 2002, and applies control measures to demonstrate the effectiveness of new measures in reducing air pollution.

The attainment modeling project was directed by the MWAQC's Technical Advisory Committee (TAC) and the Metropolitan Washington Air Quality Committee, a policy committee. EPA's Models-3/Community Multiscale Air Quality (CMAQ) is the model used for the attainment demonstration. Virginia Department of Environmental Quality (DEQ) in consultation with the Maryland Department of the Environment (MDE), DC Department of the Environment (DDOE),

and the Metropolitan Washington Council of Governments (MWCOG), was responsible for conducting CMAQ runs for the Washington, DC-MD-VA nonattainment area and surrounding counties (i.e., the Washington region domain). Virginia DEQ's modeling runs were done in coordination with the Ozone Transport Commission's (OTC) modeling for the 12-state Ozone Transport Region (OTR), and with Visibility Improvement State and Tribal Association of the Southeast (VISTAS) Association for Southeastern Integrated Planning (ASIP) modeling, done for the southeastern states. Modeling centers included New York State Dept. of Environmental Conservation (NYS DEC), University of Maryland, Northeast States for Coordinated Air Use Management (NESCAUM) and Virginia DEQ. Modeling inventories were developed, updated and shared among the regional modeling centers and provided by the MidAtlantic Visibility Union (MANE-VU) and VISTAS.

In addition to CMAQ model runs, the WOE consists of statistical analyses and additional modeling exercises that give further evidence of the region's progress towards attainment. The photochemical modeling combined with supporting Weight of Evidence analysis provide strong evidence the region will attain the 8-hour ozone standard by 2009.

## 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 2008 ozone season (May 1, 2008); are enforceable; are technically feasible; are economically feasible, defined as a cost of $3,500 to $5,000 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 minimus* 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 84 parts per billion by 2008 and the potential for intensive and costly implementation.

## 2.17 Contingency Measures

In the event that the reductions anticipated in the 2008 RFP demonstrations or the 2009 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 adjusted 2002 base year inventory for both Reasonable Further Progress and attainment. A minimum of 0.3 % VOC must be included. The total reductions required for the RFP and attainment contingencies are 1.3 tons/day VOC and 15.3 tons/day NOx, with reductions achieved by 2010 and 2011 respectively. Emissions reduction requirements for both RFP and attainment contingencies are met using different measures. These proposed contingency measures are listed in Chapter 11. Chapter 11 contains detail on these measures, how they would be implemented, enforced, and the amount of reduction benefit expected.

## Sources

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

[2] *Revised State Implementation Plan (SIP) Revision, Phase I Attainment Plan, for the Washington DC-MD-VA Nonattainment Area*, MWAQC, April 16, 1999.

[3] *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.

[4] *Approval and Promulgation of Air Quality Implementation Plans, District of Columbia, Maryland, Virginia, 1-Hour Attainment Plans, Rate-of-Progress Plans, Contingency Measures, Transportation Control Measures, VMT Offset, and 1990 Base Year Inventory," Federal Register, Vol 70, No. 92, May 13, 2005, pp. 25688-25716 and Approval and Promulgation of Air Quality Implementation Plans; Maryland; Metropolitan Washington, DC 1-Hour Ozone Attainment Plan, Lifting of Earlier Rules Resulting in Removal of Sanctions and Federal Implementation Clocks, Federal Register, Vol.70, No.220, November 16, 2005, pp.69440-69443.*

[5] *http://www.epa.gov/ttn/oarpg/naaqsfin/o3health*

[6] *American Lung Association, State of the Air Report, 2006, www.lungusa.org*

## 3.0 THE 2002 BASE-YEAR INVENTORY

### 3.1 Background and requirements

The 2002 Base-Year Inventory is published in a separate document, "2002 Base Year Emissions Inventory of Ozone Precursor Emissions for the Washington, DC-MD-VA Nonattainment Area," (June 15, 2006). 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 offices of the Council of Governments and the District of Columbia, Maryland, and Virginia air management agencies in addition to COG Web site (http://sharepoint.mwcog.org/airquality).

The emissions inventory covers the Washington DC-MD-VA nonattainment area, Figure 2-1, which is classified as a moderate nonattainment area for ozone by the U.S. Environmental Protection Agency (EPA). The 2002 emissions inventory is the starting point for calculating the emissions reduction requirement needed to meet the 15% VOC emissions (for man-made sources of emissions) reduction goal by 2008 to meet reasonable further progress requirements (RFP) prescribed for moderate nonattainment areas by the Clean Air Act Amendments and EPA.

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 day and annual basis. Included in the inventory are stationary anthropogenic (man-made), biogenic (naturally occurring), and non-road and on-road mobile sources of ozone precursors.

The 2002 base-year ozone season inventories for VOC and NOx can be seen in Tables 3-1 and 3-2.

**Table 3-1**
**2002 Base-Year Ozone Season VOC Inventory**
**(Tons/Day)**

| | District of Columbia | Maryland | Virginia | Total |
|---|---|---|---|---|
| Point | 0.24 | 4.60 | 8.07 | 12.91 |
| Area | 16.81 | 92.49 | 83.35 | 192.64 |
| Non-Road | 8.91 | 63.82 | 53.06 | 125.79 |
| On-Road | 13.09 | 56.13 | 47.71 | 116.94 |
| Biogenics | 13.63 | 166.70 | 134.41 | 314.74 |
| Total | 52.68 | 383.74 | 326.60 | 763.02 |

* Small discrepancies may result due to rounding

**Table 3-2**
**2002 Base-Year Ozone Season NOx Inventory**
**(Tons/Day)**

| | District of Columbia | Maryland | Virginia | Total |
|---|---|---|---|---|
| Point | 4.89 | 155.78 | 59.93 | 220.60 |
| Area | 2.16 | 6.77 | 15.32 | 24.25 |
| Non-Road | 10.54 | 34.21 | 40.97 | 85.72 |
| On-Road | 23.70 | 132.27 | 110.68 | 266.65 |
| Biogenics | 0.10 | 1.75 | 1.22 | 3.07 |
| Total | 41.39 | 330.78 | 228.12 | 600.29 |

* Small discrepancies may result due to rounding

**Table 3-3**
**2002 Base-Year Ozone Season CO Inventory**
**(Tons/Day)**

| | District of Columbia | Maryland | Virginia | Total |
|---|---|---|---|---|
| Point | 1.01 | 77.72 | 9.77 | 88.50 |
| Area | 2.12 | 23.09 | 16.46 | 41.68 |
| Non-Road | 73.47 | 656.47 | 671.82 | 1401.76 |
| On-Road | 139.38 | 774.98 | 642.61 | 1556.97 |
| Biogenics | 1.13 | 16.08 | 12.38 | 29.59 |
| Total | 217.11 | 1548.34 | 1353.04 | 3118.50 |

* Small discrepancies may result due to rounding

**Table 3-4**
**2002 Base-Year Annual VOC Inventory**
**(Tons/Year)**

| | District of Columbia | Maryland | Virginia | Total |
|---|---|---|---|---|
| Point | 421.97 | 1169.50 | 701.93 | 2293.40 |
| Area | 6433.31 | 42671.04 | 34395.80 | 83500.16 |
| Non-Road | 2042.84 | 15341.7 | 14177.81 | 31562.36 |
| On-Road | 4582.50 | 19405.47 | 16920.67 | 40908.64 |
| Biogenics | 2519.63 | 31126.70 | 24906.38 | 58552.71 |
| Total | 16000.25 | 109714.41 | 91102.59 | 216817.27 |

* Small discrepancies may result due to rounding

**Table 3-5**
**2002 Base-Year Annual NOx Inventory**
**(Tons/Year)**

| | District of Columbia | Maryland | Virginia | Total |
|---|---|---|---|---|
| Point | 3177.81 | 45920.04 | 14479.17 | 63577.02 |
| Area | 1694.70 | 5401.14 | 7091.38 | 14187.22 |
| Non-Road | 3535.64 | 10580.61 | 13680.71 | 27796.96 |
| On-Road | 8762.85 | 49018.07 | 41163.68 | 98944.60 |
| Biogenics | 25.91 | 430.75 | 301.22 | 757.88 |
| Total | 17196.91 | 111350.61 | 76716.16 | 205263.68 |

* Small discrepancies may result due to rounding

**Table 3-6**
**2002 Base-Year Annual CO Inventory**
**(Tons/Year)**

| | District of Columbia | Maryland | Virginia | Total |
|---|---|---|---|---|
| Point | 158.73 | 26419.14 | 1805.09 | 28382.96 |
| Area | 2328.39 | 54261.98 | 23697.04 | 80287.40 |
| Non-Road | 18753.14 | 161173.48 | 168615.54 | 348542.16 |
| On-Road | 64181.72 | 336517.27 | 288150.48 | 688849.47 |
| Biogenics | 226.51 | 3241.41 | 2481.13 | 5949.05 |
| Total | 85648.49 | 581613.28 | 484749.28 | 1152011.04 |

* 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 (tpy) of VOCs or 25 tpy 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 2002 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 also included all types of Andrews Air Force Base emissions in their point source emissions. These sources are called quasi-point source emissions.

### 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.

### 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, MOBILE 6.2.03, was used to determine the emissions characteristics of the vehicle fleet in place in the year 2002. 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. |

### 3.2.4 Nonroad Sources

Emissions for all nonroad vehicles and engines except airport (aircraft, ground support equipment (GSE) and, auxiliary power units (APU), locomotives, and diesel marine vessels were calculated using EPA's NONROAD2005 model version 2005a (February 8, 2006) except for locomotives, marine diesel vessels, and aircrafts. This model was run with its associated graphic user interface NONROAD2005.0.0 (December 2, 2005), reporting utility version. 2005c (March 21, 2006), and all geographical allocation data files updated until February 1, 2006.

Emissions from the "nonroad vehicles and engines" category result from the use of fuel in a diverse collection of vehicles and equipment, including vehicles and equipment in the following categories:

- Recreational vehicles, such as all-terrain vehicles and off-road motorcycles;
- Logging equipment, such as chain saws;
- Agricultural equipment, such as tractors;
- Construction equipment, such as graders and back hoes;
- Industrial equipment, such as fork lifts and sweepers;
- Residential and commercial lawn and garden equipment, such as leaf and snow blowers.
- Aircraft ground support equipment.

The nonroad model estimates emissions for each specific type of nonroad equipment by multiplying the following input data estimates:

- Equipment population for base year (or base year population grown to a future year), distributed by age, power, fuel type, and application;
- Average load factor expressed as average fraction of available power;
- Available power in horsepower;
- Activity in hours of use per year; and
- Emission factor with deterioration and/or new standards.

The emissions are then temporally and geographically allocated using appropriate allocation factors.

Aircraft (military, commercial, general aviation, and air taxi) and auxiliary power units (APU) operated at airports along with locomotives and diesel marine vessels are also considered nonroad sources and are included in the nonroad category.

Metropolitan Washington Airports Authority (MWAA) provided all types of airport emissions for Dulles (Fairfax & Loudoun) and Reagan National (Arlington) airports, which are documented in *Air Pollution Emission Inventories for Washington Dulles International Airport and Ronald Reagan Washington National Airport for Calendar Years 2002, 2008, 2009*[1] (see Appendix B4 of the 2002 base year inventory document). Nonroad model-generated ground support equipment emissions for Loudoun and Arlington counties were replaced by emissions

[1] Metropolitan Washington Airports Authority, *Air Pollution Emission Inventories for Washington Dulles International Airport and Ronald Reagan Washington National Airport for Calendar Years 2002, 2008, 2009,* prepared by URS Corporation, Washington, D.C. March 2006.

provided by MWAA. While MWAA GSE emissions for Dulles airport were equally divided between Fairfax and Loudoun counties, Reagan National emissions were put into Arlington County. Aircraft and APU emissions for other counties were provided by the respective states. Emissions from locomotives and commercial diesel marine vessels were also provided by the states.

### 3.2.5 Biogenic Emissions

An important component of the 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. EPA used a biogenic computer model (BEIS3.12) to estimate biogenic emissions for each county in the country for all twelve months of the year 2002. Emissions data for Washington, DC ozone non-attainment area counties were acquired from the EPA web-site (ftp://ftp.epa.gov/EmisInventory/2002finalnei/biogenic_sector_data/). EPA has recommended that states use these emissions in case they do not have their own estimated biogenic emissions. The Washington, DC-MD-VA ozone non-attainment area decided to use the inventories provided by the EPA.

## 3.3 Annual Inventories

The 2002 base-year inventories for VOC, NOx and CO in Tables 3-1 through 3-3 are for the typical ozone season day and in Tables 3-4 through 3-6 for the annual emissions. A summary of both the ozone season day and the annual inventories for VOC, NOx and CO is also found in Table 1-1 of Appendix B.

## 4.0 The 2008 and 2009 Projected Inventories

Part II of EPA's rule to implement the 8-hour NAAQS requires the Washington, DC-MD-VA ozone nonattainment region to achieve a 15 % reduction between 2002 and 2008 using reductions in either VOC or NOx emissions or with any combination of the two.[1] Also an inventory for the attainment year 2009 is required for the region. The 15 % reduction must be calculated from the anthropogenic emissions levels reported in the 2002 base year emissions inventory after those levels have been adjusted for non-creditable emissions reduction occurring between 2002 and 2008. The 2002 Base-Year Inventory is described in Chapter 3. This chapter presents the 2008 and 2009 projection inventories, the estimation of the levels of emissions to be expected in those years before the consideration of emissions controls.

The 2008 and 2009 projected inventories were derived by applying the appropriate growth factors to the 2002 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 7.0 Cooperative Forecasts (population, household and employment projections) and Vehicle Miles Traveled (VMT) projections for 2008 and 2009 were used to project area sources emissions. Round 7.0 Cooperative Forecasts were prepared by the Metropolitan Washington Council of Governments (MWCOG) staff and officially adopted by its Board of Directors on October 12, 2005, prior to the Base Realignment and Closure (BRAC) announcements. Vehicle Miles Traveled (VMT) projections were developed by COG Department of Transportation Planning staff as part of the report on 2005 Constrained Long Range Plan (CLRP) & 2006-2011 Transportation Improvement Program (TIP) for the National Capital Region Transportation Planning Board. Projections for onroad emissions were developed using MOBILE6.2 (January 2003) model and the Travel Demand Model ver. 2.1d #50 developed by the National Capitol Region Transportation Planning Board. The travel demand modeling process also used Round 7.0 Cooperative Forecasts.

EPA's nonroad model, NONROAD2005, was used for developing both 2008 and 2009 nonroad inventories. The Economic Growth Analysis System (EGAS) model was used by all three jurisdictions to project growth in point source emissions.

[1] 40 CFR 51.910(a), *Final Rule to Implement the 8-Hour Ozone National Ambient Air Quality Standard-Phase 2; Federal Register. Final Rule To Implement Certain Aspects of the 1990 Amendments Relating to New Source Review and Prevention of Significant Deterioration as They Apply in Carbon Monoxide, Particulate Matter and Ozone NAAQS; Final Rule for Reformulated Gasoline,* Federal Register. Vol.70, No. 228, Nov. 29, 2005, pp.71612-71705.

## 4.1 Growth Projection Methodology

The following sections describe the methods followed to determine the projected inventories for 2008 and 2009 for point, area, nonroad, and onroad sources.

### 4.1.1 Growth Projection Methodology for Point Sources: EGAS

The growth in point source emissions is projected using EGAS version 5.0. Point source emissions for 2002 are provided from the state data sources and the model is run with the following options selected: Source Classification Code; the Bureau of Labor Statistics national economic forecast; and the baseline regional economic forecast. Point source emission projections using EGAS for 2008 and 2009 are contained in Appendix C.

### 4.1.2 Growth Projection Methodology: Area Sources

Base year 2002 area source emissions were calculated using the year 2002 population, household, and employment data. Growth factors for the periods 2002 through 2008 and 2002 through 2009 were derived by dividing Cooperative Round 7.0 population, household, and employment forecasts and Vehicle Miles Traveled (VMT) data provided by COG Department of Transportation Planning for 2008 and 2009 by the year 2002 population, household, employment, and VMT data for the region respectively. Cooperative Round 7.0 Forecasts and VMT data are provided in Appendix D1 and E1 respectively. Projected area source inventories for 2008 and 2009 are contained in Appendix D1. Growth factors used for the 2008 and 2009 projection years are presented in Tables 4-1 and 4-2.

**Table 4-1**
**2002-2008 Growth Factors**

| Jurisdiction | Employment[a] | Population[a] | Household[a] | VMT[b] |
|---|---|---|---|---|
| District of Columbia | 1.032 | 1.038 | 1.041 | 1.033 |
| Calvert County | 1.238 | 1.126 | 1.127 | 1.151 |
| Charles County | 1.264 | 1.127 | 1.142 | 1.140 |
| Frederick County | 1.259 | 1.140 | 1.143 | 1.146 |
| Montgomery County | 1.088 | 1.084 | 1.082 | 1.048 |
| Prince George's County | 1.090 | 1.047 | 1.067 | 1.045 |
| City of Alexandria | 1.150 | 1.071 | 1.086 | 1.045 |
| Arlington County | 1.113 | 1.068 | 1.086 | 1.019 |
| Fairfax County | 1.109 | 1.098 | 1.101 | 1.058 |
| Fairfax City | 1.052 | 1.058 | 1.057 | 1.058 |

| | | | | |
|---|---|---|---|---|
| Falls Church City | 1.145 | 1.109 | 1.132 | 1.058 |
| Loudoun County | 1.367 | 1.444 | 1.447 | 1.292 |
| Prince William County | 1.201 | 1.263 | 1.267 | 1.163 |
| Manassas City | 1.055 | 1.058 | 1.079 | 1.163 |
| Manassas Park City | 1.383 | 1.249 | 1.279 | 1.163 |

[a] Growth factors based on COG Round 7.0 Cooperative Forecasts.
[b] Growth factors based on VMT estimates from 2005 CLRP & 2006-2011 TIP provided by COG Department of Transportation Planning.

**Table 4-2**
**2002-2009 Growth Factors**

| Jurisdiction | Employment[a] | Population[a] | Household[a] | VMT[b] |
|---|---|---|---|---|
| District of Columbia | 1.043 | 1.049 | 1.051 | 1.038 |
| Calvert County | 1.266 | 1.147 | 1.147 | 1.161 |
| Charles County | 1.291 | 1.141 | 1.160 | 1.159 |
| Frederick County | 1.297 | 1.162 | 1.165 | 1.175 |
| Montgomery County | 1.106 | 1.097 | 1.095 | 1.057 |
| Prince George's County | 1.108 | 1.052 | 1.076 | 1.062 |
| City of Alexandria | 1.166 | 1.083 | 1.101 | 1.083 |
| Arlington County | 1.137 | 1.082 | 1.102 | 1.023 |
| Fairfax County | 1.138 | 1.117 | 1.120 | 1.074 |
| Fairfax City | 1.066 | 1.071 | 1.067 | 1.074 |
| Falls Church City | 1.094 | 1.141 | 1.172 | 1.074 |
| Loudoun County | 1.427 | 1.515 | 1.517 | 1.331 |
| Prince William County | 1.235 | 1.304 | 1.312 | 1.189 |
| Manassas City | 1.067 | 1.064 | 1.089 | 1.189 |
| Manassas Park City | 1.489 | 1.286 | 1.322 | 1.189 |

[a] Growth factors based on COG Final Round 7.0 Cooperative Forecasts.
[b] Growth factors based on VMT estimates from 2005 CLRP & 2006-2011 TIP provided by COG Department of Transportation Planning.

2008 and 2009 emissions for area sources were calculated by multiplying the 2002 base-year area emissions by the above growth factors for 2008 and 2009 for each jurisdiction. Each area 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** – Depending on whether emission factors were based on employment or population, the surrogate chosen varied with individual sub-categories. For example, the automobile refinishing category was grown using employment, as the emission factor was based on it, but population was chosen for growing traffic markings as its emission factor was based on population.

**Commercial/Consumer Solvent Use** - Population was chosen as the growth surrogate since 2002 emissions are based on per capita emission factors.

**Residential Fuel Combustion -** Household was chosen as the growth surrogate.

**Industrial/Commercial/Institutional Fuel Combustion -** Population was chosen as the growth surrogate except for the commercial/institutional coal combustion category, where no growth was assumed.

**Vehicle Fueling (Stage II) and Underground Tank Breathing** - All gasoline marketing categories were based on vehicle miles traveled (VMT) data since VMT is an appropriate surrogate for gasoline sales. Emission factors for these categories are based on gasoline sales.

**Open Burning** - Population was chosen as the growth surrogate as yard wastes, land debris, etc. increase with population.

**Structural Fires, Motor Vehicle Fires** – Population was chosen as the growth surrogate.

**Publicly Owned Treatment Works (POTW) –** Households was chosen as the growth surrogate.

**Dry Cleaning** - Employment was chosen as the surrogate.

**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.

**Tank Truck Unloading** – Growth in VMT was applied to this category since base-year emissions are calculated using gasoline sales.

**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, Breweries** - Population was chosen as the surrogate.

**Soil/Groundwater Remediation** - 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.

**Portable Fuel Container Emissions** - Emissions for the District of Columbia and Maryland from residential and commercial sectors were grown based on household and employment respectively. Emissions for Virginia were grown using the fuel usage by SCCs associated with the refueling of portable fuel containers. These fuel usage data were derived from the NONROAD2005 model by MACTEC as part of the emissions development efforts for the Visibility Improvement State and Tribal Association of the Southeast (VISTAS) modeling process.

**Commercial Cooking** - Employment growth was used as the surrogate.

**Composting** – Zero growth was applied to this category.

**Forest Fires, Slash Burning, Prescribed Burning** – Zero growth was applied to this category.

**Accidental Oil Spills** - Zero growth was applied to this category.

**Incineration**– Zero growth was applied to this category.

**Pesticide Application** - Zero growth was applied to this category.

**Aircraft Refueling Emissions** - Emissions from refueling of aircrafts was projected based on employment.

### 4.1.3 Growth Projection Methodology: Nonroad Sources

The 2008 and 2009 nonroad source inventories were created through the use of EPA's NONROAD2005 model version 2005a (February 8, 2006), except for locomotives, marine diesel vessels, and aircrafts. This model was run with its associated graphic user interface NONROAD2005.1.0 (June 12, 2006), reporting utility version. 2005c (March 21, 2006), and all geographical allocation data files updated until February 1, 2006. The base year 2002 nonroad source inventory was also created using the same model, reporting utility and geographical allocation data files, but with a different graphic user interface version NONROAD2005.0.0 (December 2, 2005).

Nonroad model runs were made for the metropolitan Washington region for average ozone season day. The ozone season extends from May through September. However, the NONROAD2005 model used in these runs did not have the option to run the model for the ozone season period. Instead, it provided an option for a summer season (June – August) run. In order to get average ozone season day emissions, the model was run for

the entire summer season (June-August) while using average ozone season fuel parameters. Then total emissions calculated this way were divided by the total number of days in the summer season (92) to get average ozone season day emissions. Monthly fuel data obtained from the states were averaged for the period May through September to get fuel parameters reflecting the ozone season period. Three different sets of average ozone season fuel parameters were developed each for the District of Columbia, Virginia, and Maryland.

Methodology to prepare inputs for ozone season day runs is provided below.

Temperature

Temperature data were acquired from the National Climatic Data Center (NCDC). Hourly average temperature data were collected for Dulles (IAD) and Reagan National (DCA) weather stations for the top ten 8-hour maximum ozone days during the period 2002-2004. Then the two hourly datasets were averaged together to get one hourly dataset. Then minimum, maximum, and average temperatures were computed from this hourly temperature dataset.

Fuel inputs

Month specific data for fuel RVP and oxygen weight percent were provided by the state air agencies of Maryland and Virginia. These data were averaged for the period May through September to get ozone season average inputs. The District of Columbia decided to use year and ozone season specific Mobile6 model default values for these parameters. Nonroad model defaults were used for sulfur content in gas, diesel, marine diesel, and CNG/LPG. Model default (Zero %) Stage II controls were assumed for the model runs.

Model inputs (temperature, fuel, and other parameters) for both 2008 and 2009 are listed below for each jurisdiction:

**Table 4-3**
**NONROAD Model - Common Inputs**

| Parameters | Values |
|---|---|
| Min. Temperature | 69.8 |
| Max. Temperature | 92.5 |
| Avg. Temperature | 81.4 |
| Gas Sulfur (%) | 0.003 |
| Diesel Sulfur (%) | 0.0348 |
| Marine Diesel Sulfur (%) | 0.0408 |
| CNG/LPG Sulfur (%) | 0.003 |
| Oxygen Weight (%) | 2.1 |
| Stage II Control (%) | 0 |

**Table 4-4**
**NONROAD Model – State-Specific Inputs**

| State | RVP |
|---|---|
| District of Columbia | 6.8 |
| Maryland | 6.9 |
| Virginia | 6.8 |

Since the nonroad model does not generate emissions for aircraft, APU, locomotives, and commercial diesel marine vessels, these were either projected from the base year emissions using the Cooperative Forecast 7.0 or acquired from MWAA. Below are the details for projecting emissions for the above mentioned individual nonroad categories.

Aircraft emissions (commercial, military, general aviation, air taxi)
Metropolitan Washington Airports Authority (MWAA) provided all types of airport emissions for Dulles and Reagan National airports, which are documented in *Air Pollution Emission Inventories for Washington Dulles International Airport and Ronald Reagan Washington National Airport for Calendar Years 2002, 2008, 2009*[2] (see Appendix B4 of the base year 2002 inventory document). Since Dulles airport is spread across Fairfax and Loudoun counties, MWAA emission from Dulles airport were divided equally between Fairfax and Loudoun counties. Emissions from Reagan National airport were put into Arlington County.

Military aircraft emissions for Maryland for future years were provided by MDE. No growth was assumed for Virginia military aircraft emissions.

General aviation and air taxi emissions for Maryland were provided by MDE. For Virginia, these emissions were grown from the base year using population as the surrogate.

Auxiliary power unit emissions
These emissions were only available for Dulles (Fairfax & Loudoun) and Reagan National (Arlington) airports and were provided by the MWAA. Details on the development of these emissions are provided in the MWAA airport emissions document referred above.

Ground support equipment emissions
The NONROAD2005 model generated these emissions for Arlington, Loudoun, Manassas city, Fredrick, Montgomery, and Prince Georges' counties. However, emissions for Arlington, Fairfax, and Loudoun counties were taken from the MWAA document referred above. MWAA GSE emissions were generated using the EDMS model, which calculated emissions based on actual aircraft operations and used data from a recent survey performed in February 2004 on GSE fleet, fuel types, and operating

[2] Metropolitan Washington Airports Authority, *Air Pollution Emission Inventories for Washington Dulles International Airport and Ronald Reagan Washington National Airport for Calendar Years 2002, 2008, 2009*, prepared by URS Corporation, Washington, D.C. March 2006.

times. Nonroad model calculated emissions are based on GSE population only and therefore emissions generated this way were considered less accurate than the one generated by the EDMS model. MWAA also provided emissions from mobile lounges for Dulles airport separately, which were combined with GSE emissions. While MWAA GSE emission from Dulles airport were divided equally between Fairfax and Loudoun counties, those from Reagan National airport were put into Arlington county.

Commercial Diesel Marine Vessels
Base year emissions from commercial diesel marine vessels were provided by MDE and were grown to future years using employment as the surrogate.

Railroad
Railroad or locomotive emissions were provided by all three states and were grown using employment as the surrogate.

Projected nonroad source inventories for 2008 and 2009 are contained in Appendix D1. Detailed NONROAD2005 model output files are being provided separately in electronic format as Appendix D2 of this document.

### 4.1.4 Growth Projection Methodology: Onroad Sources

The 2008 and 2009 mobile source inventories were created through the use of transportation and emissions modeling techniques. This involved use of the MOBILE6.2.03 emissions factor model and the Version 2.1d #50 Travel Demand Model with 2008 and 2009 planned highway network. Full documentation of the development of the 2008 and 2009 mobile inventories is included in Appendix E1. Detailed Mob6.2.03 model input, output, and external output files are being provided separately in electronic format as Appendix E2 of this document. Appropriate population, household, and employment growth are input through the Round 7.0 Cooperative Forecasting techniques.

### 4.1.5 Biogenic Emission Projections

2002 base year emissions were estimated by EPA using BEIS3.12 model. Biogenic emission inventories for 2009 are the same as those used for the 2002 base year for Washington, DC-VA-MD ozone nonattainment region. Year specific biogenic inventories for 2009 were not estimated. No 2008 biogenic inventories were prepared as they are not used to determine reasonable further 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. The Washington, DC region is designated as moderate nonattainment for the 8-hour ozone standard. Under the current moderate designation, the NSR thresholds are 50 tpy VOC and 100 tpy NOx.

The New Source Review permit regulations in Virginia are structured so that the pertinent requirements such as major source threshold and offset ratio are self-implementing depending upon changes to the nonattainment area classification. The NSR threshold will remain at 25 tpy for both VOC and NOx for Maryland and the District. NSR offset ratio of 1.15 to 1.00 applicable for moderate area was used.

## 4.3 Actual vs. Allowable Emissions in Development of the 2008 and 2009 Projected Emissions Inventories

For the purposes of calculating 2008 and 2009 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 one 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 2008 and 2009 VOC and NOx projection-year emission inventory results with no control measures applied summarized by component of the inventory in Tables 4-3 though 4-6 below.

**Table 4-5**
**2008 Projected Uncontrolled VOC Emissions (tons/day)**
**Washington, DC-MD-VA Ozone Nonattainment Area**

| Emission Source | Maryland[a] | Virginia | District of Columbia | Total[b] |
|---|---|---|---|---|
| Point | 5.34 | 8.40 | 0.26 | 13.99 |
| Area | 101.62 | 93.55 | 17.40 | 212.56 |
| Non-road | 65.27 | 55.61 | 8.56 | 129.44 |
| Mobile | 36.56 | 32.62 | 7.99 | 77.17 |
| Total[b] | 208.78 | 190.18 | 34.21 | 433.17 |

Notes:
[a] Maryland point source emissions include 0.98 tpd of quasi- point source emissions from Andrews Air Force Base (AFB).
[b] Small discrepancies may result due to rounding.

**Table 4-6**
**2008 Projected Uncontrolled NOx Emissions (tons/day)**
**Washington, DC-MD-VA Ozone Nonattainment Area**

| Emission Source | Maryland[a] | Virginia | District of Columbia | Total[b] |
|---|---|---|---|---|
| Point | 176.91 | 56.98 | 8.12 | 242.01 |
| Area | 7.11 | 17.58 | 2.24 | 26.93 |
| Non-road | 36.14 | 44.28 | 10.71 | 91.13 |
| Mobile | 92.51 | 80.10 | 17.36 | 189.97 |
| Total[b] | 312.67 | 198.93 | 38.43 | 550.03 |

Notes:
[a] Maryland point source emissions include 2.21 tpd of quasi- point source emissions from Andrews AFB.
[b] Small discrepancies may result due to rounding.

**Table 4-7**
**2009 Projected Uncontrolled VOC Emissions (tons/day)**
**Washington, DC-MD-VA Ozone Nonattainment Area**

| Emission Source | Maryland[a] | Virginia | District of Columbia | Total[b] |
|---|---|---|---|---|
| Point | 5.33 | 8.81 | 0.26 | 14.40 |
| Area | 103.06 | 95.44 | 17.57 | 216.07 |
| Non-road | 66.00 | 56.58 | 8.58 | 131.16 |
| Mobile | 34.97 | 31.36 | 7.52 | 73.85 |
| Total[b] | 209.35 | 192.19 | 33.93 | 435.48 |

Notes:
[a] Maryland point source emissions include 0.98 tpd of quasi- point source emissions from Andrews AFB.
[b] Small discrepancies may result due to rounding.

**Table 4-8**
**2009 Projected Uncontrolled NOx Emissions (tons/day)**
**Washington, DC-MD-VA Ozone Nonattainment Area**

| Emission Source | Maryland[a] | Virginia | District of Columbia | Total[b] |
|---|---|---|---|---|
| Point | 176.85 | 57.40 | 7.54 | 241.79 |
| Area | 7.17 | 17.96 | 2.26 | 27.39 |
| Non-road | 36.66 | 45.12 | 10.82 | 92.6 |
| Mobile | 89.74 | 77.53 | 16.89 | 184.16 |
| Total[b] | 310.41 | 198.02 | 37.52 | 545.95 |

Notes:
[a] Maryland point source emissions include 2.21 tpd of quasi- point source emissions from Andrews AFB.
[b] Small discrepancies may result due to rounding.

## 4.5 Emission Reductions from Control Measures

Chapter 6 of this SIP describes the control measures that have either already been implemented or will be implemented by 2008 and 2009 that will reduce emissions in the two years. 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 6.5. Projected controlled inventories for 2008 and 2009 assume a number of control measures to be in place by these years.

Tables 4-9 through 4-12 present the projected controlled emissions for the 2008 rate-of-progress and 2009 attainment years resulting from implementation of the control measures. Below is a list of the measures implemented by the year 2002 in the Washington region. Chapter 6 presents detailed information on the measures and the projected reductions from each.

Point

- Non-CTG VOC RACT to 50 tpy
- NOx OTC Phase II Budget Rules (DC only)
- Expanded Non-CTG VOC RACT and State Point Source Regulations to 25 tons/yr
- NOx SIP Call (MD)

Area

- Stage II Vapor Recovery
- Phase II Volatility Controls of Refueling Emissions
- Reformulated Surface Coatings
- Reformulated Consumer Products – National Rule
- Reformulated Industrial Cleaning Solvents – National Rule
- National Standards for Locomotive Engines
- Surface Cleaning/Degreasing for Machinery/Automotive Repair
- Landfill Regulations
- Seasonal Open Burning Restrictions
- Stage I Expansion (Tank Truck Unloading)
- Graphic Arts Controls
- Auto body Refinishing

Nonroad

- 1994 EPA Non-Road Diesel Engines Rule
- 1995 EPA Non-Road Small Gasoline Engines Rule, Phase 1 and Phase 2 (handheld and non handheld)
- 1996 EPA Emissions standards for spark ignition marine engines
- 2002 EPA Emissions standards for large spark ignition engines
- Reformulated Gasoline (off-road)

Onroad

- High-Tech Inspection/Maintenance (I&M)
- Reformulated Gasoline (on-road)

Federal “Tier I” Vehicle Standards and New Car Evaporative Standards
National Low Emission Vehicle Program

Below is a list of the measures with phased-in implementations between 2002 and 2009 in the Washington region. Note that the District's OTC VOC rules on all the applicable area source categories are or will be fully adopted, submitted to EPA, and federally enforceable measures. However, the emission reductions of 3.38 tpd VOC in 2008 and 3.80 tpd VOC in 2009 arising from these measures in the District are not applied to the emissions inventories presented in this RFP/attainment modeling/contingency demonstration of the Washington DC-MD-VA regional SIP. The District of Columbia's measures are expected to provide additional enhancements to the air quality improvement in the region.

Point

Clean Air Interstate Rule (CAIR) (VA and DC)
Maryland Healthy Air Act (MD)

Area

Additional phase-in of reductions from National Locomotives Rule
OTC Mobile Equipment Repair and Refinishing (VA and DC) Rule
OTC AIM Coatings Rule
OTC Solvent Cleaning Rule for VA and DC
OTC Consumer Products Rule - Phase I & II
OTC Portable Fuel Container Rule - Phase I & II
OTC Industrial Adhesives Rule
On-Board Refueling/Vapor Recovery Rule for LD Trucks (2004)

Nonroad

2004 Nonroad Heavy Duty Diesel Rule (negligible benefits by 2009)
Additional phase-in of technology rules implemented by 2002.

Onroad

Heavy-Duty Diesel Engine Rule (2004)
Heavy-Duty Diesel Engine Rule (2007)
Tier 2 Motor Vehicle Emission Standards
I&M Program with Final Cutpoints
Transportation Control Measures (TCMs)
Vehicle Technology, Maintenance, or Fuel-Based Measures

## 4.6 2008 Controlled Emissions for Reasonable Further Progress

The projection of 2008 controlled emissions is simply the 2008 uncontrolled emissions minus the emission reductions achieved from the federal control measures and the reasonable further progress control measures implemented by states for the 8-hour ozone plan. This information is presented in Table 4-7 and Table 4-8. Controlled point source inventories are contained in Appendix C, controlled area and nonroad source inventories in Appendix D1, and controlled mobile source inventories in Appendix E1. Maryland point source emissions include quasi- point source (nonroad and onroad mobile) emissions from Andrews Air Force Base, which are described in detail in the 2002 Base Year emissions inventory document.

**Table 4-9**
**2008 Projected Controlled VOC Emissions (tons/day)**
**Washington, DC-MD-VA Ozone Nonattainment Area**

| Emission Source | Maryland[a] | Virginia | District of Columbia | Total[b,d] |
|---|---|---|---|---|
| Point | 5.34 | 8.40 | 0.24 | 13.98 |
| Area[c] | 87.63 | 76.55 | 17.40 | 181.59 |
| Non-road | 47.50 | 37.92 | 7.06 | 92.48 |
| Mobile | 33.86 | 29.65 | 7.47 | 70.98 |
| Total[d] | 174.33 | 152.52 | 32.18 | 358.84 |

Notes:
[a] Maryland point source emissions include 0.98 tpd of quasi- point source emissions from Andrews AFB.
[b] Regional total includes a reduction of 0.19 tpd VOC from Voluntary Measures Bundle.
[c] The controlled area source emissions for the District do not include reductions from the OTC VOC measures. The District's OTC VOC rules on all the applicable area source categories are or will be fully adopted, submitted to EPA, and federally enforceable measures. However, the emission reductions of 3.38 tpd VOC in 2008 and 3.80 tpd VOC in 2009 arising from these measures in the District are not applied to the emissions inventories presented in this RFP/attainment modeling/contingency demonstration of the Washington DC-MD-VA regional SIP. The District of Columbia's measures are expected to provide additional enhancements to the air quality improvement in the region.
[d] Small discrepancies may result due to rounding

**Table 4-10**
**2008 Projected Controlled NOx Emissions (tons/day)**
**Washington, DC-MD-VA Ozone Nonattainment Area**

| Emission Source | Maryland[a] | Virginia | District of Columbia | Total[b,c] |
|---|---|---|---|---|
| Point | 176.91 | 49.34 | 3.11 | 229.36 |
| Area | 7.11 | 17.58 | 2.24 | 26.93 |
| Non-road | 30.13 | 37.68 | 9.09 | 76.91 |
| Mobile | 77.85 | 67.20 | 15.25 | 160.30 |
| Total[c] | 292.01 | 171.80 | 29.69 | 493.22 |

Notes:
[a] Maryland point source emissions include 2.21 tpd of quasi- point source emissions from Andrews AFB.
[b] Regional total includes a reduction of 0.28 tpd NOx from Voluntary Measures Bundle.
[c] Small discrepancies may result due to rounding

## 4.7 2009 Controlled Emissions for Attainment

The projection of 2009 controlled emissions is simply the 2009 uncontrolled emissions minus the emission reductions achieved from the federal control measures and the rate-of-progress control measures and other attainment strategies implemented by states for the 8-hour ozone plan. This information is presented in Table 4-9 and Table 4-10. Maryland point source emissions include quasi- point source emissions from Andrews Air Force Base, which are described in detail in the 2002 BY emissions inventory document.

**Table 4-11**
**2009 Projected Controlled VOC Emissions (tons/day)**
**Washington, DC-MD-VA Ozone Nonattainment Area**

| Emission Source | Maryland[a] | Virginia | District of Columbia | Total[b,d] |
|---|---|---|---|---|
| Point | 5.33 | 8.72 | 0.25 | 14.31 |
| Area[c] | 86.01 | 75.52 | 17.57 | 179.10 |
| Non-road | 45.47 | 36.39 | 6.80 | 88.66 |
| Mobile | 31.64 | 28.15 | 6.88 | 66.68 |
| Total[d] | 168.45 | 148.78 | 31.51 | 348.56 |

Notes:
[a] Maryland point source emissions include 1.00 tpd of quasi- point source emissions from Andrews AFB.
[b] Regional total includes a reduction of 0.19 tpd from Voluntary Measures Bundle.
[c] The controlled area source emissions for the District do not include reductions from the OTC VOC measures. The District's OTC VOC rules on all the applicable area source categories are or will be fully adopted, submitted to EPA, and federally enforceable measures. However, the emission reductions of 3.38 tpd VOC in 2008 and 3.80 tpd VOC in 2009 arising from these measures in the District are not applied to the emissions inventories presented in this RFP/attainment modeling/contingency demonstration of the Washington DC-MD-VA regional SIP. The District of Columbia's measures are expected to provide additional enhancements to the air quality improvement in the region.
[d] Small discrepancies may result due to rounding

**Table 4-12**
**2009 Projected Controlled NOx Emissions (tons/day)**
**Washington, DC-MD-VA Ozone Nonattainment Area**

| Emission Source | Maryland[a] | Virginia | District of Columbia | Total[b,c] |
|---|---|---|---|---|
| Point | 72.18 | 38.42 | 2.43 | 113.03 |
| Area | 7.17 | 17.96 | 2.26 | 27.39 |
| Non-road | 29.28 | 37.03 | 8.79 | 75.10 |
| Mobile | 70.94 | 61.44 | 14.16 | 146.53 |
| Total[c] | 179.56 | 154.85 | 27.64 | 361.75 |

Notes:
[a] Maryland point source emissions include 2.25 tpd of quasi- point source emissions from Andrews AFB.
[b] Regional total includes a reduction of 0.3 tpd from Voluntary Measures Bundle.
[c] Small discrepancies may result due to rounding

# 5.0 2008 REASONABLE FURTHER PROGRESS (RFP) REQUIREMENTS

## 5.1 Introduction

In June 2004 EPA revoked the 1-hour ozone standard and published implementation guidance for the 8-hour ozone standard. The Metropolitan Washington, DC-MD-VA region was classified as moderate nonattainment of the 8-hour ozone standard under Subpart 2, Section 182, Part b.

EPA's implementation guidance requires that a moderate 8-hour ozone nonattainment area that has an attainment date beyond 5 years after its 8-hour designation and has previously met its 15% emission reduction requirements under the 1-hour standard will only be subject to subpart 1 RFP requirements. These requirements will be satisfied with a plan to demonstrate 15 % emissions reductions (which may be either VOC or NOx or a combination of both) from 2002 to 2008.[1] The Metropolitan Washington region is currently a moderate 8-hour ozone nonattainment area and has an attainment date (June 15, 2010), which is beyond 5 years after its 8-hour designation (June 15, 2004). The region is also a former 1-hour ozone nonattainment area with an approved 15% VOC reduction plan. Therefore, it is required by EPA to demonstrate RFP by reducing 15% emissions during the period 2002-2008. This chapter contains the Washington region's RFP demonstration for the period 2002-2008. The region will need to fulfill this RFP requirement by January 1, 2009.

In order to demonstrate RFP, 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 RFP period, or "milestone year". For the RFP period 2002-2008, the "target inventories" of emissions are the maximum quantity of anthropogenic emissions permissible during the 2008 milestone year.

This section describes the methodology used to establish the regional target inventories and controlled inventories for 2008. Because the expected NOx and VOC emissions will be less than or equal to the target levels, the Washington region will meet the RFP requirements for 2008.

### 5.1.1 Rate of Progress Demonstrated in Previous State Implementation Plans

Since 1990, the Clean Air Act has required ozone nonattainment areas to demonstrate progress towards attaining the ozone standard. This requirement is generically referred to as the RFP requirement, and, was also called rate-of-progress (ROP). But under 40 CFR 51.900, "rate-of-progress" refers to the progress required towards attaining the 1-hour ozone standard, and "reasonable further progress (RFP)" progress required towards attaining the current 8-hour ozone standard. During the period 1990-1996, areas in nonattainment for the 1-hour ozone standard were required to reduce VOC emissions by 15%. After 1996, these areas were required to demonstrate a 9% rate of progress every three years until their attainment date. The percent reductions for these ROP plans were computed relative to 1990 base line emissions.

The Clean Air Act Amendments (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:

(1) Federal Motor Vehicle Control Program (FMVCP) tailpipe and evaporative standards applicable as of January 1, 1990,
(2) Federal regulations limiting the Reid Vapor Pressure (RVP) of gasoline in ozone nonattainment areas applicable as of June 15, 1990;
(3) State regulations correcting deficiencies in reasonably available control technology (RACT) rules
(4) State regulations establishing or correcting inspection and maintenance (I/M) programs for on-road vehicles.

The basic procedures of developing target levels for the 15% Plan are describe in EPA's guidance on the *Adjusted Base Year Emissions Inventory and the 1996 Target for the 15% Rate of Progress Plans*. For the purposes of the 8-hour RFP requirements this guidance was updated by EPA in November 2005 and August 2006. [2,6]

In 2003 EPA reclassified the Metropolitan Washington region as severe non-attainment for the 1-hour ozone standard when the region did not meet the attainment deadline for serious non-attainment areas by November 1999. In March 2004 MWAQC approved a State Implementation Plan to meet the requirements for a severe nonattainment area. The "Severe Area SIP" demonstrated rate of progress of 15% from 1999-2002, and 15% from 2002-2005. The states submitted the plan to EPA, and EPA approved the states' SIPs and Rate of Progress plans in 2005.[3]

## 5.2 Guidance for Calculating Reasonable Further Progress (RFP) Emission Target Levels

The Clean Air Act Amendments of 1990 provide the primary guidance for calculating the VOC and NOx target levels used in a region's ROP plans. In November 2005 as part of its final implementation rule for the 8-hour ozone standard, EPA issued guidance to assist the states in their RFP plan development.

As discussed above, the guidance that applies specifically to the Metropolitan Washington region is described in the EPA's 8-hour ozone implementation guidance document.[1] Methodology specific to the Metropolitan Washington region, for calculating emissions target levels for the purpose of demonstrating RFP, is described in details in the EPA document's Appendix A to the preamble of the final implementation rule, under Method 2.[2]

Method 2 of the EPA's guidance document states that the target level of VOC and NOx emissions in 2008 needed to meet the 2008 RFP requirement is any combination of VOC and NOx reductions from the adjusted base year 2002 inventories (base year 2002 emissions less non-creditable emissions reduction occurring between 2002 and 2008) that total 15 %. For example, the target level of VOC emissions in 2008 could be a 10 % reduction from the adjusted base year 2002 VOC inventory and a 5 percent reduction from the adjusted NOx inventory. The actual projected 2008 VOC and NOx inventories for all sources with all control measures in place and including projected 2008 growth in activity must be at or lower than the target levels

of VOC and NOx emissions. Washington region has not chosen to substitute NOx for VOC reductions for complying with its reasonable further progress requirements and therefore all its required 15% emissions reductions during the period 2002-2008 come from VOC reductions only.[4]

This section summarizes the requirements and procedures for calculating the target emission levels required for a RFP demonstration. RFP demonstrations build upon each other, starting from the base year of 2002.

### 5.2.1 2008 VOC and NOx Target Levels

EPA's *Final Rule To Implement the 8-Hour Ozone National Ambient Air Quality Standard – Phase II* mandates that to meet the reasonable further progress requirement, the Washington, DC-MD-VA 8-hour ozone nonattainment area needs to reduce its emissions by 15% between 2002 and 2008 using either reduction in VOC or NOx or any combination of the two. The Washington region is able to demonstrate reasonable further progress for the period 2002-2008 using 15% VOC reduction.

The target levels for 2008 reasonable further progress plans are calculated according to the EPA's final rule mentioned above. The general formula for calculation of 2008 target levels is as follows:

Target Level = (RFP base year emissions - non-creditable emissions reduction between 2002 and 2008) * (Reductions required to meet the reasonable further progress requirement) [Eq. 5-1]

### 5.2.2 Calculation of 2008 Target Levels

Equation 5-1 gives the general formula for calculating 2008 target levels. Since the region has chosen to demonstrate the 2008 reasonable further progress using 15% VOC reduction, the 2008 VOC target level becomes:

2008 VOC Target level = (2002 RFP Base-Year VOC emissions – non-creditable emissions reduction between 2002 and 2008) * (15% VOC reduction) [Eq. 5-2]

#### Step 1 Develop 2002 Base Year Inventories and 2002 Reasonable Further Progress Base Year Inventories

The 2002 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 reasonable further progress base-year inventory includes only anthropogenic emissions generated within the Metropolitan Washington nonattainment area. As the 2002 base-year inventory included no emissions generated outside the Metropolitan Washington area, the only difference between the base year inventory and the reasonable further progress base year inventory is the removal of biogenic emissions. The reasonable further progress base year VOC inventory is presented in Table 5-1.

**Table 5-1**
**2002 Reasonable Further Progress Base-Year Inventory**
**(Ozone Season tons per day)**

| Source | VOC | NOx |
|---|---|---|
| Point | 12.91 | 220.60 |
| Area | 192.64 | 24.25 |
| Non-Road | 125.79 | 85.72 |
| On-Road | 116.94 | 266.65 |
| TOTAL | 448.28 | 597.22 |

Note: Small discrepancies may result due to rounding

### Step 2 Develop 2002 and 2008 RFP Adjusted Year Inventories

According to the 1990 CAAA, reductions necessary to meet the reasonable further progress requirement must be calculated from an emission baseline that excludes the effects of the non-creditable Federal Motor Vehicle Control Program (FMVCP) and Reid Vapor Pressure (RVP) programs described in Section 5.1.2. Therefore the 2002 baseline must be adjusted by subtracting the VOC and NOx reductions that will result from these two programs during the period 2002-2008. The resulting inventory is referred to as the 2002 Adjusted Base Year Inventory.

In order to calculate the non-creditable emissions reductions, which occur during the period 2002-2008, the following two mobile inventories are needed:

1) 2002 Reasonable Further Progress Adjusted-Year Inventory
2) 2008 Reasonable Further Progress Adjusted-Year Inventory

Both of these mobile inventories were created using the same inputs (listed below), with the only difference between them being the model year (inventory #1 and #2 were created for model years 2002 and 2008 respectively).

a) 1990 I/M Program
b) RVP = 7.8 psi (RVP required according to June 1990 fuel RVP regulations) [5]
c) No Post-1990 Clean Air Act Measures
d) 2002 Vehicle Activity Inputs
e) 2002 Vehicle Miles Traveled (VMT)

The MOBILE6 input files are included in Appendix D2. Table 5-2 & 5-3 show RFP adjusted-year inventories for 2002 and 2008 respectively.

**Table 5-2**
**2002 Reasonable Further Progress Adjusted-Year Inventory**
**(Ozone Season tons per day)**

| Source | VOC | NOx |
|---|---|---|
| Point | 12.91 | 220.60 |
| Area | 192.64 | 24.25 |
| Non-Road | 125.79 | 85.72 |
| On-Road | 166.55 | 308.24 |
| TOTAL | 497.89 | 638.81 |

Note: Small discrepancies may result due to rounding

**Table 5-3**
**2008 Reasonable Further Progress Adjusted-Year Inventory**
**(Ozone Season tons per day)**

| Source | VOC | NOx |
|---|---|---|
| Point | 12.91 | 220.60 |
| Area | 192.64 | 24.25 |
| Non-Road | 125.79 | 85.72 |
| On-Road | 154.10 | 276.63 |
| TOTAL | 485.44 | 607.20 |

Note: Small discrepancies may result due to rounding

### Step 3 Non-creditable Emissions Reductions

The non-creditable emissions reductions that occur in absence of any post-1990 CAA measures during a reasonable further progress period can be determined by taking the difference between the RFP adjusted-year inventories for the relevant milestone years. For VOC and NOx, the relevant milestone years are 2002 and 2008.

Non-creditable Emissions Reductions = 2002 RFP Adjusted Year Inventory – 2008 RFP Adjusted Year Inventory [Eq. 5-3]

Calculation of non-creditable emissions reductions is shown in Table 5-4 below:

**Table 5-4**
**Calculation of Non-creditable Emissions Reductions**
**(Ozone Season tons per day)**

| Description | VOC | NOx |
|---|---|---|
| 2002 RFP Adjusted Year Inventory (a) | 497.89 | 638.81 |
| 2008 RFP Adjusted Year Inventory (b) | 485.44 | 607.20 |
| Non-creditable Emissions Reduction (a-b) | 12.45 | 31.61 |

### Step 4 Calculation of 2008 Target Levels

Following Equation 5-2, the VOC target level for 2008 is calculated in Table 5-5 below:

**Table 5-5**
**Calculation of VOC Target Level for 2008**
**(Ozone Season tons per day)**

| Description | VOC |
|---|---|
| 2002 RFP Base-Year Inventory (a) | 448.28 |
| Non-creditable Emissions Reduction (b) | 12.45 |
| 2002 Adjusted Base-Year Inventory (c) = (a-b) | 435.83 |
| Reduction Required for Reasonable Further Progress (d) = 15% VOC reduction from (c) | 65.38 |
| 2008 Target Levels for Reasonable Further Progress (e) = (c-d) | 370.45 |

## 5.3 Compliance with 2008 Reasonable Further Progress Requirements

In order to demonstrate reasonable further progress for the period 2002-2008, the Washington region must show that expected emissions in 2008 are equal to or less than the 2008 target levels presented in Table 5-5.

The 2008 controlled inventories are inventories of all anthropogenic VOC and NOx emissions expected to occur in the Washington nonattainment area during 2008. The inventories were developed as described in Chapter 4 and are displayed in Tables 4-7 and 4-8. As summarized in Table 5-6, the 2008 controlled VOC inventory is less than the 2008 target VOC inventory. Table 5-6 demonstrates that the Washington region fulfills the 2002-2008 reasonable further progress requirement using 15% VOC reduction during this period.

**Table 5-6**
**Washington Nonattainment Area**
**Comparison of 2008 Controlled and Target Inventories**
**Ozone Season Daily Emissions (tons per day)**

| Description | VOC |
|---|---|
| 2008 Reasonable Further Progress Target Level | 370.45 |
| 2008 Controlled Emissions[a,b] | 358.84 |

Notes:
[a] Regional total includes a reduction of 0.19 tpd VOC from Voluntary Measures Bundle.
[b] The controlled area source emissions for the District do not include reductions from the OTC VOC measures. The District's OTC VOC rules on all the applicable area source categories are or will be fully adopted, submitted to EPA, and federally enforceable measures. However, the emission reductions of 3.38 tpd VOC in 2008 and 3.80 tpd VOC in 2009 arising from these measures in the District are not applied to the emissions inventories presented in this RFP/attainment modeling/contingency demonstration of the Washington DC-MD-VA regional SIP. The District of Columbia's measures are expected to provide additional enhancements to the air quality improvement in the region.

## 5.4 Reasonable Further Progress Contingency Emissions Reduction Requirements

This section briefly discusses the procedures for calculating the emission reduction required to meet the RFP contingency requirements, which have been discussed in detail in the chapter 11. A total of 3% reduction using a combination of VOC and NOx reductions are needed to comply with the RFP contingency emissions reduction requirements; however, a minimum of 0.3% VOC is required. Therefore, minimum reduction requirements are as follows:

VOC Reduction Required = (2002 RFP Base-Year VOC emissions – non-creditable emissions reduction between 2002 and 2008)* (0.3% VOC reduction) [Eq. 5-4]

NOx Reduction Required = (2002 RFP Base-Year NOx emissions – non-creditable emissions reduction between 2002 and 2008)* (2.7% NOx reduction) [Eq. 5-5]

Following Equations 5-4 and 5-5, the minimum VOC and maximum NOx reductions requirement for RFP contingency are calculated in Table 5-7 below:

**Table 5-7**
**Calculation of VOC and NOx Reductions for RFP Further Progress Contingency**
**(Ozone Season tons per day)**

| Description | VOC | NOx |
|---|---|---|
| 2002 RFP Base-Year Inventory (a) | 448.28 | 597.22 |
| Non-creditable Emissions Reduction (b) | 12.45 | 31.61 |
| Adjusted Base-Year Inventory (c) = (a-b) | 435.83 | 565.61 |
| 0.3% VOC Reduction Required for RFP Contingency (d) = (0.3/100) * (c) | 1.31 | |
| 2.7% NOx Reduction Required for RFP Contingency (e) = (2.7/100) * (c) | | 15.27 |

## 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 Reasonable Further Progress Plan and the Attainment Demonstration", February 18, 1994.

U.S. EPA, "NOx Substitution Guidance", December 15, 1993.


---

[1] 40 CFR 51.910(a); *Final Rule to Implement the 8-Hour Ozone National Ambient Air Quality Standard, Federal Register, Vol 70, No. 228, Nov.29, 2005, pp. 71612-71705.*

[2] *"Appendix A to Preamble—Methods to Account for Non-Creditable Reductions When Calculating ROP Targets for the 2008 and Later ROP Milestone Years," in Final Rule to Implement the 8-Hour Ozone National Ambient Air Quality Standard, Federal Register, Vol 70, No. 228, Nov.29, 2005, pp. 71696.*

[3] *Approval and Promulgation of Air Quality Implementation Plans; District of Columbia, Maryland, Virginia; 1Hour Ozone Attainment Plans, Rate-of-Progress Plans, Contingency Measures, Transportation Control Measures, VMT Offset, and 1990 Base Year Inventory, Federal Register, vol 70, No. 92,May 13, 2005, pp.25688-25719.*

[4] *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 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 (0-15%) of the required VOC reductions for the 2008 reasonable further progress (App. F – Severe SIP).*

[5] *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.*

[6] *Memorandum, "8-hour Ozone National Ambient Air Quality Standard (NAAQS) Implementation – Reasonable Further Progress (RFP)," from William T. Harnett, dated August 15, 2006.*

# 6.0 CONTROL MEASURES

This section is divided into five sections: Point Source Measures; Area Source Measures; Nonroad Source Measures; Mobile Measures; and Voluntary Measures.

Reductions from the control measures presented in this Chapter are summarized in Table A.

**TABLE A**
**SUMMARY OF CONTROL STRATEGIES**
**VOC and NOx Benefits of Control Measures**
**(2002-2009)**

| | | VOC Reductions tons/day | | NOx Reductions tons/day | |
|---|---|---|---|---|---|
| ***Ref No.*** | ***Control Measure*** | ***2008*** [b] | ***2009*** [c] | ***2008*** [b] | ***2009*** [c] |
| **MEASURES INCLUDED IN THE FUTURE CONTROLLED SCENARIO** | | | | | |
| **POINT SOURCE MEASURES** | | | | | |
| 6.1.2 | State NOx RACT and Regional NOx Transport Requirement (RACT, NOx SIP Call, CAIR, HAA) | 0.00 | 0.00 | 12.65 | 128.76 |
| **SUBTOTAL** | | **0.00** | **0.00** | **12.65** | **128.76** |
| **AREA SOURCE MEASURES**[(a)] | | | | | |
| 6.2.11 | Mobile Equipment Repair and Refinishing Rule | 3.49 | 3.59 | 0 | 0 |
| 6.2.12 | Portable Fuel Containers Rule: Phase I | 7.34 | 9.30 | 0 | 0 |
| 6.2.13 | Architectural and Industrial Maintenance Coatings Rule | 10.62 | 10.82 | 0 | 0 |
| 6.2.14 | Reformulated Consumer Products Rule: Phase I | 6.23 | 6.34 | 0 | 0 |
| 6.2.15 | Solvent Cleaning Operations Rule | 2.91 | 2.99 | 0 | 0 |
| 6.2.16 | Industrial Adhesives and Sealants Rule | - | 2.42 | 0 | 0 |
| 6.2.17 | Portable Fuel Containers Rule: Phase II | - | 0.75 | 0 | 0 |
| 6.2.18 | Reformulated Consumer Products Rule: Phase II | 0.39 | 0.76 | 0 | 0 |
| **SUBTOTAL** | | **30.98** | **36.97** | **0** | **0** |
| **NON-ROAD MEASURES** | | | | | |
| 6.3.1 | EPA Non-Road Gasoline Engines Rule | 36.91 | 42.44 | 11.68 | 14.76 |
| 6.3.2 | EPA Non-Road Diesel Engines Rule | | | | |
| 6.3.3 | Emissions standards for spark ignition marine engines | | | | |
| 6.3.4 | Emissions standards for large spark ignition engines | | | | |
| 6.3.5 | Reformulated Gasoline (off-road) | | | | |
| 6.3.6 | Standards for Locomotive | 0.05 | 0.06 | 2.54 | 2.74 |
| **SUBTOTAL** | | **36.96** | **42.50** | **14.22** | **17.50** |
| **ON-ROAD MEASURES** | | | | | |
| 6.4.2 | High-Tech Inspection/Maintenance (updated cutpoints) | | | | |
| 6.4.4 | National Low Emission Vehicle Program | | | | |
| 6.4.5 | Tier 2 Motor Vehicle Emission Standards | | | | |
| 6.4.6 | Heavy-Duty Diesel Engine Rule | 6.19 | 7.17 | 29.67 | 37.63 |
| 6.4.7 | Transportation Control Measures and Vehicle Technology, Fuel, or Maintenance Measures | 0.19 | 0.18 | 0.49 | 0.45 |
| **SUBTOTAL** | | **6.38** | **7.35** | **30.16** | **38.08** |
| **VOLUNTARY MEASURES (Multiple Source Sectors)** | | | | | |
| 6.5 | Voluntary Bundle | 0.19 | 0.19 | 0.28 | 0.30 |
| **TOTAL REDUCTIONS** | | **74.51** | **87.01** | **57.31** | **184.64** |

Notes:

[a] The Area Source reductions do not include the District of Columbia. The District's OTC VOC rules on all the applicable area source categories are or will be fully adopted, submitted to EPA, and federally enforceable measures. However, the emission reductions of 3.38 tpd VOC in 2008 and 3.80 tpd VOC in 2009 arising from these measures in the District are not applied to the emissions inventories presented in this RFP/attainment modeling/contingency demonstration of the Washington DC-MD-VA regional SIP. The District of Columbia's measures are expected to provide additional enhancements to the air quality improvement in the region.

[b] Reductions included in the 2008 Reasonable Further Progress demonstration, occurring between 2002 and 2008.

[c] Reductions included in the attainment demonstration, occurring between 2002 and 2009.

## 6.1 POINT SOURCE MEASURES

### 6.1.1 Non-CTG VOC RACT (federal and state regulation)

This measure involves extending emission standards to point sources with the potential to emit in excess of 25 tons per year (tpy) of VOCs.

**Control Strategy**

The Washington, D.C. metropolitan area, when designated as severe nonattainment for the 1-hour ozone standard, was obligated under the CAAA to implement RACT for major sources (25 tpy) not covered by EPA's Control Technique Guidance (CTG) documents. Under the 15% VOC Reduction Plan, Virginia, Maryland, and the District of Columbia developed and implemented 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). This control measure included 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 were found only in Maryland.

As a moderate nonattainment area for the 8-hour ozone standard, "reasonably available" control technologies must be determined and implemented for industry sources with the potential to emit greater than 50 tpy.

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.

Maryland’s RACT implementation involved three types of standards: 1) identification of major source categories and establishment of RACT for both major and non major sources in those categories; 2) RACT for categories that did not have major sources but together with all small sources were above major source threshold; and 3) specific RACT for sources that emitted more than 20 lbs of VOC per day.

**Source Type Affected**

This measure affects point sources with the potential to emit 25 tpy or more of VOCs. In Maryland, it affects both major and non major sources that together constitute emissions above 25 tons per day, small sources that together emit greater than 25 tons and point sources that emit more than 20 lbs of VOCs per day.

## 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 25 tpy, which had not been previously regulated. All three states have submitted or will submit to EPA a separate SIP revision addressing RACT SIP requirements. All three states recertified RACT for the point sources emitting more than 50 tpy in the region.

## Implementation

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

## Projected Reductions and Emission Benefit Calculations

The benefits of requiring RACT to point sources with potential to emit greater than 25 tpy is already reflected in the 2002 baseline inventory and the 2008 and 2009 projections thereof. States recertified that the existing levels of controls at sources subject to the regulations comply with RACT requirements. As such, there are no emission benefits of RACT recertification.

## References

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

### 6.1.2 NOx RACT and Regional NOx Transport Requirements (federal and state regulation)

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 required 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;
- the "NOx SIP Call" to reduce ozone transport in the Eastern United States;
- EPA's Clean Air Interstate Rule (CAIR); and
- Maryland's Healthy Air Act.

**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). In the Washington DC region, NOx reduction controls must be applied to sources that have the potential to emit 25 tons per year or more of NOx.

Maryland, Virginia, and the District of Columbia completed the requirements of RACT under the 1-hour ozone standard in the late 1990's. EPA required that the states review and recertify RACT under the 8-hour ozone standard. In this process, each state reviewed existing RACT rules, existing sources and potentially new source categories to ensure RACT requirements are being met. All three states have submitted or will submit to EPA a separate SIP revision addressing RACT SIP requirements. All three states recertified RACT for all applicable sources.

NOx OTC Phase II Budget Rules

In the late 1990's 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 required large stationary sources to reduce summertime NOx emissions by approximately 65 percent from 1990 levels. The regulation also included provisions allowing sources to comply by trading "allowances." This regulation required 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 required 22 states, including Maryland and Virginia, and the District of Columbia, to further reduce large point source NOx emissions to EPA identified state emission budget levels by 2007. State regulation adoption timelines notwithstanding the majority of the 22 SIP call states had these regulations in place by 2003/2004.

Clean Air Interstate Rule (CAIR)

On May 12, 2005, the U.S. EPA promulgated the Clean Air Interstate Rule, which requires reductions in emissions of NOx and SO2 from large fossil fuel-fired electric generating units. The rule is set up in several phases with the first phase of NOx reductions to come by 2009. The rule sets up both an annual emissions budget and an ozone season emissions budget. The rule requires that units with nameplate capacity greater than 25 megawatts emit no more NOx than their allocations determined by the state either through emission controls or banking and trading.

Virginia CAIR

Virginia has adopted state regulations codifying the requirements of the Clean Air Interstate Rule. Virginia's rules create an emissions cap based on the allowances allocated to the facility. The rules do not allow trading as a method of complying with the emissions cap.

Maryland Healthy Air Act

In April of 2006 the Maryland General Assembly and Governor Ehrlich adopted the Healthy Air Act (HAA), a law that requires reductions in NOx, SO2, and Mercury emissions from Maryland's largest and oldest coal fired power plants. Maryland implements the HAA through regulation. The regulation requires reductions in NOx emissions from coal-fired electric generating units (excluding fluidized bed combustion units) starting in 2009. By 2009 Maryland expects an approximate 70 percent reduction in NOx emissions from these regulations when compared to 2002 emissions. To meet the requirements of Maryland's regulations a company's "system" (covered units owned by the same company) must meet a system-wide cap by 2009. Compliance cannot be achieved through the purchase of allowances under the HAA.

District of Columbia CAIR

The District of Columbia is currently drafting its Clean Air Interstate Rule (CAIR). Its CAIR regulations do not allow trading of NOx allowances for achieving the reductions for the facilities within its jurisdiction.

Summary

The point source NOx controls are a phased approach to controlling emissions of NOx from power plants and other large fuel combustion sources. The programs resulting in emission reductions from point sources in the region include:

- The NOx SIP Call rule
- EPA's Clean Air Interstate Rule
- Maryland's Healthy Air Act

NOx reductions resulting from these controls are presented by source for Maryland in Tables 6-1 and 6-2, for Virginia in Tables 6-3 and 6-4, and for the District in Tables 6-5 and 6-6. Table 6-7 summarizes emission reductions by jurisdiction and for the region for each of the NOx point source controls listed in Tables 6-1 through 6-6.

In Maryland, the expected emission reductions for 2008 and 2009 were calculated using the emissions estimates consistent with annual allocations under the Healthy Air Act implementing regulation. The program does not allow trading of NOx allowances. The expected emissions

reductions are listed in Tables 6-4 and 6-5.

In Virginia, the expected emission reductions for 2008 and 2009 from electric generating utilities were calculated using knowledge of historical NOx emission rates, adjusted by the expected control efficiencies achieved from various control devices that have been installed, or by estimating the amount of allowances the facility would receive under the Virginia CAIR rule. The expected emissions reductions are listed in Tables 6-3 and 6-4.

In the District of Columbia, the expected emission reductions for 2008 and 2009 were calculated using the listed allowances within the Clean Air Interstate Rule. The expected emissions reductions are listed in Tables 6-5 and 6-6.

See Appendix C for further point source documentation.

**Table 6-1**
**2008 NOx Point Source Reductions for Maryland (tons per day)**

| Facility | 2008 Uncontrolled Emissions | Reductions | | | Total Emission Red. |
|---|---|---|---|---|---|
| | | RACT | NOx SIP Call | Healthy Air Act | |
| Dickerson | 25.613 | 0 | 0 | 0 | 0 |
| Chalk Point | 50.586 | 0 | 0 | 0 | 0 |
| Morgantown | 78.512 | 0 | 0 | 0 | 0 |
| **Total 2008 Reductions** | | **0** | **0** | **0** | **0** |

**Table 6-2**
**2009 NOx Point Source Reductions for Maryland (tons per day)**

| Facility | 2009 Uncontrolled Emissions | Reductions | | | Total Emission Red. |
|---|---|---|---|---|---|
| | | RACT | NOx SIP Call | Healthy Air Act[a] | |
| Dickerson | 25.902 | 0 | 0 | 18.813 | 18.813 |
| Chalk Point | 50.525 | 0 | 0 | 34.836 | 34.836 |
| Morgantown | 78.207 | 0 | 0 | 51.025 | 51.025 |
| **Total 2009 Reductions** | **154.634** | **0** | **0** | **104.674** | **104.674** |

[a]Healthy Air Act emission reduction estimates based on a regulation that imposes ozone season limits on the affected sources.

## Table 6-3
## 2008 NOx Point Source Reductions for Virginia (tons per day)

| Facility ID | Facility Name | 2008 Baseline Emissions Tons/day | Reductions Tons/day | | | Total Emission Reductions Tons/day | 2008 Estimated Emissions Tons/day |
|---|---|---|---|---|---|---|---|
| | | | NSR | RACT | NOx SIP Call | | |
| 51-153-0002 70225 | Dominion Possum Point Power Station | 16.217 | 3.435[a] | | | 3.435 | 12.782 |
| 51-510-0003 70228 | Mirant-Potomac River Power Plant | 20.158 | | | 4.194 | 4.194 | 15.964 |
| 51-153-0139 72340 | Prince William County Department of Public Works | 0.115 | | 0.01 | | 0.01 | 0.105 |
| | | | | | | 7.639 | 28.851 |

Notes:
[a]70225 went through a PSD netting exercise resulting in a permit that required emission reductions of NOx. See permit dated 10/5/01.

## Table 6-4
## 2009 NOx Point Source Reductions for Virginia (tons per day)

| Facility ID | Facility Name | 2009 Baseline Emissions Tons/day | Reductions Tons/day | | | | Total Emission Reduced Tons/day | 2009 Estimated Emissions Tons/day |
|---|---|---|---|---|---|---|---|---|
| | | | NSR | RACT | NOx SIP Call | CAIR | | |
| 51-153-0002 70225 | Dominion Possum Point Power Station | 16.240 | 3.435 | | | 0.937[a] | 4.372[(1)] | 11.868 |
| 51-510-0003 70228 | Mirant-Potomac River Power Plant | 20.415 | | | 4.194 | 10.402[a] | 14.596 | 5.819[(1)] |
| 51-153-0139 72340 | Prince William County Department of Public Works | 0.115 | | 0.01 | | | 0.01 | 0.105 |
| | | | | | | | 18.978 | 17.792 |

Notes:
[a]Actual CAIR allocations have not yet been calculated by VA staff. These reductions and emission rates are estimates based on past heat input rates and the draft CAIR allocation analysis.

**Table 6-5**
**2008 NOx Point Source Reductions for the District of Columbia (tpd)**

| Facility | 2008 Uncontrolled Emissions | Reductions | | | Total Emission Red. |
|---|---|---|---|---|---|
| | | RACT | NOx SIP Call | CAIR | |
| Pepco - Benning | 4.04 | - | 2.61 | N/A | 2.61 |
| Pepco - Buzzard | 2.82 | - | 2.31 | N/A | 2.31 |
| Capitol Power Plant | 0.51 | - | 0 | 0 | 0 |
| GSA West & Central Heating | 0.26 | - | 0.10 | 0 | 0.10 |
| Georgetown Univ. Power Plant | 0.08 | - | 0 | 0 | 0 |
| U.S. Soldiers Home | 0.03 | - | 0 | 0 | 0 |
| **Total 2008 Reductions** | | **0** | **5.02** | **0** | **5.02** |

**Table 6-6**
**2009 NOx Point Source Reductions for the District of Columbia (tpd)**

| Facility | 2009 Uncontrolled Emissions | Reductions | | | Total Emission Red. |
|---|---|---|---|---|---|
| | | RACT | NOx SIP Call | CAIR | |
| Pepco - Benning | 3.69 | - | 0 | 2.95 | 2.95 |
| Pepco - Buzzard | 2.58 | - | 2.07 | 0 | 2.07 |
| Capitol Power Plant | 0.51 | - | 0 | 0 | 0 |
| GSA West & Central Heating | 0.27 | - | 0.11 | 0 | 0.11 |
| Georgetown Univ. Power Plant | 0.08 | - | 0 | 0 | 0 |
| U.S. Soldiers Home | 0.03 | - | 0 | 0 | 0 |
| **Total 2009 Reductions** | | **0** | **2.18** | **2.95** | **5.13** |

The CAIR reductions reflect the allotted allowances for the District of Columbia (85% of 112 tons per season).

**Table 6-7**
**Point Source NOx Reductions Summary (tons per day)**

| Control | District of Columbia | Maryland | Virginia | Total |
|---|---|---|---|---|
| **2008** | | | | |
| NSR | 0 | 0 | 3.435 | 3.435 |
| NOx RACT | 0 | 0 | 0.01 | 0.01 |
| NOx SIP Call | 5.02 | 0 | 4.194 | 9.214 |
| CAIR | 0 | 0 | 0 | 0 |
| Healthy Air Act | 0 | 0 | 0 | 0 |
| **Total 2008 Reductions** | **5.02** | **0** | **7.639** | **12.65** |
| **2009** | | | | |
| NSR | 0 | 0 | 3.435 | 3.435 |
| NOx RACT | 0 | 0 | 0.01 | 0.01 |
| NOx SIP Call | 2.18 | 0 | 4.194 | 6.374 |
| CAIR | 2.95 | 0 | 11.36 | 14.31 |
| Healthy Air Act | 0 | 104.674 | 0 | 104.674 |
| **Total 2009 Reductions** | **5.13** | **104.674** | **18.978** | **128.76** |

**Implementation**

District Department of the Environment
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** |
| 2008 NOx Reductions | 5.02 | 0 | 7.639 | 12.65 |
| 2009 NOx Reductions | 5.13 | 104.674 | 18.978 | 128.76 |

**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 Department of the Environment, 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).

Federal Register Vol. 70, No. 91, May 12, 2005, p. 25162.

## 6.2 AREA SOURCE MEASURES

### 6.2.1 Reformulated Surface Coatings (federal rule)

This measure involved 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 was 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 measure is based on the national regulatory negotiation for AIM coatings. According to EPA guidance, the final rule yields a 20 percent 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.

**Implementation**

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

**Projected Reductions and Emission Benefit**

The benefits of this program are reflected in the 2002 baseline inventory and the 2008 and 2009 projections thereof. No additional reductions are calculated.

**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.

### 6.2.2 Reformulated Consumer Products (federal rule)

This measure required 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 EPA was required to publish by November 15, 1995 under 42 U.S.C. 7511b(e)(3). 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 selected, after conducting a study consistent with 42 U.S.C. 7511b(e)(2).

**Control Strategy**

The 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 was required to 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 percent of photochemically reactive VOC emissions from such products.

EPA guidance from John Seitz specifies a 10 percent 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 percent of the "commercial or consumer products" were 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 was 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 and Emission Benefit**

The benefits of this program are reflected in the 2002 baseline inventory and the 2008 and 2009 projections thereof. No additional reductions are calculated.

**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.

### 6.2.3 Reformulation of Industrial Cleaning Solvents (federal rule)

This measure required 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 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 percent of photochemically reactive VOC emissions from such products.

EPA guidance from John Seitz specifies a 10 percent 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 and Emission Benefit**

The benefits of this program are reflected in the 2002 baseline inventory and the 2008 and 2009 projections thereof. No additional reductions are calculated.

**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.

### 6.2.4 Surface Cleaning and Degreasing for Machinery and Automobiles Repair (state rule)

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

**Projected Reductions and Emission Benefit**

The benefits of this program are reflected in the 2002 baseline inventory and the 2008 and 2009 projections thereof. No additional reductions are calculated.

### 6.2.5 Landfill Regulations (state rule)

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 was 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 requires capture and control systems to capture at least 80 percent of the VOC emissions and route them to a 98% destruction efficiency control device.

**Implementation**

Federal standards for existing landfills were 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
Virginia - Department of Environmental Quality

**Projected Reductions and Emission Benefit**

The benefits of this program are reflected in the 2002 baseline inventory and the 2008 and 2009 projections thereof. No additional reductions are calculated.

**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.

### 6.2.6 Seasonal Open Burning Restrictions (state rule)

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 through 2009.

**Implementation**

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

**Projected Reductions and Emission Benefit**

The benefits of this program are reflected in the 2002 baseline inventory and the 2008 and 2009 projections thereof. No additional reductions are calculated.

**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.

### 6.2.7 Stage I Vapor Recovery System Expansion (state rule)

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 controlled were 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. Note that Stafford County is not part of the Washington, DC-MD-VA 8-hour ozone nonattainment area.

**Implementation**

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

**Projected Reductions and Emission Benefit**

The benefits of this program are reflected in the 2002 baseline inventory and the 2008 and 2009 projections thereof. No additional reductions are calculated.

**References**

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

### 6.2.8 Stage II Vapor Recovery (federal law)

As a serious ozone nonattainment area, Washington was 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 with a throughput of at least 10,000 gallons per month and reduces 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. Recovered vapors are then collected by tanker trucks and returned to the terminal for recovery or destruction.

**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**

The benefits of this program are reflected in the 2002 baseline inventory and the 2008 and 2009 projections thereof. No additional reductions are calculated.

**Emission Benefit Calculations**

Not applicable.

**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.

### 6.2.9 Graphic Arts Controls (state rule/CTG)

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)<br>alcohol substitution for non-heatset (99 % reduction)<br>5% IPA for sheet-fed (50% reduction) |
| Cleaning Solutions | 30% VOC content limit (70% reduction) |

**Implementation**

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

**Projected Reductions and Emission Benefit**

The benefits of this program are reflected in the 2002 baseline inventory and the 2008 and 2009 projections thereof. No additional reductions are calculated.

**References**

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

### 6.2.10 Auto Body Refinishing (state rule/CTG)

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 and Emission Benefit**

The benefits of this program are reflected in the 2002 baseline inventory and the 2008 and 2009 projections thereof. No additional reductions are calculated.

**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)

### 6.2.11 Mobile Repair and Refinishing Rule (state rule/OTC model 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. This rule became effective in the District of Columbia in February 2004. The rule applies 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.

**Implementation**

District of Columbia - Department of Environment
Virginia - Department of Environmental Quality

**Projected Reductions**

| | VOC Emission Reductions (tons per day) | | | |
|---|---|---|---|---|
| | District of Columbia | Maryland | Virginia | Total |
| 2008 VOC Reductions | 0.13 | - | 3.49 | 3.61 |
| 2009 VOC Reductions | 0.13 | - | 3.59 | 3.72 |

**Emission Benefit Calculations**

Projected reductions are based on an emission reduction factor of 38 percent, based on Pechan (2001).

**References**

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

### 6.2.12 Portable Fuel Containers Rule: Phase I (state rule/OTC model 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 adopted phase I of the Ozone Transport Commission (OTC) Model Rule for Portable Fuel Containers in January 2002.

Virginia adopted phase I of the Ozone Transport Commission (OTC) Model Rule for Portable Fuel Containers on November 2003.

The rule was adopted in the District of Columbia in April 2004.

The rule applies to all counties in the nonattainment area.

Reductions from this rule increase annually beginning with implementation in the State of Maryland on January 1, 2004.

The District of Columbia and the Commonwealth of Virginia required compliance with this rule as of January 1, 2005.

**Implementation**

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

## Projected Reductions

Reductions are shown under phase II of the Portable Fuel Container Rule.

## Emission Benefit Calculations

Projected reductions are based on an emission reduction factor of 75 percent after full implementation after 10 years. Implementation began in 2004 in Maryland and 2005 in the District and Virginia. In 2008, the emission reduction factor is 25 -32.5 percent. In 2009, the emission reduction factor is 32.5 - 40 percent.

## References

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

### 6.2.13 Architectural and Industrial Maintenance Coatings Rule (state rule/OTC model 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.

Maryland adopted this rule on March 29, 2004.

The rule became effective in the District of Columbia in April 2004.

The rule will apply to all counties in the nonattainment area.

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 - Department of Environment
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 |
| 2008 VOC Reductions | 1.45 | 50.22 | 5.4 | 12.07 |
| 2009 VOC Reductions | 1.46 | 5.29 | 5.53 | 12.28 |

Note: The District's OTC VOC rules on all the applicable area source categories are or will be fully adopted, submitted to EPA, and federally enforceable measures. However, the emission reductions arising from these measures in the District are not applied to the emissions inventories presented in this RFP/attainment modeling/contingency demonstration of the Washington DC-MD-VA regional SIP. The District of Columbia's measures are expected to provide additional enhancements to the air quality improvement in the region.

## Emission Benefit Calculations

Projected reductions are based on an emission reduction factor of 31 percent, based on Pechan (2001).

## References

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

### 6.2.14 Consumer Products Rule: Phase I (state rule/Ozone Transport Commission (OTC) model rule)

Phase I of the Consumer Products Rule required 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**

Phase I of the Ozone Transport Commission (OTC) Model Rule for Reformulated Consumer Products became effective in the District of Columbia in April 2004.

The State of Maryland adopted phase I of the Ozone Transport Commission (OTC) Model Rule for Reformulated Consumer Products on August 18, 2003.

The Commonwealth of Virginia adopted phase I of the Ozone Transport Commission (OTC) Model Rule for Reformulated Consumer Products on March 9, 2005.

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 - Department of Environment
Virginia - Department of Environmental Quality

**Projected Reductions**

Reductions are shown under phase II of the Consumer Products Rule.

**Emission Benefit Calculations**

Projected reductions are based on an emission reduction factor of 14.2 percent, based on Pechan (2001).

**References**

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

### 6.2.15 Solvent Cleaning Operations Rule (state rule/ Ozone Transport Commission (OTC) model 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 rule applies to all counties in the nonattainment area.

The rule became effective in the District of Columbia in April 2004.

The State of Maryland had rules in place by 1996 that contain limits comparable to the OTC model rule. Therefore the OTC model rule was not needed in Maryland as a state rule was already in place.

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 - Department of Environment
Virginia - Department of Environmental Quality

**Projected Reductions**

| | VOC Emission Reductions (tons per day) | | | |
|---|---|---|---|---|
| | District of Columbia | Maryland | Virginia | Total |
| 2008 VOC Reductions | 0.21 | 0 | 2.91 | 3.13 |
| 2009 VOC Reductions | 0.22 | 0 | 2.99 | 3.20 |

Note: The District's OTC VOC rules on all the applicable area source categories are or will be fully adopted, submitted to EPA, and federally enforceable measures. However, the emission reductions arising from these

measures in the District are not applied to the emissions inventories presented in this RFP/attainment modeling/contingency demonstration of the Washington DC-MD-VA regional SIP. The District of Columbia's measures are expected to provide additional enhancements to the air quality improvement in the region.

## Emission Benefit Calculations

Projected reductions are based on an emission reduction factor of 66 percent, based on Pechan (2001).

## References

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

### 6.2.16 Industrial Adhesives and Sealants Rule (state rule/ Ozone Transport Commission (OTC) model rule)

This rule establishes VOC content limitations for industrial and commercial application of solvent-based adhesives and sealants. Controls will cover adhesives, sealants, adhesive primers, sealer primers, adhesive application to substrates, and aerosol adhesives. VOC content limits are similar to those contained in the CARB Reasonably Available Control Technology (RACT) or Best Available Control Technology (BACT) document for adhesives and sealants (Dec. 1998).

#### Source Type Affected

Manufacturers and distributors of industrial adhesives and sealants.

#### Control Strategy

All jurisdictions plan to adopt the OTC Model Rule for Industrial Adhesives and Sealants in 2007. The rule will be effective in Maryland and the District of Columbia no later than May 1, 2008 and for Virginia no later than May 1, 2009.

#### Implementation

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

#### Projected Reductions

| | VOC Emission Reductions (tons per day) | | | |
|---|---|---|---|---|
| | District of Columbia | Maryland | Virginia | Total |
| 2008 VOC Reductions | 0 | 0 | 0 | 0 |
| 2009 VOC Reductions | 0.16 | 1.19 | 1.23 | 2.58 |

Note: The District's OTC VOC rules on all the applicable area source categories are or will be fully adopted, submitted to EPA, and federally enforceable measures. However, the emission reductions arising from these measures in the District are not applied to the emissions inventories presented in this RFP/attainment modeling/contingency demonstration of the Washington DC-MD-VA regional SIP. The District of Columbia's measures are expected to provide additional enhancements to the air quality improvement in the region.

**Emission Benefit Calculations**

Emission reductions are based on a 64 percent reduction in emissions of VOC from the baseline. Further details are available from OTC (2007).

**References**

OTC 2007. *Identification and Evaluation of Candidate Control Measures: Final Technical Support Document.* Prepared by MACTEC Federal Programs, Inc., Herndon, Virginia for the Ozone Transport Commission. February 28, 2007.

### 6.2.17 Portable Fuel Containers Rule: Phase II (state rule/ Ozone Transport Commission (OTC) model rule)

This measure expands existing performance standards for portable gasoline containers and spouts to kerosene containers. 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

All jurisdictions plan to adopt the Phase II OTC Model Rule for Portable Fuel Containers in 2007. The rule will be effective in all jurisdictions no later than May 1, 2008. The rule will apply to all counties in the nonattainment area.

#### Implementation

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

#### Projected Reductions

| | VOC Emission Reductions (tons per day) | | | |
|---|---|---|---|---|
| | **District of Columbia** | **Maryland** | **Virginia** | **Total** |
| 2008 VOC Reductions (Phase I rule only) | 0.75 | 5.17 | 2.17 | 8.09 |
| 2009 VOC Reductions | 0.99 | 6.95 | 3.11 | 11.05 |

Includes reductions from Phase I and Phase II.

Note: The District's OTC VOC rules on all the applicable area source categories are or will be fully adopted, submitted to EPA, and federally enforceable measures. However, the emission reductions arising from these measures in the District are not applied to the emissions inventories presented in this RFP/attainment modeling/contingency demonstration of the Washington DC-MD-VA regional SIP. The District of Columbia's measures are expected to provide additional enhancements to the air quality improvement in the region.

**Emission Benefit Calculations**

Phase I: Projected reductions are based on an emission reduction factor of 75 percent after full implementation after 10 years. Implementation began in 2004 in Maryland and 2005 in the District and Virginia. In 2008, the emission reduction factor is 25 -32.5 percent. In 2009, the emission reduction factor is 32.5 - 40 percent.

Phase II: Emission reductions are based on a 4 percent reduction in emissions of VOC. Further details are available from OTC (2007).

**References**

OTC 2007. *Identification and Evaluation of Candidate Control Measures: Final Technical Support Document.* Prepared by MACTEC Federal Programs, Inc., Herndon, Virginia for the Ozone Transport Commission. February 28, 2007.

### 6.2.18 Consumer Products Rule: Phase II (state rule/ Ozone Transport Commission (OTC) model rule)

Phase II of the Consumer Products Rule involves adopting the CARB 7/20/05 Amendments which sets new or revises existing limits on 13 consumer product categories. 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

All jurisdictions plan to adopt phase II of the OTC Model Rule for Reformulated Consumer Products in 2007. The rule will be effective in Maryland and the District of Columbia no later than May 1, 2008 and for Virginia no later than May 1, 2009.

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 - Department of Environment
Virginia - Department of Environmental Quality

#### Projected Reductions

| | VOC Emission Reductions (tons per day) | | | |
|---|---|---|---|---|
| | District of Columbia | Maryland | Virginia | Total |
| 2008 VOC Reductions | 0.84 | 3.59 | 3.03 | 7.46 |
| 2009 VOC Reductions | 0.85 | 3.63 | 3.47 | 7.95 |

Note: The District's OTC VOC rules on all the applicable area source categories are or will be fully adopted, submitted to EPA, and federally enforceable measures. However, the emission reductions arising from these measures in the District are not applied to the emissions inventories presented in this RFP/attainment modeling/contingency demonstration of the Washington DC-MD-VA regional SIP. The District of Columbia's measures are expected to provide additional enhancements to the air quality improvement in the region.

**Emission Benefit Calculations**

Phase I: Projected reductions are based on an emission reduction factor of 14.2 percent, based on Pechan (2001).

Phase II: Emission reductions are based on a 2 percent reduction in emissions of VOC. Further details are available from OTC (2007).

**References**

OTC 2007. *Identification and Evaluation of Candidate Control Measures: Final Technical Support Document.* Prepared by MACTEC Federal Programs, Inc., Herndon, Virginia for the Ozone Transport Commission. February 28, 2007.

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

## 6.3 NON-ROAD MEASURES

The following non-road emission reduction measures that are discussed in this section are calculated using the NONROAD2005 emission factor model:

- EPA Non-road Gasoline Engines Rule, 6.3.1
- EPA Non-road Diesel Engines Rule, 6.3.2
- Emissions Standards For Spark Ignition Marine Engines, 6.3.3
- Emissions Standards for Large Spark Ignition Engines, 6.3.4
- Reformulated Gasoline for Off-Road Applications, 6.3.5
- Emission Standards for Locomotives, 6.3.6, are calculated using the Area Source spreadsheet but emission benefits are included in the nonroad sector totals.

### Projected Reductions and Emission Benefit Calculations

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. NONROAD2005, the current non-road emissions model approved for use by the EPA, is not designed to calculate the benefits of each of the above control measures individually. As a result, this and future SIP revisions will not enumerate the benefits of individual non-road control measures. 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** |
| 2008 VOC Reductions | 1.50 | 17.77 | 17.69 | 36.96 |
| 2009 VOC Reductions | 1.78 | 20.53 | 20.19 | 42.50 |

| | NOx Emission Reductions (tons per day) | | | |
|---|---|---|---|---|
| | **District of Columbia** | **Maryland** | **Virginia** | **Total** |
| 2008 NOx Reductions | 1.62 | 6.01 | 6.60 | 14.23 |
| 2009 NOx Reductions | 2.03 | 7.38 | 8.09 | 17.50 |

### 6.3.1 Phase I and Phase II Emissions Standards for Gasoline-Powered Non-Road Utility Engines (federal rule)

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 equipm.ent, 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* 15207 (March 30, 1999).

#### Implementation

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

## 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, 1995).

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* 15207, (March 30, 1999); correction published 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).

### 6.3.2 Emissions Standards for Diesel-Powered Non-Road Utility Engines of 50 or More Horsepower (federal rule)

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 are promulgated under §7547 (a).

EPA's first rule on such emissions standards was published in 59 Federal Register 31306 (June 17, 1994), and was effective on July 18, 1994.

Tier 2 and Tier 3 Emission Standards were promulgated in 1998. This program includes the first set of standards for nonroad diesel engines less than 37 kW (phasing in between 1999 and 2000), including marine engines in this size range. It also phases in more stringent "Tier 2" emission standards from 2001 to 2006 for all engine sizes and adds yet more stringent "Tier 3" standards for engines between 37 and 560 kW (50 and 750 hp) from 2006 to 2008.

EPA adopted a comprehensive national program to greatly reduce emissions from future nonroad diesel engines by integrating engine and fuel controls as a system to gain the greatest air quality benefits. This rule was published June 29, 2004. The requirement to reduce sulfur levels in nonroad diesel fuel by more than 99 percent will allow for the first time advanced emission control systems to be used on the engines used in construction, agricultural, industrial, and airport service equipment.

**Implementation**

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

**References**

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

U.S. Environmental Protection Agency, "Control of Emissions of Air Pollution from Nonroad Diesel Engines; Final Rule." 63 Federal Register 56967, October 23, 1998.

U.S. Environmental Protection Agency, "Control of Emissions of Air Pollution from Nonroad Diesel Engines and Fuel; Final Rule." 69 Federal Register Vol. 69, No. 124, June 29, 2004

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).

### 6.3.3 Emissions Standards for Spark Ignition (SI) Marine Engines (federal rule)

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 percent 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 9-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 percent reduction in HC compared to unregulated levels. These standards do not apply to any currently owned engines or boats.

**Implementation**

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

**References**

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

U.S. Environmental Protection Agency, "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", 61 Federal Register 52087, October 4, 1996.

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

### 6.3.4 Emissions Standards for Large Spark Ignition Engines (federal rule)

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

**Control Strategy**

The 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 began.

Controls on the category of large industrial spark-ignition engines were first required in 2004. Controls on the other engine categories began 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, which started 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. Tier 2 standards became effective in 2007.

**Implementation**

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

**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.

### 6.3.5 Reformulated Gasoline Use in Non-Road Motor Vehicles and Equipment (state opt-in to federal rule)

This measure involves taking credit for reductions due to the use of federally reformulated gasoline in non-road mobile sources. Reformulated gasoline is 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 opted-in on delivery of reformulated gasoline began receiving 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.

#### 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.

### 6.3.6 Standards for Locomotives (federal rule)

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 are 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.

**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** |
| 2008 NOx Reductions | 0.26 | 1.02 | 1.26 | 2.54 |
| 2009 NOx Reductions | 0.27 | 1.09 | 1.37 | 2.73 |

| | NOx Emission Reductions (tons per day) | | | |
|---|---|---|---|---|
| | **District of Columbia** | **Maryland** | **Virginia** | **Total** |
| 2008 VOC Reductions | 0.01 | 0.02 | 0.02 | 0.05 |
| 2009 VOC Reductions | 0.01 | 0.03 | 0.02 | 0.06 |

Note: NOx and VOC values are generated using the Area Source spreasheet but are presented in the overall nonroad sector totals.

## Emission Benefit Calculations

Emission benefits are based on EPA guidance on emission factors for locomotives. In 2008, the reductions are 10.3 percent for VOC and 30.7 percent for NOx. In 2009, the reductions are 13.5 percent for VOC and 32.35 percent for NOx.

## 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.

*Emission Factors for Locomotives,* EPA420-F-97-051, December 1997, Table 9.

## 6.4 ON-ROAD MEASURES

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

- Controls on Refueling Emissions and Reformulated Gasoline for On-road Applications, 6.4.1
- Enhanced I/M, 6.4.2
- Federal Tier 1 Vehicle Standards, 6.4.3
- National Low Emission Vehicle Standards, 6.4.4
- Federal Tier 2 Vehicle Standards, 6.4.5
- Heavy Duty Diesel Engine Rule, 6.4.6

### Projected Reductions and Emission Benefit Calculations

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 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) and vehicle technology, fuel, and maintenance-based measures, which are quantified outside of the MOBILE6 model. The table below summarizes the combined benefits from the above control measures by jurisdiction. See Appendix E1 for documentation of the MOBILE 6 modeling process.

| | VOC Emission Reductions (tons per day) | | | |
|---|---|---|---|---|
| | **District of Columbia** | **Maryland** | **Virginia** | **Total** |
| 2008 VOC Reductions | 0.52 | 2.70 | 2.97 | 6.19 |
| 2009 VOC Reductions | 0.64 | 3.33 | 3.21 | 7.18 |

| | NOx Emission Reductions (tons per day) | | | |
|---|---|---|---|---|
| | **District of Columbia** | **Maryland** | **Virginia** | **Total** |
| 2008 NOx Reductions | 2.11 | 14.66 | 12.90 | 29.67 |
| 2009 NOx Reductions | 2.73 | 18.80 | 16.09 | 37.62 |

### 6.4.1 Phase II Volatility Controls of Refueling Emissions and Reformulated Gasoline Use in On-road Vehicles (federal regulation)

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 all gasoline vehicles. In 2005, the 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 subsequently became mandatory as a result of designation as severe ozone nonattainment.

The benefits of this program are reflected in the 2002 baseline inventory and the 2008 and 2009 projections thereof. No additional reductions are calculated.

#### Source Type Affected

All gasoline-powered vehicles (non-road source benefits are documented under Section 6.4.2) 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. The volatility reductions under §7545 (h) became effective in summer 1992. Further volatility reductions required under §7545 (k) are associated with the reformulated gasoline that began selling in the Washington nonattainment area on January 1, 1995.

#### Implementation

The volatility controls of refueling emissions program was implemented by the EPA under 42 U.S.C. §§7545 (h) and (k). Implementation of the RFG program 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. Under Phase I of the RFG program, all gasoline sold in the nonattainment area on or after January 1, 1995, must be reformulated gasoline. Phase II of the RFG program became effective after January 1, 2000. The program became mandatory for the Washington region one year after designation as Severe nonattainment, which occurred on March 23, 2004.

#### References

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

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

### 6.4.2 Enhanced Vehicle Emissions Inspection and Maintenance (Enhanced I/M) (federal regulation)

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 that 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 and diesel vehicles and 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 using a decentralized program.

#### Implementation

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

Appendix E1 contains detailed information regarding implementation of I/M programs in the District, Maryland, and Virginia.

#### 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.

### 6.4.3 Federal "Tier I" New Vehicle Emission and New Federal Evaporative Emissions Standards (federal regulation)

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.

The benefits of this program are reflected in the 2002 baseline inventory and the 2008 and 2009 projections thereof.

**Source Type Affected**

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

**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.

**References**

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

### 6.4.4 National Low Emission Vehicle Program (federal regulation)

Under the National Low-Emission Vehicle (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 was in place nationwide in model year 2001.

The benefits of this program are reflected in the 2002 baseline inventory and the 2008 and 2009 projections thereof. No additional reductions are calculated.

**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.

**References**

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

### 6.4.5 Tier 2 Motor Vehicle Emission Regulations (federal regulation)

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 are being phased-in to this standard between 2004 and 2007.

Beginning in 2004, the refiners and importers of gasoline 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 was set at 30 ppm, with a corporate average of 90 ppm and a cap of 300 ppm. Finally, in 2006, refiners met 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.

**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.

### 6.4.6 Heavy-Duty Diesel Engine Rule (federal regulation)

Under the Heavy-Duty Diesel Engine Rule, truck manufacturers must comply with more stringent tailpipe standards by 2004 and 2007. 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.

#### 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.

### 6.4.7 Transportation Control Measures (TCMs) and Vehicle Technology, Fuel, and Maintenance-based Measures (state and local program)

Section 108(f) of the Clean Air Act Amendments provides examples of 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.

Additional information on TCMs is contained in Appendix F.

**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**

*Transportation Control Measures:*

| | VOC Emission Reductions (tons per day) | | | |
|---|---|---|---|---|
| | **District of Columbia** | **Maryland** | **Virginia** | **Total*** |
| 2008 VOC Reductions | 0.0025 | 0.0429 | 0.0624 | 0.1124 |
| 2009 VOC Reductions | 0.0022 | 0.0395 | 0.0576 | 0.1037 |

| | NOx Emission Reductions (tons per day) | | | |
|---|---|---|---|---|
| | **District of Columbia** | **Maryland** | **Virginia** | **Total*** |
| 2008 NOx Reductions | 0.0025 | 0.1 | 0.1385 | 0.2490 |
| 2009 NOx Reductions | 0.0023 | 0.0896 | 0.1238 | 0.2229 |

*Vehicle Technology, Maintenance, or Fuel-Based Measures:*

| | VOC Emission Reductions (tons per day) | | | |
|---|---|---|---|---|
| | **District of Columbia** | **Maryland** | **Virginia** | **Total*** |
| 2008 VOC Reductions | 0 | 0.0064 | 0.0165 | 0.0829 |
| 2009 VOC Reductions | 0 | 0.0059 | 0.0152 | 0.0812 |

| | NOx Emission Reductions (tons per day) | | | |
|---|---|---|---|---|
| | **District of Columbia** | **Maryland** | **Virginia** | **Total*** |
| 2008 NOx Reductions | 0.0022 | 0.0154 | 0.0595 | 0.2365 |
| 2009 NOx Reductions | 0.0022 | 0.0138 | 0.0552 | 0.2306 |

Note: Totals also include TCMs and Vehicle Technology, Maintenance, and Fuel-based Measures for the Washington Metropolitan Area Transit Administration (WMATA). Emission reduction estimates were supplied by the District of Columbia Department of Transportation, the Maryland Department of Transportation, the Virginia Department of Transportation. See Appendix F for details.

## 6.5 Voluntary Bundle

In September 2004, EPA issued its policy on "Incorporating Emerging and Voluntary Measures in a State Implementation Plan (SIP)."[1] This policy establishes criteria for EPA to approve credit under a SIP for emission reductions from voluntary and emerging measures. This policy permits states to develop and implement innovative programs that partner with local jurisdictions, businesses and private citizens to implement emission-reducing measures at the local level.

In August 2005, EPA issued a second guidance document to facilitate innovative control measures. This document was entitled "Guidance on Incorporating Bundled Measures in a State Implementation Plan."[2] The guidance supports the development of innovative measures by describing how States can develop individual voluntary and emerging measures and "bundle" them into a single SIP submission. The emissions reductions for each measure in the bundle are quantified but it is the performance of the entire bundle (the sum of the emission reductions from all the measures in the bundle) that is measured by EPA for SIP compliance purposes. The bundled measures policy takes into account the fact that some measures may perform less effectively than projected by allowing the State to average these measures with others that perform better than expected. Agencies must implement each voluntary control measure, and states must monitor each 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 more effective control measures.

This SIP proposes a set of measures for the voluntary bundle that includes emission reductions measures included in the bundle for the 1-hour ozone SIP and several new programs proposed herein. All of the voluntary measures have been implemented after the 2002 SIP base year. The 1-hour ozone SIP bundle commitments were modified. Diesel retrofit and low-emission vehicle purchases are no longer included in the bundle and are being used for weight of evidence or as Transportation Emission Reduction Measures (TERMs). In addition, one of the programs included in the SIP voluntary bundle for the 1-hour ozone standard (Low-VOC Consumer Products in Virginia) has been adopted as a mandatory measure and therefore, it is no longer included as part of the voluntary bundle.

The bundled measures will reduce emissions daily through the ozone season in May through September. The measures will be implemented by county, city and state agencies in consultation with the District of Columbia, the State of Maryland or the Commonwealth of Virginia. The emission reductions credited in this plan are below EPA's presumptive limits for voluntary initiatives.

Some of the programs identified in the voluntary measures package for Reasonable Further Progress (RFP) will be fully implemented by May 1, 2008 – the beginning of the 2008 ozone season – even though most reductions will occur by January 2008, the date on which the region will achieve rate of progress. Full implementation of all other measures will begin in 2009.

---

[1] See http://www.epa.gov/cleanenergy/stateandlocal/guidance.htm

[2] Ibid.

Some of the programs identified in the voluntary measures package for Reasonable Further Progress (RFP) will be fully implemented by May 1, 2008 – the beginning of the 2008 ozone season – even though most reductions will occur by January 2008, the date on which the region will achieve rate of progress. Full implementation of all other measures will begin in 2009.

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.

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

**Source Type Affected**

This bundle reflects commitments by owners, operators, purchasers or users of the following types of emissions-related items/equipment in the Metropolitan Washington area: commercial power generation, portable fuel containers, municipal buildings, urban forest trees, locomotives, solvents, and paints.

**Implementation**

Arlington County, Virginia
Calvert County, Maryland
City of Alexandria, Virginia
City of Falls Church, Virginia
City of Greenbelt, Maryland
Fairfax City, Virginia
Fairfax County, Virginia
Loudoun County, Virginia
Maryland Department of Transportation
Maryland National Capital Parks and Planning Commission
Montgomery County, Maryland
Prince George's County, Maryland
Prince William County, Virginia
Virginia Department of Environmental Quality
Washington Surburban Sanitary Commission, Maryland

**Monitoring and Enforcement**

The District of Columbia, the State of Maryland, and the Commonwealth of Virginia commit to monitoring, evaluation and reporting of the emissions effects of the programs comprising the voluntary measures. 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.

The District of Columbia, Maryland, and Virginia will evaluate the emission benefits from this voluntary measures package through a "true-up" analysis to be conducted at least every three calendar years. As agreed in the 1-hour ozone SIP, the first true-up is scheduled for March 2007. The next true-up will be completed by June 2010, three years from the submittal of this SIP revision. Should the evaluation program determine that the measures 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 June 2010 true-up shows emissions benefits lower than expected, the states will remedy the deficiency by June 2011 if the remedy does not require rulemaking, or by June 2012 if rulemaking is required.

## Projected Reductions

The District of Columbia, the State of Maryland, and the Commonwealth of Virginia have used available methods to create their best estimate of the emission benefits created from the bundle of voluntary measures. These estimates have been agreed upon by the implementing agencies and are conservative in nature. The summary of the estimates and the methodology follows below. More detailed information about the methodologies is provided in Appendix H.

**Table 6-8. Summary of Emission Reductions for Voluntary Bundle Commitments (2002-2009)**

| Jurisdiction | Emission Reduction for 2008 (tpd VOC) | Emission Reduction for 2009 (tpd VOC) | Emission Reduction for 2008 (tpd NOx) | Emission Reduction for 2009 (tpd NOx) |
|---|---|---|---|---|
| **Regional Wind Power Purchase Program** | 0 | 0 | 0.13 | 0.15 |
| **Renewable Portfolio Standards** | 0 | 0 | - | - |
| **LED Traffic Signal Retrofits** | 0 | 0 | 0.02 | 0.02 |
| **VRE Idling Reduction** | 0.01 | 0.01 | 0.13 | 0.13 |
| **Low-VOC Paint** | 0.17 | 0.17 | 0 | 0 |
| **Gas Can Replacement** | 0.01 | 0.01 | 0 | 0 |
| **TOTAL** | 0.19 | 0.19 | 0.28 | 0.30 |

Note: Includes cumulative impacts of commitments made in the 1-hour and 8-hour ozone SIPs.

## Point Source Strategies

### Renewable Energy and Energy Efficiency

The following energy efficiency and renewable energy measures are included as innovative voluntary control measures in the SIP.

- Renewable Energy Programs
  - Regional Wind Power Purchase Program
  - Clean Energy Rewards Program
  - Renewable Portfolio Standards
- Energy Efficiency Programs
  - LED Traffic Signal Retrofit Program
  - Building Energy Efficiency Programs
- Green Building Programs

### Emission Reduction Calculations and Projected Reductions

In recent years, substantial progress has been made in the development of methodologies to quantify emission reduction benefits from energy efficiency and renewable energy (EERE) measures. Several methods have been used to calculate the benefits resulting from the displacement of fossil fuel generation in the dispatch order. The methodology outlined below was developed by Resource Systems Group, Inc. (RSG) in cooperation with Environmental Resources Trust (ERT).

The State of Maryland relied on an initial version of the RSG/ERT methodology in its regional wind purchase submission as part of the bundle of voluntary measures submitted to EPA in its 1-hour ozone SIP. This SIP control measure was subsequently cited with approval by the EPA in its August 2004 "Guidance on State Implementation Plan (SIP) Credits for Emission Reductions from Electric-sector Energy Efficiency and Renewable Energy Measures."[3] EPA also approved the wind purchase as the first-ever renewable energy measure to receive NOx emissions reduction credit in a State Implementation Plan.[4]

Udated versions of the RSG methodology have been subsequently used in three separate projects to estimate the displacement of emissions at fossil-fueled power plants resulting from EERE measures in New Jersey, Connecticut, and Virginia. Most of this work has been supported by the U.S. Department of Energy.[5] The New Jersey work was conducted in cooperation with the U.S. Environmental Protection Agency and the National Renewable Energy Laboratory.

---

[3] See http://www.epa.gov/cleanenergy/stateandlocal/guidance.htm

[4] 70 Fed. Reg. 24988 (May 12, 2005).

[5] U.S Department of Energy, *Final Report on the Clean Energy/Air Quality Integration Initiative for the Mid-Atlantic Region*, August 2006. See http://www.eere.energy.gov/wip/clean_energy_initiative.html; Resource Systems Group, *Estimation of Avoided Emission Rates for Nitrogen Oxide Resulting from Renewable Electric Power Generation in the New England, New York and PJM Interconnection Power Market Areas, 2006*, Prepared under grant funding from the U.S. Department of Energy and under subcontract to Environmental Resources Trust and Connecticut Smart Power; Resource Systems Group, *Avoided Emissions at Three Proposed Wind Power Projects in Virginia*, 2006, Prepared under grant funding from the U.S. DOE's Clean Energy/Air Quality Integration Initiative.

Each state is including provisions in their NOx Ozone Season emissions trading program that will set aside a portion of the state's ozone season NOx allowance budget to support renewable energy and energy efficiency projects. Each state will assure that NOx allowances are retired in an amount commensurate with the size of the six EERE measures cited below to ensure surplus emission reductions.

The SIP measures will be structured to take into account the differences in the NOx emissions trading regulations of Maryland, the District of Columbia, and Virginia. Maryland's NOx SIP Call regulations authorize the allocation of NOx allowances to support EERE projects and purchases but the NOx SIP Call regulations for the District of Columbia and Virginia do not provide such authority. Thus, emission reductions from EERE projects will not be claimed for Virginia government entities in 2007 and 2008.

However, in 2009, NOx emissions trading for electric generating units in all three states will be governed by the Clean Air Interstate Rule (CAIR), and all three governments are including provisions in their CAIR setting aside a portion of allowances in their summer ozone season trading budget to support EERE projects and purchases. The Virginia Air Pollution Control Board approved the VA CAIR on December 6, 2006, and Maryland and the District of Columbia plan to adopt their regulations to implement CAIR in 2007. As a result, surplus emission reductions from all three jurisdictions can be claimed for 2009.

**Table 6-9. Summary of Benefits EERE Programs**

| Measure | Daily kWh Generation /Savings | 2009 NOx Emission Reduction (tpd) |
|---|---|---|
| Renewable Energy Programs | | |
| Regional Wind Power Purchase Program | 123,000,000 | 0.15 |
| Clean Energy Rewards Program | up to 31,900,000 | - |
| Renewable Portfolio Standard (RPS) | 22,500,000 | - |
| Energy Efficiency Programs | | |
| LED Traffic Signal Retrofit Program | 26,905,556 | 0.02 |
| Building Energy Efficiency Programs | ~15,000,000 | - |
| Green Building Programs | - | - |
| TOTAL | ~150,000,000 | 0.17 |

Note: Total does not include the Clean Energy Rewards, RPS, or the Building Energy Efficiency Programs.

**Regional Wind Power Purchase Program**

Under this measure, local and State government entities in the nonattainment area have committed to purchase a specific number of kilowatt-hours (kWh) of power during the summer ozone season from wind turbines. The government agencies will purchase the wind energy directly from an electricity supplier or purchase renewable energy certificates (RECs)[6] that assure that such wind energy is placed on the electric grid. This zero-emission wind power will displace emissions from fossil-fueled power plants that would normally supply power to the Metropolitan Washington region. The air agencies in Maryland, the District of Columbia, and Virginia will retire NOx allowances in an amount commensurate with the amount of emissions displaced.

**Source Type Affected**

The measure affects certain local and State government entities within the Metropolitan Washington nonattainment area. The region is implementing this measure to reduce electric power generation from coal, oil, and/or gas-fired sources, thereby reducing NOx emissions from these sources.

**Control Strategy**

This measure is envisioned as a region-wide measure encompassing purchases of wind power or wind energy RECs by state and local government entities within the Metropolitan Washington nonattainment area.

This program was initiated on a pilot basis in the 1-hour ozone SIP and has been expanded here. To meet the existing commitments from the 1-hour ozone SIP, local governments signed multi-year commitments with wind power suppliers to assure that a fixed quantity of wind energy would be placed on the electric grid in upwind or continguous States. These purchases have displaced fossil fuel generated power, thus reducing the NOx emitted from those plants.

**Implementation**

Arlington County, Virginia
Fairfax County, Virginia
Prince William County, Virginia
Montgomery County, Maryland
Members of the Montgomery County buying group (see list below)
Prince George's County
Washington Suburban Sanitary Commission (WSSC)
District of Columbia

[6] Renewable energy certificates represent the unique and exclusive proof that 1 Megawatt-hour of energy was generated from a renewable energy source and placed on the electric grid.

In Fiscal Years (FY) 2005 and 2006, a buying group led by Montgomery County, Maryland purchased 40,845,139 kilowatt-hours (kWh) of wind energy RECs per fiscal year. The purchase represented 5% of the total annual electricity consumption of each purchasing group participant. Montgomery County executed a contract amendment on September 18, 2006 to purchase additional kWhs of clean, renewable energy in compliance with SIP requirements (RECs for energy were generated at the Mountaineer Wind Energy Center in West Virginia) for FY07 and FY08 (July 1, 2006 to June 30, 2008). In the new contract, the County, and many other members of the buying group opted to increase their wind energy purchase to 10% of their total annual electricity consumption, for a total of 51,809,091 kWh of clean energy purchased by the group in FY07, and 57,481,122 kWh in FY08. Credit for 28,000,000 kWH per year was taken in the one-hour ozone SIP, leaving 23,809,091 kWh in FY07 and 29,481,122 kWh in FY08 available for credit in the 8-hour SIP. The purchase will cover the period from July 1, 2006 to June 30, 2008

The following other counties, cities, and state agencies will participate in the Montgomery County buying group:

Montgomery County Public Schools (MCPS)
Montgomery County Government
Maryland National Capital Park and Planning Commissions (M-NCPPC)
Montgomery College
Housing Opportunities Commission (HOC)
City of Rockville
Gaithersburg
Takoma Park
College Park
Rockville Housing Enterprise
Town of Kensington
Chevy Chase Village
Somerset
Glenn Echo
Chevy Chase Sect. 5
Town of Laytonsville

In addition, the Virginia Energy Purchasing Governmental Association (VEPGA) issued an RFP in March 2007 to select a supplier of wind energy RECs in the amount of at least 11,230,000 kWh/year. The RFP will cover the period April 2007 to March 2010. The following counties, cities, and state agencies will participate in this buying group: Fairfax County, Arlington County, and Prince William County.

The District of Columbia plans to purchase 16,500 kWh/year from wind energy or wind energy RECs. There is the possibility that this purchase can be used by utilities to meet RPS requirements so is not analyzed further here.

All three RFPs will include:

- A reporting requirement indicating the actual amount of wind energy in kWh purchased during the ozone season and per year. In addition, the request for proposal issued for the Virginia municipalities will contain a requirement that the purchase of wind energy RECs be made from wind plants in the PJM Interconnection grid in one or more of the following States: Maryland, Virginia, Pennsylvania, West Virginia, or Ohio. Based on EPA's analysis of ozone transport data set forth in the preamble to the EPA's CAIR (70 Fed. Reg. 25249-50), these five States are considered upwind of one or more counties in the DC-MD-VA nonattainment area. The RFPs for the MD jurisdictions will require that the purchase of wind energy RECs be made from wind plants in States contiguous to Maryland.
- A reporting requirement indicating actual amount of wind energy in kWh purchased during the ozone season and per year.

## Monitoring and Enforcement

Each State will provide evidence that it has assured the retirement of the designated amount of NOx allowances from future use under a NOx emissions trading program. In addition, all jurisdictions and agencies participating in the regional wind power purchase program have committed to maintain copies of signed contracts and energy bills to verify the amount of wind energy or wind energy RECs purchased. They also will purchase wind energy or wind energy RECs from a certified supplier who can provide independent certification that the wind energy purchased is placed on the electric grid. This evidence will help to validate the emission reduction credit included in the SIP.

## Projected Reductions

The renewable energy purchase program is expected to involve purchase 104,000 MWh of power or wind energy RECs annually, reducing 0.15 tpd NOx during the 2009 ozone season. Further information on the projected reductions is included in Appendix H.

**Table 6-10. Wind Purchase Commitments for the 8-hour Ozone SIP Voluntary Bundle (all in kWh/year)**

| Jurisdiction | 1-hour Ozone SIP Commitment for 2005 | 8-hour Ozone SIP Commitment for 2008 | 8-hour Ozone SIP Commitment for 2009 | 2005 Emission Reduction Credited in 1-hour Ozone SIP (tpd NOx) | 2008 Emission Avoided (tpd NOx) | 2009 Emission Avoided (tpd NOx) |
|---|---|---|---|---|---|---|
| Montgomery County, MD Purchasing Group (existing) | 28,000,000 | 28,000,000 | 28,000,000 | | | |
| Montgomery County, MD Purchasing Group (new) | | 14,740,561 | | | | |
| Prince George's County, MD | | 8,423,095 | 8,423,095 | | | |
| Washington Suburban Sanitary Commission (WSSC) | | 70,000,000 | 70,000,000 | | | |
| Arlington County, VA | 2,340,000 | 4,700,000 | 4,700,000 | | | |
| Fairfax County, VA | | 5,800,000 | 11,600,000 | | | |
| Prince William County, VA | | 750,000 | 750,000 | | | |
| Total | | 104,413,656 | 123,473,095 | 0.05 | 0.13 | 0.15 |

Notes:
All emission reductions are for ozone season only and are estimated using the emissions calculator in Appendix H.
Montgomery County FY 2008 new commitments only through June 30, 2008. Commitment does not extend to 2009.
Because NOx SIP Call regulations in Virginia don't have NOx allowance retirement provisions for 2008, the 2008 NOx Emission Avoided do not include 0.1 tpd from Virginia commitments.

**Clean Energy Rewards Program**

Under this measure, Montgomery County Government will provide rewards (incentives) to residents, small businesses, and community organizations purchasing clean energy products certified by the Department of Environmental Protection (DEP). The authority for this program is granted in the Montgomery County Code Section 18A-11, as amended, and Executive Regulation No. 2-06AM. Based on the program's funding of $361,000 for FY 2007, Montgomery County has estimated that its Clean Energy Rewards Program will provide incentives for 31,900 MWh of clean energy.

**Source Type Affected**

The measure affects Montgomery County residents, small businesses, congregations, and non-profits, and is supported by Montgomery County Government, within the Metropolitan Washington nonattainment area. Montgomery County is implementing this measure to reduce consumption of electric power generated from coal, oil, and/or natural gas fired sources by consumers, thereby reducing NOx emissions from these sources.

**Control Strategy**

Clean Energy Rewards is a unique program developed by Montgomery County to encourage consumers to switch to clean energy. Consumers must purchase at least 50 percent of their annual energy consumption from a clean energy product certified by the Department of Environmental Protection (DEP) to be eligible for rewards.

Under the program, eligible clean energy products must be generated within the PJM Regional Transmission Organization (RTO) from solar, wind, and/or Tier 1 biomass as defined by the Maryland Code, Public Utility Company Article, 7-703 (Maryland's RPS). However, current products for FY 2007 are limited to energy generated from wind and solar sources, and Montgomery County believes that the majority of certified clean energy products will be wind-based in 2007.

Participating suppliers must provide documentation to DEP's Director verifying that all products marketed through Clean Energy Rewards meet the program's criteria. These steps ensure the clean energy is generated within the PJM region and is not used to meet the requirements of the Maryland Renewable Energy Portfolio Standard or is otherwise double counted. Only purchases of wind energy or solar will be reported for purposes of the SIP.

## Implementation

*Montgomery County Government.* The Department of Environmental Protection solicited support from several energy suppliers and REC marketers for this program. Potential suppliers are required to submit product information labels or other generation data about each product to be marketed through the program, and sign a Memorandum of Understanding with the County agreeing to deliver the rewards to consumers either as a credit on their bill, or as a product discount. Montgomery County residents will receive 1 cent/kWh up to 20,000 kWh per year. Non-residential end-users (small business, congregations, and non-profits) will receive 1.5 cents/kWh up to 100,000 kWh per year.

DEP is the main marketing arm of the Clean Energy Rewards Program. However, program suppliers also are encouraged to market the product and the program to Montgomery County consumers with DEP guidance to insure consistency. DEP has developed a web site and educational materials to inform consumers about the program and the benefits of clean energy. The County is running an advertising campaign in Montgomery County Metro stations and in the *Montgomery County Extra* section of *The Washington Post*; and is meeting with and promoting the program through community organizations and other Montgomery County support structures. DEP anticipates that these marketing measures will reach thousands of Montgomery County electric consumers.

Consumers can sign-up for clean energy products through DEP's web site starting November 15, 2006, and will begin receiving the products and accruing rewards starting January 1, 2007.

## Monitoring and Enforcement

DEP is requiring suppliers to submit reports identifying the consumers participating in the Clean Energy Rewards Program, the amount of eligible clean energy consumed through the program by resource type, and additional product verification data. Customer lists and energy consumption will be submitted to DEP on a quarterly basis. This information will be used to determine the funds to reimburse energy suppliers for rewards paid.

By March of 2008 and each following year, DEP will receive reports from energy suppliers verifying the energy reserved for the program and the generation sources. Participating suppliers must provide documentation to DEP's Director verifying that all products marketed through Clean Energy Rewards meet the program's criteria. Additionally, suppliers are required to reserve electricity in an account under the PJM Generation Attribute Tracking System (GATS) using the identifier "(ENV)" and designate it as "Montgomery County Clean Energy Rewards." Once electricity is reserved in this account, it cannot be used to meet RPS requirements or otherwise sold. These steps ensure that the clean energy is generated within the regional airshed and is not used to meet the RPS requirements or is otherwise double counted. The details of these submissions will allow Montgomery County to verify the amount of zero-emission NOx clean energy generated within Maryland and adjacent states on an annual basis.

Since this is a new program, it is impossible to estimate with certainty the exact volume of clean energy that will be purchased by Montgomery County consumers. However, given the funding

appropriated, the County Council's support, and the Clean Energy Products Certified in FY2007 this program is likely to be well subscribed. Moreover, under the EERE set-aside in the Maryland NOx emission trading regulations, in the future NOx allowances also will be retired commensurate with the amount of avoided emissions.

**Renewable Portfolio Standards**

This measure will focus on NOx emission reductions resulting from the displacement of power generation from coal, oil, and/or gas-fired sources by zero-emission renewable energy sources. The District of Columbia Department of the Environment will retire NOx allowances in an amount commensurate with the amount of emissions displaced.

**Source Type Affected**

The measure affects the District of Columbia within the Metropolitan Washington nonattainment area. According to the DC Renewable Energy Portfolio Standard (RPS) Act of 2004, a major purpose of the Act is to "ensure that the benefits of electricity from renewable energy sources, including long-term reduced emissions…accrue to the public at large."

**Control Strategy**

Under the DC RPS Act, retail electricity suppliers are required to meet their regulatory requirements by supplying renewable energy that is located: (A) in the PJM Interconnection region or in a state that is adjacent to the PJM Interconnection region; or (B) outside the area described in (A) but in a control area that is adjacent to the PJM Interconnection region, if the electricity is delivered into the PJM Interconnection region.

The increased supply of renewable energy will displace fossil fuel generated power in the PJM Interconnection area, thus reducing the NOx emitted from these plants.

The District of Columbia plans to include provisions in its NOx Ozone Season Trading Program under the Clean Air Interstate Rule setting aside a portion of the District's total NOx allowance budget to support renewable energy and energy efficiency projects. The District will assure that NOx allowances will be retired in an amount commensurate with the NOx emissions reduced as a result of the tier one zero-emission renewable energy purchases. This retirement of allowances will ensure that surplus emission reductions will be provided. Since the CAIR program for electric generating units is not effective until 2009, credit for NOx emission reductions will not be claimed until 2009.

**Implementation**

*District of Columbia.* Under the DC RPS Act, retail electricity suppliers serving customers in the District of Columbia are required to provide 2.5% of their supply from tier one renewable energy sources in 2009. In addition, retail electric suppliers are required to provide 0.019% from solar energy or solar REC purchases. This renewable energy percentage increases each year to a level of 11% in 2022 and later. Tier 1 renewable sources are defined to include: (1) zero-emission renewable energy sources, including solar energy, wind energy, geothermal energy, and ocean energy; and (2) low-emission renewable energy, including qualifying biomass, qualified methane from anaerobic decomposition, and fuel cells.

**Monitoring and Enforcement**

The District of Columbia will provide evidence that it has assured the retirement of the designated amount of NOx allowances from future use under its renewable energy set-aside. In addition, the District of Columbia Department of the Environment has committed to obtain information from the DC Public Service Commission confirming that electricity suppliers have made purchases of renewable energy consistent with the commitments incorporated in this control measure.

**Calculation of Emission Reduction Benefits**

The calculation of NOx emission reductions for 2009 involves the following steps:

(1) Estimate total retail sales of electricity in DC for the summer ozone season in 2009;
(2) Estimate the amount of Megawatt-hours supplied from zero-emission Tier 1 renewable resources in the summer ozone season for 2009 (based on the requirements of the DC RPS Act and estimates by the DC Department of the Environment);
(3) Calculate avoided NOx emissions in lbs/MWh during the summer ozone season based on an estimate of actual avoided NOx emissions and the calculation of NOx allowances retired; and
(4) Calculate avoided NOx emissions in tons/day during the summer ozone season.

The total annual consumption of electricity in the District of Columbia is 12,354,981.11 MWh. In estimating the portion of the Tier 1 renewable energy purchases comprised of wind energy or associated RECs, MWCOG relied on the expertise of one of the Commissioners of the DC Public Service Commission (PSC). Since the DC RPS has not yet been operational, the PSC Commissioner suggested that DC review the experience of another Mid-Atlantic State with a similar Tier 1 category in its RPS – one that included both landfill gas and wind energy. New Jersey fit that category, and the NJ Board of Public Utilities provided information indicating the following allocation of purchases among landfill gas, wind and solar in its Tier 1 category during the most recent year: (1) 92.27% landfill gas; (2) 6.48% wind energy; and (3) 1.2% solar.

Based on this NJ estimate and the different treatment of solar in the DC RPS, we have extrapolated to the DC RPS and calculated that wind energy will represent an estimated 6.56% of the Tier 1 requirement in 2009. Solar energy must provide 0.019% of total electricity consumption. Electricity generated from landfill gas is not considered in the analysis. The emissions calculator described in Appendix H was used to estimate the avoided NOx emissions.

The District of Columbia is claiming zero credit from this measure.

**Table 6-11 Projected Annual Generation and Avoided Emissions from the DC RPS Tier 1 Sources**

| DC RPS Tier 1 Category | MWh Annual Generation | NOx Emissions Avoided (tpd) |
|---|---|---|
| Wind | 20,262 | 0.025 |
| Solar PV | 2,347 | 0.007 |

## Green Building Programs

Under this program, local governments in the nonattainment area have committed to reducing energy demand associated with operation of existing and new buildings by implementing Green Building Programs. Depending on the energy efficiency and renewable energy components of these programs, they will decrease demand for electricity and displace power generation from coal, oil, and/or gas-fired sources that would normally supply power to the Metropolitan Washington region, thereby reducing NOx emissions from those sources.

## Source Type Affected

The measure affects state and local governments within the Metropolitan Washington nonattainment area.

## Control Strategy

This measure is envisioned as a region-wide measure encompassing green building programs by state and local governments within the Metropolitan Washington nonattainment area. These programs are in the early stages of development and affect several local jurisdictions in the nonattainment area. Local governments have begun to implement a variety of Green Building Programs that may reduce demand for electricity. The reduction in energy demand will displace fossil fuel generated power, thus reducing the NOx emitted from those plants.

Green Building Programs can include a number of initiatives such as certification under the Leadership in Environmental and Energy Design (LEED) Program, labeling under the ENERGY STAR® program, Green Globes rating, and green building codes. In order to provide air quality benefits, any program must include as a key component a requirement that retrofitted or new buildings achieve a reduction in energy demand compared to an established baseline.

Each state in the nonattainment area is including provisions in its NOx Ozone Season emissions trading regulations that set aside a percentage of the state's total NOx allowance budget to support energy efficiency and renewable energy (EERE) projects.

## Implementation

This section identifies the current status of Green Building Programs listed for the SIP, examines what uses or adaptations of major green building rating systems could be made to quantify emissions effects in a SIP context, and summarizes major green buildings efforts to date within the nonattainment area.

### *Current Status of Green Building Programs for the SIP*

The following table lists the initial survey responses for Green Building programs in the nonattainment area that the jurisdictions indicated they would like to include as voluntary measures, for SIP purposes. None of the jurisdictions intend to quantify the listed Green Buildings program elements for 2009 emission reductions for the 8-hour Ozone SIP.

**Table 6-12. Summary of Voluntary Measures Initial Survey Responses Regarding Green Building Programs (2002-2009)**

| Jurisdiction | Program Element |
|---|---|
| Fairfax County | LEED goal for recreation center |
| Arlington County | LEED scorecard for projects; developer incentives |
| Montgomery County | Green Building ordinance |
| District of Columbia | Planning for LEED requirements for all govt buildings |
| City of Alexandria | LEED silver goal for all govt buildings |
| City of Alexandria | Require plan for voluntary LEED for private sector |
| City of Greenbelt | LEED silver for public works building |

Additional green building activities of the local governments in the nonattainment area are further described in the section below on "Green Building Activities in the Nonattainment Area."

For these green building programs to produce quantifiable electric load and emission reduction results, more specific program requirements will be necessary. Green building program rating systems are a good framework for discussing how these specific program requirements could be designed.

#### *Green Building Program Rating Systems*

Popular green building program rating systems are LEED certification, ENERGY STAR® Building label, and Green Globes.

*LEED.* LEED® is a nationally accepted benchmark for the design, construction, and operation of high performance green buildings established by the U.S. Green Building Council (USGBC). LEED promotes a whole-building approach to sustainability by recognizing performance in five key areas of human and environmental health: sustainable site development, water savings, energy efficiency, materials selection, and indoor environmental quality. Specific LEED programs include:

- New Commercial Construction and Major Renovation projects (known as LEED-NC and is the most widely applied)
- Existing Building Operations and Maintenance (known as LEED-EB)
- Commercial Interiors projects
- Core and Shell Development projects
- Homes (pilot program)
- Neighborhood Development (pre-pilot program)
- Guidelines for Multiple and On-Campus Building Projects; Schools; Retail for New Construction and Commercial Interiors; Healthcare; and Laboratories.

To earn LEED certification, a building project must meet certain prerequisites and performance benchmarks or "credits" within each category. Projects are awarded Certified, Silver, Gold, or Platinum certification depending on the number of credits they achieve.

As the documentation required for LEED certification is substantial, it is common for organizations to require "LEED-equivalent" building performance levels to avoid the

administrative cost of certification. However, without the certification documentation, performance can be difficult to verify.

LEED-NC has 14 out of a total of 69 credits that impact building energy and corresponding power generation emissions. Several buildings have successfully certified for LEED Silver without earning any of those building energy credits. Therefore, it is important to design MWCOG Green Buildings programs to require a reduction in energy consumption in addition to the LEED certification level.

Also, LEED-NC energy performance is based on the simulated design of the building, which once constructed and occupied may or may not operationally achieve the certified energy performance levels as predicted. The building design simulation is typically conducted on an hourly calculation basis, and these calculation models and results could be used to derive ozone season energy savings. The intention of the USGBC is that building projects certified under the LEED-NC rating system subsequently re-certify under LEED-EB with actual building energy performance data.

ENERGY STAR®. ENERGY STAR® Label for Buildings is provided by the U. S. Environmental Protection Agency (EPA) to benchmark the energy performance of commercial buildings. A building with performance scored among the nation's top 25 percent – equal to an energy performance score of 75 or greater on a 1 to 100 scale – and that maintains a healthy and productive indoor environment can qualify as an ENERGY STAR® building. The score accounts for the most significant drivers of energy intensity such as weather (based on location information) and building characteristics (such as size). Currently there are twelve eligible building space types. The score is based on annual energy intensity, normalized in units of kBtu/ft2-yr, and 12-months of operation with energy utility bills are required. The Statement of Energy Performance automatically includes a calculation of power generation $CO_2$ emissions (as determined by the EPA) based on the annual site energy use in that location.

The LEED-EB rating system awards energy performance credits based on the ENERGY STAR® rating score.

As achieving the ENERGY STAR® building label may require improvements to the building to reduce annual energy usage (and increase the score), the corresponding power generation emission reductions could be quantified and counted. The ENERGY STAR® rating tool already automatically calculates annual $CO_2$ emissions reductions corresponding to the energy consumption reduction. However, more detailed information would have to be recorded to account for the seasonal, daily or hourly emission reductions occurring during the nonattainment period.

*Green Globes.* Another green building rating program has been developed by the Green Building Initiative™ and is known as The Green Globes™ environmental assessment and rating system. Green Globes is questionnaire-driven for new building construction projects. At each stage of the design process, users go through a sequence of questions that provide guidance for integrating important elements of sustainability. The construction documents questionnaire is the basis for the rating and seven areas are addressed: Project Management – Policies and

Practices; Site; Energy; Water; Resources, Building Materials and Solid Waste; Emissions and Effluents; and Indoor Environment. The building energy points are awarded based on the ENERGY STAR® rating score as determined by the Target Finder tool. The emissions points address fossil-fuel heating equipment and operation. Once an assessment is verified by a third party, building properties achieving a score of 35% or more receive a Green Globes rating (one to four globes) based on the percentage of total points (up to 1000) achieved.

***Green Building Activities in the Nonattainment Area***

This section identifies green buildings activities in the jurisdictions, LEED-certified buildings in the nonattainment area, and discusses Federal green buildings.

*Jurisdiction Activities.* Many of the jurisdictions are undertaking green buildings activities. These have not been included in this SIP submission. NREL compiled this information from the Internet and personal communications.

*Metropolitan Washington Council of Governments (COG).* In June 2006, COG Board Chair Jay Fisette announced a goal of promoting Green Building policies and practices in the Washington region. This effort supports the COG Board's focus on growth and development, and provides environmental and energy friendly methods for supporting sustainable development in the region, consistent with COG's Strategic Energy Plan. On September 29th, COG's "Regional Leadership Conference on Green Building" was held with over 300 attendees from the public and private sectors. The conference focused on a review of local and national Green Building best management practices, policies, regulations and legislation. In addition, several COG members have adopted or will soon adopt legislation encouraging or requiring Green Building practices for government and/or private sector construction. The COG Board adopted resolution R55-06 at the November 8, 2006 COG Board Meeting, which supports the development of regional Green Building policies and best practice guidelines, establishes a special ad hoc elected official advisory committee, and adopts the existing Intergovernmental Green Building Group (IGBG) as a COG technical committee.

The 2006 Regional Energy Strategic Plan - “Powered by Energy Efficiency – Fueled by Energy Conservation," outlines an energy vision and mission for the National Capital Region and expands existing regional energy and environmental goals. The Energy Strategic Plan also identifies potential initiatives to address the region’s diversity of energy sources, help manage energy demand, mitigate the effects of energy disruption and enhance overall environmental quality. Development of the Plan was identified by the COG Board of Directors as a 2006 priority. In addition, the Plan is consistent with and complements the proposed Green Building Program. The Plan was submitted to member governments in June 2006 for a 90-day comment period. The COG Board approved the revised version of the Energy Strategic Plan by adopting resolution R56-06 at the COG Board Meeting on November 8, 2006.

*Washington, D.C.* In December 2006, the District of Columbia Council enacted green building legislation applicable to private development. The legislation, which is expected to be approved by the U.S. Congress, would make Washington the first major city to require private developers to adhere to the standards of the USGBC. Even before the legislation, that jurisdiction was already on track to open the nation's first LEED-certified stadium.

The bill requires all commercial development of 50,000 square feet or more to meet the building council's standards starting in 2012. The requirement applies to both new construction and significant renovations of old buildings.

All city-owned commercial projects funded in 2008 or later would have to attain certification, and District of Columbia-funded housing projects would be required to follow similar environmental standards. The bill also orders the mayor to adopt separate standards for schools, which the USGBC is now developing.

*Montgomery County.* On November 28, 2006, the Montgomery County Council unanimously enacted "Green Building" requirements for future public and private construction in Montgomery County -- the strongest "Green Building" requirements in the region.

The legislation requires that County-built or funded non-residential buildings achieve a LEED Silver rating and requires private non-residential or multi-family residential buildings to achieve a LEED Certified rating.

Buildings covered by the law include any newly constructed or extensively modified non-residential or multi-family residential building with at least 10,000 square feet of gross floor area. The law would take effect for private buildings one year after the County implementing regulations are finalized, but not later than September 1, 2008. Follow up regulations will address many of the details on the rating system (LEED NC, EB), and such regulations are expected to be developed by July 2007.

The current legislation does not have a defined mandatory energy-efficiency component beyond the prerequisites of the LEED rating system. The Montgomery County energy code is IECC 2003 (IECC 2006 is expected to be adopted in the spring of 2007) which is more aggressive than most of the neighboring jurisdictions.

*Arlington County.* Arlington County's green building program is a leading municipal program in the region and has been developed in the context of the County's commitment to smart growth and community sustainability. County policy encourages all large commercial and multi-family residential projects to incorporate LEED components of 25 or more credits on a voluntary basis. Arlington's Green Building Incentive Program allows developers to apply for bonus density in exchange for official LEED certification. Projects may apply for a bonus density of 0.15 to 0.35 additional floor-to-area ratio (FAR). Developers who choose to participate in the density bonus and commit to LEED certification post a bond that is released when the building is certified. Site plan projects that do not receive official LEED certification from the USGBC are asked to contribute $0.03 per square foot to the County's Green Building Fund. This money is used to fund green building education and workshops.

A few buildings have gone through the County's green building incentive program, including the new Navy League building, the National Rural Electric Cooperative Association building, and a private multifamily building currently under construction. Examples of the County's own green buildings include Langston Brown School and the Walter Reed Community Center.

*Fairfax County.* Fairfax County is expanding activities in support of environmentally sustainable development, which include incorporating more sustainable building practices. The County has focused its green building efforts in two areas: the greening of public buildings, and policy for private development. Of 20 municipal buildings recently built in the County, 18 have LEED elements, with many moving toward certification. The County is in the process of reviewing the Comprehensive Plan, its key guidance document, and is developing broad language supporting green building.

*City of Alexandria.* The City of Alexandria initiated a green building policy four years ago and adopted a LEED standard for all public buildings in 2003-4. Project staff review the LEED checklist to determine actions within their existing budgets, and then make the decision whether to fully certify. They currently target a 3.5 percent premium for projects in order to meet the LEED silver standard. One percent is reserved for green construction costs. Alexandria also enacted legislation in July 2006 to allow a design-build process for projects. Green building will be integrated into that process.

*LEED Certified and Registered Buildings.* At least 46 building projects in the nonattainment area jurisdictions are registered for LEED, and one LEED certified building is currently listed on the USGBC website:

> Langston-Brown High School Continuation & Community Center
> LEED® Project # 0172
> LEED Version 2 Certification Level: SILVER
> September 3, 2003
> Arlington Public Schools, Arlington County
> Arlington, VA
> http://www.usgbc.org/ShowFile.aspx?DocumentID=425
> This project was awarded 1 credit for 15% reduction in the energy cost budget.

ENERGY STAR® *Buildings Label.* There are over 300 ENERGY STAR® labeled buildings in Maryland, Virginia and Washington, D.C., but none are owned by the MWCOG government organizations. Many of the jurisdictions have signed-up as ENERGY STAR® Partners committed to improving their energy efficiency. These local government partners currently include:

Alexandria Public Schools
Arlington County
Commonwealth of Virginia
Fairfax County Government
Fairfax County Public Schools (Special Recognition in 2004)
Loudon County Public Schools
Prince William County
City of Washington, DC (and DC Energy Office)
Washington DC Public Schools
Charles County Public Schools

City of Takoma Park
Montgomery County

*Federal Green Buildings.* Legislation and federal mandates provide an example of setting guidelines for sustainable buildings generally and energy efficiency specifically. The Energy Policy Act of 2005 and Executive Order 13423 of January 2007 require all new federal buildings to achieve a 30 percent improvement in energy cost to ASHRAE Standard 90.1-2004. This ASHRAE Standard is the same baseline applied in LEED-NC version 2.2. The Executive Order also requires federal agencies to follow the guidelines of the Memorandum of Understanding for Federal Leadership in High Performance and Sustainable Buildings. Federal agencies are also required to meet progressive energy use intensity reduction targets for their entire building stock. These goals are stated in terms of reduced energy consumption. There are a number federal buildings located in the MWCOG region with case study information available.

**Monitoring and Enforcement**
All jurisdictions and agencies claiming emissions reductions from green buildings programs will commit to maintain records of the projects undertaken to verify the reduction in electricity demand. The factors that must be recorded include the baseline and proposed design or operationally achieved annual energy usage values by fuel type. The corresponding energy savings values have to be further tracked on an hourly or seasonal basis to correspond to the nonattainment period.

**Projected Reductions and Emissions Benefit Calculations**
Annual electricity consumption reductions can be calculated from reporting the LEED Energy Performance, On-Site Renewable Energy, and Green Power certified credits and the baseline and proposed/achieved building energy usage numbers by fuel type. LEED certification energy performance values are reported on an annual cost basis, although an hourly simulation program is usually utilized for building energy modeling. With additional guidance, seasonal or daily numbers could be available from the process.

Co-benefits of Green Building programs include reduction in energy demand and associated emissions from building heating appliance fuels; reducing the heat island effect (with vegetative shading and high-albedo materials); reduction in VOCs associated with built environment treatments (adhesives and sealants, paints and coatings, carpet, and composite wood); and reduction in transportation emissions (by encouraging the use of mass transit and alternative fuel vehicles).

Because of the uncertainty surrounding the amount of creditable reductions available from this program, Maryland and Virginia are claiming zero credit from this measure.

## Building Energy Efficiency Programs

### Energy Efficiency Programs

Under this program, the local governments in the nonattainment area have undertaken measures to improve the energy performance of government facilities. This section describes the estimation of the electricity reductions (measured in kilowatt-hours, kWh) achieved by those measures. An overview is given here, and the details of each local government program are provided in Appendix H.

### Source Type Affected

These programs improve the energy efficiency of buildings and building equipment owned and operated by the local governments in the Metropolitan Washington area.

### Control Strategy

This measure is envisioned as a region-wide measure encompassing energy performance contracts and other structured energy savings programs by state and local governments within the Metropolitan Washington nonattainment area. This program is at varying stages of development, and commitments received involve several local jurisdictions in the nonattainment area. State and local governments have signed contracts with energy service companies (ESCOs) to retrofit existing facilities to reduce the demand for electricity and have undertaken other energy efficiency measures in their facilities. The reduction in electricity demand will displace fossil fueled power generation, thus reducing the NOx emitted from those plants.

Each state in the nonattainment area is including provisions in its NOx Ozone Season emissions trading regulations that set aside a percentage of the state's total NOx allowance budget to support energy efficiency and renewable energy (EERE) projects.

### Implementation

*Arlington County, Virginia.* The Arlington County government has instituted a variety of measures since 2002 to improve energy efficiency of operations. In addition, Arlington has allocated funds for additional efficiency investments that will increase the energy savings between now and 2010.

*Fairfax County, Virginia.* Fairfax County government has implemented several large energy efficiency projects in 2005 and 2006. These projects involve variable speed drives, lighting and heating, ventilation and air conditioning (HVAC) upgrades, and other efficiency investments.

*Montgomery County, Maryland.* Montgomery County departments undertake their own energy efficiency investments, as detailed in each of their Resource Conservation Plans. (See http://www.montgomerycountymd.gov/content/dep/Energy/2007rcp.pdf). These investments cover a wide range of measures during the period 2003 to 2008.

*Calvert County, Maryland.* Calvert County has a number of energy efficiency initiatives being undertaken to improve air quality, including lighting upgrades, programmable thermostats, and appliance replacement with ENERGY STAR®.

**Monitoring and Enforcement**
All jurisdictions and agencies reporting emission reductions from energy efficiency programs will commit to maintain copies of signed energy service performance contracts and energy bills and other documentation to verify the reduction in electricity demand.[7]

**Projected Reductions and Emissions Benefit Calculations**
The estimates below were developed in collaboration with local jurisdictions. These estimates quantify the reductions in energy consumption resulting from the energy service performance contracts and other efficiency measures undertaken by each jurisdiction. The methods used to develop these estimates are described in Appendix H, which also explains how electricity savings are divided into three categories.

**Table 6-13. Projected Annual Reductions from Energy Efficiency Programs**

| Annual kWh Reductions by Year and Type of Measure, MWH | | | |
|---|---|---|---|
| **Arlington County** | | | |
| Year | A/C | Lighting | Other |
| 2008 | 27 | 775 | 312 |
| 2009 | 31 | 820 | 607 |
| **Fairfax County** | | | |
| Year | A/C | Lighting | Other |
| 2008 | - | 98 | 4,232 |
| 2009 | - | 84 | 3,597 |
| **Montgomery County** | | | |
| Year | A/C | Lighting | Other |
| 2008 | 4,855 | 13,788 | 8,367 |
| 2009 | 4,127 | 11,720 | 7,112 |

Because of the uncertainty surrounding the amount of creditable reductions available from this program, Maryland and Virginia are claiming zero credit from this measure.

[7] Currently, not enough is known about the methods used to develop kWh reduction estimates to be able to define the documentation necessary to establish their validity. Jurisdictions are considering establishing a baseline based on documented energy code requirements for energy efficiency.

## LED Traffic Signal Retrofit Program

Under this program, state and local governments in the nonattainment area have committed to replace existing traffic signals with more energy efficient Light Emitting Diode (LED) technology. This will decrease demand for electricity and subsequent power generation from coal, oil, and/or gas-fired sources that would normally supply power to the Metropolitan Washington region, thereby reducing NOx emissions from those sources.

## Source Type Affected

The measure affects state and local governments within the Metropolitan Washington nonattainment area.

## Control Strategy

This measure is envisioned as a region-wide measure encompassing LED traffic signal retrofits by state and local governments within the Metropolitan Washington nonattainment area. This program is in the early stages of development, and commitments received at this point affect several state and local jurisdictions in the nonattainment area. Transportation agencies have begun to retrofit existing traffic signals to LED technology to reduce the demand for electricity. The reduction in energy demand will displace fossil fuel generated power, thus reducing the NOx emitted from those plants.

Each state in the nonattainment area are including a provision in their regulatory program 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 the energy demand reduction to ensure reductions of ozone season emissions allowed under the state regulatory program.

## Implementation

Maryland Department of Transportation (MDOT)
Virginia Department of Transportation (VDOT)
District Department of Transportation (DDOT)
Montgomery County, Maryland
Arlington County, Virginia
City of Alexandria, Virginia
City of Falls Church, Virginia

Under this program, jurisdictions are committing to replace older incandescent traffic signals with more energy-efficient LED signals. All of the identified replacements will be in place by May 1, 2009.

The following table summarizes the LED signal replacement commitments:

| LED Traffic Signal Replacment | Number of LED Signal Units |
|---|---|
| Washington, DC | 69,140 |
| VDOT | 6,894 |
| MDOT | 15* |
| Montgomery County, MD | 250* |
| Arlington County, Virginia | 92* |
| City of Alexandria, Virginia | 25* |
| City of Falls Church, Virginia | 92 |

* Data reported is number of intersections with LED signal units installed.

**Monitoring and Enforcement**

All jurisdictions and agencies participating in the LED Traffic Signal Retrofit program have committed to maintain records of the traffic signals being replaced and energy bills to verify the reduction in energy demand.

**Projected Reductions and Emissions Benefit Calculations**

| LED Traffic Signal Replacment | Number of LED Signal Units | Ozone Season NOx Reduction (tpd)[a] |
|---|---|---|
| Washington, DC | 69,140 | 0.02 |
| Virginia | 6,894 | 0.004 |

Note: Only DDOT and VDOT commitments are included in the emission benefit calculation at this time.

[a]The emission factors used for this analysis are discussed in Appendix H.

**Mobile Source Strategies**

The following mobile source strategies are included in the voluntary bundle:

- Remote Sensing Program

There were two programs included in the 1-hour ozone SIP which are now being withdrawn, and as such, will not be included in the 8-hour ozone SIP voluntary bundle: diesel retrofit and alternative fuel vehicle/low-emission vehicle purchase program.

- **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.

- **Alternative Fuel Vehicle/Low-emission Vehicle Purchase Program.** Under this program, local governments and transit agencies purchase low-emission vehicles instead of conventional gasoline powered vehicles.

Local governments committed to these two initiatives in the 1-hour ozone SIP voluntary bundle, and no emission reduction credits were applied. Annual reporting for the evaluation report indicates that these commitments were met. Local governments are now reserving any emission reduction credits that these programs may generate for potential future use in meeting transportation conformity or as weight of evidence. As such, they are no longer included in the local voluntary bundle in the 8-hour ozone SIP. The 8-hour ozone SIP demonstrates RFP and attainment without modeling of any reductions from these measures, therefore removal of these commitments from the voluntary bundle does not interfere with air quality planning requirements.

**Remote Sensing Device Program**

The Commonwealth of Virginia has implemented a remote sensing program throughout the Northern Virginia portion of the Washington nonattainment area. This program reduces 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.

**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 are identified via a remote sensing program as they drive throughout the region. Owners of high-emitting vehicles are mailed a notice requiring out-of-cycle testing and repair for the vehicle's emission system. High-emitting Virginia vehicles not registered within the inspection and maintenance (I/M) program area but driving through the Washington region on a regular basis are 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 has developed a rule that will backstop this program and provide clear penalties for noncompliance. Penalties are based on the level of the emissions exceedences and vary from $450 to $225, adjusted from the base year of 1990 by the consumer price index. See 9 VAC 5-91-750. The entire rule may be found at http://www.deq.virginia.gov/air/pdf/airregs/C091.pdf.

**Projected Reductions and Emission Benefit Calculations**

Because of the uncertainty surrounding the amount of creditable reductions available from this program and also due to the problematic nature of relating mobile source concentrations to emission rates, Virginia is claiming zero credit from this measure.

## Auxiliary Power Units (APU) 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 encouraged 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 was envisioned as a region-wide measure encouraging a variety of locomotive owners and operators within the Metropolitan Washington nonattainment area to purchase and install APUs to reduce locomotive idling.

This program was included in the 1-hour ozone SIP and is not being expanded at this time. Only one commitment has been received. Virginia Railway Express (VRE), a local commuter railroad, has committed to install 13 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.

There are no new commitments beyond those made in the 1-hour ozone SIP.

### Implementation

Virginia Railway Express

VRE has completed their APU installation program, 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 periodic evaluation report.

**Projected Reductions**

VRE is operating 13 APUs at a projected reduction of 0.13 tpd NOx per year.

**Emissions Benefits Calculations**

Emission benefits are calculated as follows:

$$\frac{\#\text{ of units} \times \frac{hours}{week}\text{ idling avoided} \times \frac{gal}{hour}\text{ avoided fuel consumption} \times \frac{lb}{gal}\text{ emissions avoided}}{2000\frac{lb}{ton} \times 7\frac{days}{week}} = \text{tpd avoided}$$

## VOC Reduction Strategies

The following programs are included in the voluntary bundle to reduce emissions of VOCs in the region:

- Low-VOC Paints Program
- Gasoline Container Replacement Program
- Solvent Parts Washer Replacement Program

## Low-VOC Paints Program

Interior and exterior paint is applied to a variety of surfaces, including buildings and roads. Though 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 nonattainment area.

This program was included in the 1-hour ozone SIP and is being expanded here. 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

Arlington County, Virginia
Calvert County, Maryland
City of Alexandria, Virginia
City of Greenbelt, Maryland
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

All participating jurisdictions plan to purchase and use paints with VOC content below the allowable levels under the existing regulatory programs for architectural, industrial, and maintenance coatings. See Appendix H for more details.

**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 periodic evaluation reports.

**Projected Reductions**

Including the commitments made in the 1-hour ozone SIP, this measure affects 566 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 H.

**Emissions Benefits Calculations**

Benefits from this program are calculated by determining emissions reduced over and above those required by the OTC AIM rule. They are calculated as follows:

$$\text{VOC Reduced (tpd)} = \frac{\frac{gallons}{day} \times 3.7854 \frac{liters}{gallon}}{453.39 \frac{g}{lb} \times 2000 \frac{lb}{ton}} * \left( \frac{g}{liter} \text{cap under AIM rule} - \frac{g}{liter} \text{cap in commitments} \right)$$

**Solvent Parts Washer Replacement Program**

Under this program, local governments voluntarily replace solvent-based parts cleaners with zero-emitting technology. This program reduces VOC emissions in the Washington nonattainment area.

**Source Type Affected**

The measure affects local governments within the Metropolitan Washington nonattainment area.

**Control Strategy**

This measure is envisioned as a region-wide measure encouraging replacement of solvent-based parts cleaners with zero-emitting technology in private industry and state and local governments within the Metropolitan Washington nonattainment area.

This program is in the early stages of development, and commitments received at this point affects only one local jurisdiction in the nonattainment area. Montgomery County has begun to replace county-owned solvent-based parts cleaners with zero-emitting technology. The program eliminates VOC emissions from those units.

**Implementation**

Montgomery County, Maryland

Montgomery County has replaced solvent-based parts washers with microbial/aqueous washers at county-owned vehicle service facilities. The county is also conducting a pilot program that will offer rebates to private automotive shops to purchase microbial/aqueous parts washers in place of solvent- based parts washers. The County hopes to expand the rebate program County-wide. Montgomery County is also working to implement an Environmental Partners Program across a wide range of businesses, including the general public, which will promote environmentally friendly practices that include air quality benefits.

**Monitoring and Enforcement**

All jurisdictions and agencies participating in the Solvent Parts Washer Replacement program have committed to maintain records of the number of units replaced, the annual quantity of solvent use that was displaced, and the VOC content of the displaced solvent. 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 periodic evaluation reports.

**Projected Reductions and Emissions Benefit Calculations**

VOC emission reductions can vary based on the amount of solvent previously used by the facility before the switch to a solvent free system. Based on preliminary estimates provided by staff, replacing a typical unit may reduce VOC emissions by 0.1 to 2 tons/year/unit. Maryland is claiming zero SIP credit for this measure.

## 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 percent.

## 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 program was adopted as part of the voluntary bundle developed for the 1-hour ozone SIP. Commitments included local jurisdictions, state agencies, and their contractors operating in the nonattainment area. Jurisdictions 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 were destroyed in accordance with requirements for disposal of hazardous waste.

There are no new commitments beyond those made in the 1-hour ozone SIP.

## 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

## Monitoring and Enforcement

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

**Projected Reductions**

This program was expected to replace 1,478 gas cans, resulting in a benefit of 0.01 tpd VOC.

**Emissions Benefits Calculations**

Calculation of emission benefits was 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. 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 percent of the 2.28 million cans sold in the region per year, or 204,000 cans. 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.

**Urban Heat Island Mitigation/Tree Planting/Canopy Conservation and Management**

Strategic tree planting and tree canopy conservation and management are innovative voluntary measures that will achieve area-wide improvement of the tree canopy, providing air quality benefits including reductions in ground-level ozone in the Washington DC Metro nonattainment area. Air quality benefits associated with trees and their shade result from lowering summertime air temperatures and from actual pollutant absorption and contact removal from the trees themselves.

One of the most dramatic improvements achievable from area-wide comprehensive tree canopy conservation and planting is reducing the negative effects of urban heat islands (the rise in temperatures due to an increased number of buildings and impermeable surface areas retaining heat). Strategic placement of trees around homes, buildings, streets, and parking lots, increases shade and evapotranspiration, thereby lowering summertime air temperatures and surface temperatures of asphalt, concrete, and other impervious areas. Lowering air summertime temperatures helps reduce ground-level ozone in several ways:

- slow the temperature-dependent reaction that forms ground-level ozone;
- reduce evaporative emissions, primarily VOCs (precursors to ground-level ozone) from sources such as vehicles; and
- reduce the amount of electricity generated for cooling, thereby reducing air pollutant emissions including ground-level ozone precursors, from power plants.

In addition, through up-take and contact removal, trees remove ground-level ozone, nitrogen oxides, sulfur oxides, and other ozone precursors from the air. Other air quality benefits from trees include removal of carbon monoxide and fine particulate matter less than 10 microns. Carbon dioxide is removed and stored by trees, dust is intercepted, and oxygen is released.

**Source Type Affected**

The measure affects state and local governments within the Washington DC Metro nonattainment area.

**Control Strategy**

To achieve reductions in ground-level ozone, government agencies, volunteer organizations, and private landowners must make long-term commitments to conserving existing canopy and planting significant numbers of trees in strategic locations. Under this measure, local governments in the metropolitan nonattainment area will commit to:

1. Measure Existing Resources and Track Changes – Initiate and/or enhance efforts to measure, track, and enhance existing urban tree canopy and canopy expansion efforts.

2. Programs to Enhance and Increase Benefits from Trees – Implement urban forestry programs to enhance canopy coverage to reduce summertime air and surface temperatures. Programs include planting trees in strategic locations to cool targeted

surfaces and provisions for long-term maintenance. Priority planting sites include locations where buildings, streets, driveways, and parking lots will be shaded by the new plantings.

3. Public Outreach – The region commits to undertake a public outreach program designed to promote tree and canopy conservation and planting. Local governments, counties, states, and COG will work with volunteer tree planting organizations, school children, property owners, and stakeholder groups of businesses to support tree conservation and planting, conduct educational outreach regarding the benefits of trees and canopy, species selection, tree planting and establishment, and long-term tree maintenance. Efforts will be made to document all conservation and planting efforts including voluntary programs.

4. Regional Canopy Management Plan – Local governments will work to develop a long range plan to enhance tree conservation and planting, and to establish goals for increasing tree canopy coverage between 2010 and 2030 that could lead to lower levels of ground-level ozone pollution. Issues to address include coordination of efforts, tracking progress in centralized databases, continuation and increases of resources from state and federal sources, involvement of private landowners and businesses, and periodic evaluations and reports.
5. Species Selection – During photosynthesis, trees release secondary metabolic products. Some of these include biogenic volatile organic compounds (VOCs), precursors to the formation of ozone. In most instances, the improvements in air quality gained from trees outweigh the concerns over additional biogenic VOC emissions. Additionally, large trees are considerably more beneficial for air quality than small trees. Therefore, when planting trees, species should be selected for large-size and long-term survival based on specific site conditions and adjusted, when possible, for low-VOC emitters.
6. Monitoring Programs – Monitor these activities and report periodically.

**Current Programs**

Many programs that support, encourage, or require the tree and forest conservation and planting exist within the local jurisdictions, counties, and states in the Washington DC Metro nonattainment area. Special attention will be paid coordinating these programs to enhance tree protection, canopy conservation and expansion to enhance regional air quality.

**Implementation**

Fairfax County tree canopy requirement for new development.
Fairfax County parking lot canopy ordinance.
Fairfax County government land planting program.
Fairfax County countywide nonprofit tree planting program.
Arlington County Urban Forest Master Plan.
Arlington County plant 1,280 trees annually.
Arlington County Chesapeake Bay Preservation Ordinance/Landscape Conservation Plan.

City of Alexandria Urban Forestry Plan under development.
City of Alexandria 12,000 square feet of vegetative roof installed on city buildings.
City of Alexandria Reflective roofs standard for government buildings.
City of Greenbelt Tree planting program. Shade tree improvement initiative.
Montgomery County street tree planting program. 1,200 trees per year.
Montgomery County "Shade to Save" pilot program.
Montgomery County is developing a residential tree planting program.
Montgomery County is developing urban tree legislation.
Montgomery County Stream Restoration Projects plant native trees and shrubs to enhance and establish forests near stream project sites.
Montgomery County Rainscapes Program.
Montgomery County Forest Conservation Law
Amendments to the Forest Conservation Law to adjust for changes in development patterns are being developed.
Montgomery County Forest Banking Program
Montgomery County Legacy Open Space program
Montgomery County Rural Legacy Program
Montgomery County Development Rights Program
Prince George's County Releaf Grant Program
Prince George's County Tree Replacement Program
Prince George's County Gorgeous Prince George's Day
MNCPPC Montgomery County Parks Department actively maintains and plants shade trees in developed areas of parks.
MNCPPC Montgomery County Parks Department establishes forested areas on open land within the park system.
Calvert County Reflective roof systems on 6 county buildings.

**Monitoring and Enforcement**

The state and local governments will maintain records of program activity and public outreach campaigns designed to promote tree and canopy conservation and planting or enhancement. The jurisdictions will also provide evidence of educational outreach efforts regarding documenting and reporting voluntary planting and maintenance programs. Results of all initiatives will be quantified and reported consistent with other SIP requirements to the public and EPA.

**Projected Reductions and Emissions Benefits Calculations**

This program is expected to lead to reductions in ground-level ozone throughout the Washington DC Metro nonattainment area. Methods to quantify benefits from trees and tree canopy are evolving. Several methods have been used to calculate benefits resulting from canopy expansion. Currently, the Air Pollution Removal Calculator developed by the United States Forest Service will be used to estimate pollution removal and value for urban trees based on basic user inputs. This program draws on data collected and analyzed for various cites in the region by the USFS for the Urban Forest Effects (UFORE) model.

Maryland, Virginia, and the District of Columbia are claiming zero credit for this measure.

## References

US EPA. 2007. Heat Island Effect: Vegetation & Air Quality. Most recent update Jan 16, 2007. http://epa.gov/heatisland/strategies/level3_vegairquality.html. Trees and Our Air, January 1999, Galveston-Houston Association for Smog Prevention.

# 7.0 REASONABLY AVAILABLE CONTROL MEASURE (RACM) ANALYSIS

## 7.1 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 RACM 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 such measures. Full details of the analysis are included in Appendix I. The Metropolitan Washington Council of Governments (MWCOG) conducted this RACM evaluation in coordination with the District of Columbia Department of Environment (DC-DOE), Maryland Department of the Environment (MDE) and the Virginia Department of Environmental Quality (VA DEQ).

### 7.1.1 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 RACM 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.*

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 2008 ozone season (May 1, 2008) [1]
- Enforceable
- Technically feasible
- Economically feasible (proposed as a cost of $3,500-$5,000 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, proposed as 0.1 tons per day

An explanation of these criteria is given in succeeding sections.

### 7.1.2 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 84 ppb required to attain the 8-hour ozone standard at least one year earlier than expected. As the Washington region currently expects to reduce ozone levels to 84 ppb during the 2009 ozone season, any RACM must enable the region to meet the 84 ppb standard by May 1, 2008, the beginning of the 2008 ozone season.

### 7.1.3 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 Measures Guidance.

### 7.1.4 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.

### 7.1.5 Economic Feasibility and Cost Effectiveness

EPA guidance states that regions should consider both economic feasibility and cost of control when evaluating potential RACM. Therefore, the Washington region has specified a cost-effectiveness threshold for all possible RACM. 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, 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 are as low as approximately $3,500 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.[1]

The region proposes a threshold of $3,500-$5,000 for cost effectiveness. All measures costing under $5,000 per ton NOx or VOC reduced will be evaluated against the remaining criteria to determine whether they meet the requirements for a RACM.

### 7.1.6 Substantial and Widespread Adverse Impacts

Some candidate RACM 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.

### 7.1.7 *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. Under moderate area RACT requirements, the smallest major source subject to RACT emits 25 tpy, or approximately 0.1 tpd. Following

[1] 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.

these requirements and the precedent set by the San Francisco RACM analysis, the region will not consider control measures affecting source categories that produce less that 0.1 tpd NOx or VOC emissions.

### 7.1.8 Advancing Achievement of 84 ppb Standard

In order for measures to be collectively declared RACM, implementation of the measures must enable the region to demonstrate attainment of the 84 ppb ozone standard one full ozone season earlier than currently expected. As discussed in Section 7.1.1, the Washington region currently expects to demonstrate attainment in 2009. Therefore, any RACM would need to enable the region to meet the 84 ppb standard during the 2008 ozone season.

Photochemical modeling performed as part of the Washington region's attainment demonstration has not yet been completed. It is impossible to determine how many additional tons the region would need to reduce in order to ensure that attainment is met in 2008. Preliminary modeling results indicate that any RACM would need to collectively reduce more than 20-40 per day (tpd) of NOx and/or VOC emission in order to advance the attainment date by one year.

### 7.1.9 Intensive and Costly Effort

When considered together, the implementation requirements of any RACM cannot be so great as to preclude effective implementation and administration given the budget and staff resources available to the Washington region.

## 7.2 RACM Measure Analysis

### 7.2.1 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 1993 and 2003 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 7.1 as documented in Appendix I.

### 7.2.2 Analysis Results

Table 7-1 provides lists, organized by source sector, of potential measures evaluated against the RACM criteria. The table shows which measures were determined to meet the individual measure criteria described in Sections 7.1.1 through 7.1.6. For each measure, the table lists whether the measure is considered RACM, and provides a rationale for each individual determination.

## 7.3 RACM Determination

If implemented collectively, any group of potential RACM would need to provide reductions of 20-4 tpd of NOx and/or VOC by the 2008 ozone season. The region has reviewed all of the potential control measures to determine if collectively they could meet these criteria. Several mandatory programs are available that can provide moderate levels of emission reductions, however, none of these measures can provide benefits by the 2008 ozone season, and the total overall reduction that could be provided by these measures is below 20-40 tpd. While there are potential voluntary measures that can be implemented before 2008, together these voluntary measures will not provide sufficient creditable emission reductions to advance the attainment date by one year. Therefore, there are no reasonably (RACM) appropriate for the Washington region's moderate area SIP.

Though the measures listed in Table 7-1 did not meet the criteria for RACM, many of the measures are worthwhile measures that reduce emissions. These measures will be considered potential control measures for future SIPs prepared for the Washington region.

**Table 7-1. Potential RACM Measures**

| List # | | Measure | Description | RACM: Implementation by May 2008? | RACM: Enforceable? | RACM: Technologically Feasible? | RACM: Economically Feasible? | RACM: No Adverse Impacts? | RACM: Reductions >0.1tpd? | RACM: Yes/No? | RACM: Explanation |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Stationary Sources** | | | | | | | | | | | |
| S | 1 | Reductions from EGUs: OTC Model Rule | Adopt OTC Multipollutant Model Rule for EGUs. | No | Yes | Yes | Yes | Yes | Yes | No | Will not provide reductions by May 2008 |
| S | 2 | Reductions from EGUs Plant RACT/Technology-Based Approach | Identify and Require Additional Power Plant-Specific Emission Reduction Technologies. | - | Yes | Yes | - | - | Yes | No | No creditable emission reductions |
| S | 3 | OTC Model Rule: Distributed Generation Rule | Adopt OTC Model Rule to Require Additional Controls on Distributed Generation Sources. | No | Yes | Yes | - | No | Yes | No | Will not provide reductions by May 2008 |
| S | 4 | OTC Model Rule: Peaking Unit Rule | Adopt OTC Model Rule to Require Additional Controls on EGU Peaking Units. | No | Yes | - | - | No | Yes | No | Will not provide reductions by May 2008 |
| S | 5 | OTC Model Rule: ICI Boiler Standards | Adopt OTC Model Rule on Standards for Industrial, Commercial, and Institutional Boilers. | No | Yes | Yes | Yes | No | Yes | No | Will not provide reductions by May 2008 |
| S | 6 | Control Asphalt and Concrete Facilities | Require NOx emission limits on asphaltic concrete production facilities. | No | Yes | Yes | No | No | Yes | No | Will not provide reductions by May 2008 |
| S | 7 | Control Portland Cement Facilities | Adopt OTC Model Rule on RACT Update for Portland Cement Facilities. | No | Yes | Yes | Yes | No | Yes | No | Will not provide reductions by May 2008 |
| S | 8 | Mineral Products Industry Controls: Glass and Fiberglass | Control Glass and Fiberglass Facility Emissions. | No | Yes | Yes | Yes | Yes | No | No | Will not provide reductions by May 2008 |
| S | 9 | Controls on Municipal Solid Waste Incinerators | Adopt OTC Model Rule on RACT Update for MSW Incineration Facilities. | No | Yes | Yes | - | Yes | Yes | No | Will not provide reductions by May 2008 |
| S | 10 | Control VOC Emissions from Chemical Manufacturing | Chemical Manufacturing: More stringent standards on the manufacture of polystyrene, formica, polyester resin, wood and paper, other polymers, pharmaceuticals, paints, varnishes, soaps, detergents, inks, solvents, fuel additives, acids, fertilizers, and resins. | No | Yes | Yes | - | No | No | No | Will not provide reductions by May 2008 |
| S | 11 | Local Cap and Trade Program | Implement cap and trade program for VOC sources in region. Consider California RECLAIM program. | No | Yes | Yes | - | No | Yes | No | Will not provide reductions by May 2008 |
| S | 12 | Statewide Emission Registration Program | Require a mandatory statewide registration program for all NOx and VOC emission sources. | No | Yes | Yes | No | No | Yes | No | Not economically feasible |
| S | 13 | Clear Skies Act | Implement Clear Skies Legislation. | No | Yes | Yes | Yes | Yes | Yes | No | Will not provide reductions by May 2008 |
| S | 14 | State Multipollutant Legislation | Adopt State Multipollutant Legislation. | No | Yes | Yes | Yes | Yes | Yes | No | Will not provide reductions by May 2008 |

**Table 7-1. Potential RACM Measures**

| List # | | Measure | Description | RACM: Implementation by May 2008? | RACM: Enforceable? | RACM: Technologically Feasible? | RACM: Economically Feasible? | RACM: No Adverse Impacts? | RACM: Reductions >0.1tpd? | RACM: Yes/No? | RACM: Explanation |
|---|---|---|---|---|---|---|---|---|---|---|---|
| S | 15 | Emission Reduction Credit Retirement Program | Establish program to retire emission reduction credits for stationary sources. | No | Yes | Yes | Yes | - | Yes | No | Will not provide reductions by May 2008 |
| S | 16 | Episodic Mandatory Facility Reductions | Require mandatory facility reductions on Air Quality Action Days. Require Curtailment Plan. | No | Yes | Yes | - | No | No | No | No creditable emission reductions |
| S | 17 | Enhanced Enforcement/Rule Compliance at Existing Stationary Sources | Step up enforcement of and compliance with existing rules for emissions control by stationary sources. | Yes | Yes | Yes | No | Yes | No | No | No creditable emission reductions |
| S | 18 | Low NOx Fuel Oil for Stationary Sources | Require oil-burning stationary sources to burn ThermaNOx, a low-NOx No. 2 fuel oil emulsion, during ozone season. | No | - | Yes | - | Yes | - | No | Will not provide reductions by May 2008 |
| S | 19 | Energy Efficiency Programs | Increase Adoption of Energy Efficient Technology by Government and the Private Sector with Commensurate Retirement of EGU NOx Allowances. | - | Yes | Yes | - | Yes | - | No | Will not advance attainment date |
| S | 20 | Energy Efficiency: Energy Efficiency Standards | Establish requirements for minimum energy efficiency, with Commensurate Retirement of EGU NOx Allowances. | - | Yes | Yes | - | Yes | - | No | Will not advance attainment date |
| S | 21 | Renewable Energy: Renewable Portfolio Standards | Increase Purchases of Renewable Energy by Government and the Private Sector, with Commensurate Retirement of EGU NOx Allowances. | - | Yes | Yes | - | Yes | - | No | Will not advance attainment date |
| S | 22 | Renewable Energy: Solar Photovoltaic Programs | Increase Purchases and Installation of Renewable Energy sources by Government and the Private Sector, with Commensurate Retirement of EGU NOx Allowances. Consider Incentive Programs. | - | Yes | Yes | - | Yes | - | No | Will not advance attainment date |
| S | 23 | Renewable Energy: Wind Energy Purchases | Increase Purchases of Renewable Energy by Government and the Private Sector, with Commensurate Retirement of EGU NOx Allowances. | - | Yes | Yes | No | Yes | - | No | Will not advance attainment date |
| S | 24 | Renewable Energy: Solar Hot Water Heating | Increase Use of Solar Hot Water Heating by Government and the Private Sector, with Commensurate Retirement of EGU NOx Allowances. | - | Yes | Yes | - | Yes | - | No | Will not advance attainment date |

**Table 7-1. Potential RACM Measures**

| List # | | Measure | Description | RACM: Implementation by May 2008? | RACM: Enforceable? | RACM: Technologically Feasible? | RACM: Economically Feasible? | RACM: No Adverse Impacts? | RACM: Reductions >0.1tpd? | RACM: Yes/No? | RACM: Explanation |
|---|---|---|---|---|---|---|---|---|---|---|---|
| S | 25 | Energy Efficiency: Energy Performance Contracting Program | Increase Use of Energy Performance Contracts in the Public and/or Private sector to Reduce Energy Consumption, with Commensurate Retirement of EGU NOx Allowances. | - | Yes | Yes | - | Yes | - | No | Will not advance attainment date |
| S | 26 | Energy Efficiency Programs: LED Traffic Signal Retrofit Program | Increase Use Energy Efficient LED Traffic Signals. | - | Yes | Yes | Yes | Yes | - | No | Will not advance attainment date |
| S | 27 | Energy Efficiency: Green Building Code Program | Establish energy efficiency standards for building codes, with Commensurate Retirement of EGU NOx Allowances. | - | Yes | Yes | - | Yes | - | No | Will not advance attainment date |
| S | 28 | Energy Efficiency: Ground Source Heat Pump Initiative | Increase Purchases and Installation of Ground Source Heat Pumps in the Public and/or Private Sector, with Commensurate Retirement of EGU NOx Allowances. | - | Yes | Yes | - | Yes | - | No | Will not advance attainment date |
| S | 29 | Energy Efficiency Programs: LED Street Light Retrofit Program | Increase Use of Energy Efficient LED Street Lights. | - | Yes | - | - | Yes | - | No | Will not advance attainment date |
| S | 30 | Energy Efficiency: Energy Star Exit Signs | Increase market penetration of Energy Efficient Lighting (EXIT Signs). | - | Yes | Yes | - | Yes | - | No | Will not advance attainment date |
| S | 31 | Chemical Industry Controls | Reduce upwind NOx emissions limits in the manufacture of chemicals. | No | Yes | - | - | - | - | No | Will not provide reductions by May 2008 |
| S | 32 | Upwind NOx Controls: Expand NOx RACT to Upwind Counties | Expand NOx RACT Requirements. | No | Yes | - | Yes | Yes | Yes | No | Will not provide reductions by May 2008 |
| S | 33 | Metallurgical Industry Controls: Iron and Steel | Control Upwind Iron and Steel Production Emissions. | No | Yes | - | - | - | - | No | Will not provide reductions by May 2008 |
| S | 34 | Metallurgical Industry Controls: Lead | Control Upwind Lead Smelter Emissions. | No | Yes | - | - | - | - | No | Will not provide reductions by May 2008 |
| S | 35 | Metallurgical Industry Controls: Aluminum | Control Upwind Aluminum Production Emissions. | No | Yes | - | - | - | - | No | Will not provide reductions by May 2008 |
| S | 36 | Metallurgical Industry Controls: Zinc/Copper | Control Upwind Zinc/Copper Smelter Emissions. | No | Yes | - | - | - | - | No | Will not provide reductions by May 2008 |
| S | 37 | Mineral Products Industry Controls: Lime | Control Upwind Lime Facility Emissions. | No | Yes | - | - | - | - | No | Will not provide reductions by May 2008 |
| S | 38 | Mineral Products Industry Controls: Phosphate | Control Upwind Phosphate Rock Plant Emissions. | No | Yes | - | - | - | - | No | Will not provide reductions by May 2008 |
| S | 39 | Forest Product Industry Controls | Control Upwind Wood, Paper and Pulp Production Emissions. | No | Yes | - | - | - | - | No | Will not provide reductions by May 2008 |

**Table 7-1. Potential RACM Measures**

| List # | | Measure | Description | RACM: Implementation by May 2008? | RACM: Enforceable? | RACM: Technologically Feasible? | RACM: Economically Feasible? | RACM: No Adverse Impacts? | RACM: Reductions >0.1tpd? | RACM: Yes/No? | RACM: Explanation |
|---|---|---|---|---|---|---|---|---|---|---|---|
| S | 40 | Upwind VOC Controls: Plant-by-Plant BACT Controls | Identify and Require Additional Facility-Specific Emission Reduction Technologies. | No | Yes | - | - | - | Yes | No | Will not provide reductions by May 2008 |
| S | 41 | Upwind VOC Controls: Expand VOC RACT to Upwind Counties | Expand VOC RACT Requirements. | No | Yes | - | Yes | Yes | Yes | No | Will not provide reductions by May 2008 |
| S | 42 | Upwind NOx Controls: Plant-by-Plant BACT Controls | Identify and Require Additional Facility-Specific Emission Reduction Technologies. | No | Yes | - | - | - | Yes | No | Will not provide reductions by May 2008 |
| S | 43 | Upwind RACT Update: Refineries | Update RACTs for Refineries in Upwind Contributing Areas. | No | Yes | - | - | Yes | Yes | No | Will not provide reductions by May 2008 |
| **Area Sources** | | | | | | | | | | | |
| A | 1 | Control VOC Content of Adhesives and Sealants | Adopt OTC Model Rule. Reduce VOC limits for adhesives and sealants. | No | Yes | Yes | - | - | Yes | No | Will not provide reductions by May 2008 |
| A | 2 | 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 | Yes | - | - | Yes | No | No | De minimis |
| A | 3 | Expand Coverage of OTC Consumer Products Rule (Phase II) | Expand Number of Products Covered by OTC Consumer Product Rule. Require Lower VOC Content of Products Already Covered. | No | Yes | - | - | - | Yes | No | Will not provide reductions by May 2008 |
| A | 4 | Expand Coverage of OTC AIMs Rule (Phase II) | Expand Number of Products Covered by OTC AIMs Rule. Require Lower VOC Content of Products Already Covered. | No | Yes | - | - | - | Yes | No | Will not provide reductions by May 2008 |
| A | 5 | Green Procurement Policy | Establish procurement policies that foster emission reduction (paints, solvents, coatings, asphalt, roofs, building materials, AFVs, EE office equipment, ULSD). | Yes | No | Yes | - | Yes | - | No | No creditable emission reduction |
| A | 6 | Control Growth and Development: Land Use Restrictions | Implement land use restrictions to control residential, commercial, and industrial development in the nonattainment area. | - | No | Yes | - | No | - | No | No creditable reductions |
| A | 7 | Control Growth and Development: Mitigate New Development | Mitigate emissions from new development. | - | No | Yes | - | No | - | No | No creditable reductions |
| A | 8 | Implement Programs to Reduce the Urban Heat Island Effect: Forestry. | Increase Urban Tree Canopy | No | No | Yes | - | Yes | No | No | No creditable emission reduction |
| A | 9 | Implement Programs to Reduce the Urban Heat Island Effect: Roofs. | Increase Green and Cool Roof Market Penetration | No | No | Yes | - | Yes | No | No | No creditable emission reduction |

**Table 7-1. Potential RACM Measures**

| List # | | Measure | Description | RACM: Implementation by May 2008? | RACM: Enforceable? | RACM: Technologically Feasible? | RACM: Economically Feasible? | RACM: No Adverse Impacts? | RACM: Reductions >0.1tpd? | RACM: Yes/No? | RACM: Explanation |
|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 10 | Implement Programs to Reduce the Urban Heat Island Effect: Pavement. | Increase Cool Pavement Market Penetration | No | No | Yes | - | Yes | No | No | No creditable emission reduction |
| A | 11 | Expand Stage I Vapor Recovery | Expand Requirements for Stage I Vapor Recovery to Upwind Counties. | No | Yes | Yes | Yes | Yes | Yes | No | Will not provide reductions by May 2008 |
| A | 12 | Expand Stage II Vapor Recovery | Expand requirements for Stage II Vapor Recovery to Upwind Counties. | No | Yes | Yes | Yes | Yes | Yes | No | Will not provide reductions by May 2008 |
| A | 13 | Upwind Fuels Controls | Expand Use of Reformulated Gasoline to Upwind Counties. Consider OTC Regional Fuels Initiative. | No | Yes | Yes | Yes | Yes | Yes | No | Will not provide reductions by May 2008 |
| A | 14 | Expand OTC Consumer Products Rule | Expand OTC Consumer Product Rule to Upwind Counties. | No | Yes | Yes | Yes | Yes | Yes | No | Will not provide reductions by May 2008 |
| A | 15 | Expand OTC Mobile Equipment Repair and Refinishing Rule | Expand OTC Mobile Equipment Repair and Refinishing Rule to Upwind Counties. | No | Yes | Yes | Yes | Yes | Yes | No | Will not provide reductions by May 2008 |
| A | 16 | Expand OTC Portable Fuel Containers Rule | Expand OTC Portable Fuel Containers Rule to Upwind Counties. | No | Yes | Yes | Yes | Yes | Yes | No | Will not provide reductions by May 2008 |
| A | 17 | Expand OTC Solvent Cleaning Rule | Expand OTC Solvent Cleaning Rule to Upwind Counties. | No | Yes | Yes | Yes | Yes | Yes | No | Will not provide reductions by May 2008 |
| A | 18 | Expand OTC AIMs Rule | Expand OTC AIMs Rule to Upwind Counties. | No | Yes | Yes | Yes | Yes | Yes | No | Will not provide reductions by May 2008 |
| A | 19 | Control Upwind Port Emissions | Pursue approaches to reduce land based port emissions. | No | Yes | Yes | Yes | Yes | Yes | No | Will not provide reductions by May 2008 |
| A | 20 | Control Drycleaning Facilities | Ban transfer systems in Petroleum Dry Cleaning. | No | Yes | Yes | - | No | Yes | No | Will not provide reductions by May 2008 |
| A | 21 | Expand Seasonal Open Burning Restrictions | Expand prohibitions on seasonal open burning. | No | Yes | Yes | Yes | Yes | No | No | No creditable reductions |
| A | 22 | Enhanced Enforcement: Environmental Partnerships/Pollution Prevention Initiatives | Voluntary compliance audits, encourage low emitting technology (swap out solvent machines) | Yes | No | Yes | - | Yes | No | No | No creditable emission reductions |
| A | 23 | Control Agricultural Sources | Encourage agricultural best practices, including those that reduce pesticide use. | Yes | No | Yes | - | No | Yes | No | No creditable emission reduction |
| A | 24 | RACT Update: Control Industrial Incineration | Implement programs to reduce emissions from industrial incineration. | No | Yes | - | - | - | - | No | Will not provide reductions by May 2008 |
| A | 25 | Home Heating Oil Standards | Adopt OTC model rule on standards for home heating oils. | No | Yes | Yes | - | No | - | No | Will not provide reductions by May 2008 |
| A | 26 | Control Fermentation Sources (wineries/breweries) | Reduce evaporative VOC emissions from the fermentation process at wineries and/or breweries. | No | Yes | Yes | - | No | - | No | Will not provide reductions by May 2008 |

**Table 7-1. Potential RACM Measures**

| List # | | Measure | Description | RACM: Implementation by May 2008? | RACM: Enforceable? | RACM: Technologically Feasible? | RACM: Economically Feasible? | RACM: No Adverse Impacts? | RACM: Reductions >0.1tpd? | RACM: Yes/No? | RACM: Explanation |
|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 27 | Control Landfills and Wastewater Facilities | Reduce the NOx and VOC emission limits for flares. | No | Yes | Yes | No | Yes | No | No | De minimis |
| A | 28 | Control Wastewater Treatment Facilities | Require capture and control of VOC emissions from facilities treating industrial wastewater and domestic sewage. Adopt SCAQMD Rule 1176: Sumps and Wastewater Separators. | No | Yes | - | - | No | - | No | Will not provide reductions by May 2008 |
| A | 29 | Control VOC Emissions from Fuel Facilities | Reduce the VOC emission limits for bulk plants/terminal, including storage tanks. Adopt SCAQMD Rule 1178: Further Reductions of VOC Emissions from Storage Tanks at Petroleum Facilities. | No | Yes | - | - | No | Yes | No | Will not provide reductions by May 2008 |
| A | 30 | Control VOC Emissions from Construction and Maintenance | Reduce VOC emissions from roofing kettles. | No | Yes | No | No | No | - | No | Will not provide reductions by May 2008 |
| A | 31 | Control Residential Wood Burning | Implement voluntary program to reduce emissions from wood-burning fireplaces and wood stoves. | Yes | No | Yes | - | Yes | No | No | No creditable emission reduction |
| A | 32 | Low-Emission Natural Gas Water Heaters | Adopt SCAQMD Rule 1121: Control of NOx from Residential Type Natural Gas Fired Water Heaters. | No | No | Yes | Yes | No | No | No | De minimis |
| A | 33 | Low-Emission Natural Gas 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 | No | Yes | Yes | No | No | No | De minimis |
| A | 34 | Control Restaurant Sources | Implement programs to reduce emissions from restaurants, including charbroil operations and deep fat fryers. | No | No | Yes | No | No | No | No | Will not provide reductions by May 2008 |
| A | 35 | "Cash for Clunkers" Gasoline Containers Replacement Program | Accelerate the Replacement of Older Gasoline Cans with CARB Compliant Containers. Offer incentives for consumers to turn in old gas cans and obtain new ones. | Yes | No | Yes | - | Yes | No | No | No creditable emission reduction |
| A | 36 | Enhanced Enforcement of Area Source Regs: Open Burning | Enhance enforcement of seasonal open burning restrictions. | Yes | Yes | Yes | - | Yes | No | No | No creditable emission reductions |
| A | 37 | Enhanced Enforcement of Area Source Regs: Solvent Cleaning | Enhance enforcement of surface cleaning rules. | Yes | Yes | Yes | - | Yes | No | No | No creditable emission reductions |
| A | 38 | Mitigation Fees: Preempted Sources | Charge emission mitigation fee to federally preempted sources. | No | - | Yes | - | Yes | - | No | Will not provide reductions by May 2008 |

**Table 7-1. Potential RACM Measures**

| List # | | Measure | Description | RACM: Implementation by May 2008? | RACM: Enforceable? | RACM: Technologically Feasible? | RACM: Economically Feasible? | RACM: No Adverse Impacts? | RACM: Reductions >0.1tpd? | RACM: Yes/No? | RACM: Explanation |
|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 39 | Pesticide Application: Best Practices | Establish best practices for pesticide application. | Yes | - | Yes | - | No | - | No | No creditable emission reduction |
| A | 40 | Control Bakeries | Adopt SCAQMD Rule 1153: Commercial Bakery Ovens. Reduce exemption level and set standards for unregulated bakeries. | No | Yes | Yes | No | No | No | No | Will not provide reductions by May 2008 |
| A | 41 | Government Actions (Air Quality Action day similar to snow day) | Implement a liberal leave policy for local, state and federal employees on Air Quality Action Days, permitting employees to work from home or take unscheduled leave. | Yes | No | Yes | Yes | Yes | Yes | No | No creditable emission reduction |
| A | 42 | Clean Air Partners: Public Outreach and Education | Implement Strategic Communication Campaigns to Increase Public Awareness (target lawnmowers, paints, refueling). | Yes | No | Yes | Yes | Yes | Yes | No | No creditable emission reduction |
| A | 43 | Local Government Education Campaign | Encourage local governments to adopt Air Quality Action Day policies (target lawnmowers, paints, refueling). | Yes | No | Yes | Yes | Yes | Yes | No | No creditable emission reduction |
| A | 44 | Mass Marketing Campaign | Marketing effort involving business-to-business advertising campaign in print media and on world wide web. | Yes | No | Yes | Yes | Yes | Yes | No | No creditable emission reduction |
| A | 45 | Public Outreach and Education: Fueling | Educate to improve fueling practices. | Yes | No | Yes | Yes | Yes | Yes | No | No creditable emission reduction |
| A | 46 | Public Outreach and Education: Sources | Public Education on NOx and ROG sources in Schools and Small Businesses. | Yes | No | Yes | Yes | Yes | Yes | No | No creditable emission reduction |
| A | 47 | Episodic limits on asphalt paving and traffic marking activities | Prohibit road paving and traffic marking on Air Quality Action days. | Yes | Yes | Yes | Yes | Yes | - | No | No creditable emission reduction |
| A | 48 | No Fuel Policy on Air Quality Action Days | Voluntary reduction in fueling activities on Air Quality Action Days. | Yes | No | Yes | Yes | No | - | No | No creditable emission reduction |
| A | 49 | Episodic Pesticide Application Ban | Ban pesticide application on Code Red Air Quality Action Days. | Yes | - | Yes | - | No | - | No | Adverse impacts |
| A | 50 | Episodic Voluntary Pesticide Application Reduction | Encourage voluntary restrictions on pesticide application on Code Red Air Quality Action Days. | Yes | - | Yes | - | No | - | No | Adverse impacts |
| A | 51 | Clean Air Partners: Air Quality Action Days | Take a variety of actions on Air Quality Action Days to reduce emissions and improve air quality (target lawnmowers, paints, refueling). | Yes | No | Yes | Yes | Yes | Yes | No | No creditable emission reduction |
| **Non-road Sources** | | | | | | | | | | | |

**Table 7-1. Potential RACM Measures**

| List # | | Measure | Description | RACM: Implementation by May 2008? | RACM: Enforceable? | RACM: Technologically Feasible? | RACM: Economically Feasible? | RACM: No Adverse Impacts? | RACM: Reductions >0.1tpd? | RACM: Yes/No? | RACM: Explanation |
|---|---|---|---|---|---|---|---|---|---|---|---|
| N | 1 | Clean Air Construction Initiative: Road Construction Projects | Develop alternative programs for state and local governments (public entities) to reduce on-road and off-road construction and maintenance related emissions. Episodic: no work or idling restrictions. Non-episodic: Control retrofits. | Yes | No | Yes | - | - | Yes | No | No creditable emission reduction |
| N | 2 | Clean Air Construction Initiative: Off-Road Construction Projects | Develop alternative programs for state and local governments (public entities) to reduce on-road and off-road construction and maintenance related emissions. Episodic: no work or idling restrictions. Non-episodic: Control retrofits. | Yes | No | Yes | - | - | Yes | No | No creditable emission reduction |
| N | 3 | Clean Air Maintenance Initiative: Road Maintenance Contracts | Develop alternative programs for state and local governments (public entities) to reduce on-road and off-road construction and maintenance related emissions. Episodic: no work or idling restrictions. Non-episodic: Control retrofits. | Yes | No | Yes | - | - | Yes | No | No creditable emission reduction |
| N | 4 | Clean Air Construction Initiative: Preference for Low-emissions Industrial Equipment | In bids for government contracts, award extra points to bidders using low-emission industrial equipment. | Yes | No | Yes | - | - | Yes | No | No creditable emission reduction |
| N | 5 | Control Construction Emissions | Limitations and Fleet Rules for Construction Equipment. | No | Yes | - | No | No | Yes | No | Not economically feasible |
| N | 6 | Non-Road Diesel Engine Retrofit Program: Voluntary | Develop voluntary program encouraging retrofit of non-road diesel equipment in public and/or private fleets. | Yes | No | Yes | - | Yes | Yes | No | No creditable emission reduction |
| N | 7 | Non-Road Diesel Engine Retrofit Program: Mandatory | Develop mandatory program requiring retrofit of non-road diesel equipment in public and/or private fleets. | No | Yes | Yes | - | - | Yes | No | Will not provide reductions by May 2008 |
| N | 8 | Retrofit/Repower Locomotives | Provide financial incentives to retrofit or repower locomotives operating in the nonattainment area for cleaner burning diesel or alternative fuels. | Yes | No | - | - | Yes | - | No | No creditable emission reduction |
| N | 9 | Locomotive Idling Reduction | Support Installation of Idling Reduction Technologies on Locomotives. | Yes | No | Yes | - | Yes | - | No | No creditable emission reduction |
| N | 10 | Control Off-Road Diesel Engines (smoke test) | Implement mandatory smoke testing program for heavy-duty (>50 hp) off-road diesel engines. | No | Yes | Yes | No | Yes | - | No | Will not provide reductions by May 2008 |

**Table 7-1. Potential RACM Measures**

| List # | | Measure | Description | RACM: Implementation by May 2008? | RACM: Enforceable? | RACM: Technologically Feasible? | RACM: Economically Feasible? | RACM: No Adverse Impacts? | RACM: Reductions >0.1tpd? | RACM: Yes/No? | RACM: Explanation |
|---|---|---|---|---|---|---|---|---|---|---|---|
| N | 11 | Airport Emission Cap | Establish Agreement with Airports Authority to Cap or Reduce Emissions. | Yes | No | - | - | Yes | Yes | No | No creditable emission reduction |
| N | 12 | Airport Emissions Cap in Upwind Counties | Voluntary Agreement to Cap Airport Emissions Outside the Nonattainment Area. | Yes | No | - | - | Yes | Yes | No | No creditable emission reduction |
| N | 13 | Airport Electric GSE | Subsidize adoption of electric ground service equipment. | Yes | Yes | Yes | Yes | Yes | Yes | No | Will not advance attainment date |
| N | 14 | Airport GSE Retrofits | Subsidize the retrofit of airport ground service equipment. | Yes | Yes | Yes | Yes | Yes | Yes | No | Will not advance attainment date |
| N | 15 | Airport GSE Idling Controls | Develop voluntary program to encourage operators to limit idling of airport ground service equipment. | Yes | Yes | Yes | Yes | Yes | Yes | No | Will not advance attainment date |
| N | 16 | Airport APU Initiatives | Seek voluntary agreement to reduce use of aircraft APUs through use of gate-provided services or other strategies | Yes | Yes | Yes | Yes | Yes | Yes | No | Will not advance attainment date |
| N | 17 | Locomotive Engine Standards | Encourage new federal locomotive engine emission standards (EPA 2012) | No | - | - | - | Yes | Yes | No | Will not provide reductions by May 2008 |
| N | 18 | Marine Diesel Engine Standards | Encourage new federal marine engine emission standards (EPA 2012). | No | - | - | - | Yes | Yes | No | Will not provide reductions by May 2008 |
| N | 19 | Control Off-Road Diesel Engines (Blue Sky) | Encourage the use of engines that are included in EPA's voluntary "Blue Sky Series" engine program. | Yes | No | Yes | - | Yes | - | No | No creditable emission reductions |
| N | 20 | Control Spark Ignition Engines | Retrofit controls and 3-way catalyst for spark ignition engines. | - | Yes | - | - | Yes | - | No | No creditable emission reductions |
| N | 21 | Industrial Equipment Replacement | Subsidize replacement of fossil-fuel fired industrial equipment with electric industrial equipment. | Yes | No | - | - | No | - | No | No creditable emission reductions |
| N | 22 | Light Commercial Equipment Retrofits | Require light commercial equipment to be retrofitted with emissions controls. | No | No | - | No | - | - | No | Not economically feasible |
| N | 23 | Control Light Commercial Equipment | Retrofit portable engines and generators. | No | No | - | No | Yes | - | No | Not economically feasible |
| N | 24 | Recreational Equipment Retrofits | Require recreational equipment to be retrofitted with particulate fitlers and/or oxidation catalysts. | No | Yes | - | - | - | - | No | Not economically feasible |
| N | 25 | Control Recreational Marine Emissions | Provide incentives for newer boats and engines. | Yes | No | Yes | No | Yes | - | No | No creditable emission reductions |
| N | 26 | Idling Restrictions for Lawn & Garden Equipment | Limit idling by commercial lawn & garden equipment. | No | No | Yes | No | - | - | No | Not enforceable |

**Table 7-1. Potential RACM Measures**

| List # | | Measure | Description | RACM: Implementation by May 2008? | RACM: Enforceable? | RACM: Technologically Feasible? | RACM: Economically Feasible? | RACM: No Adverse Impacts? | RACM: Reductions >0.1tpd? | RACM: Yes/No? | RACM: Explanation |
|---|---|---|---|---|---|---|---|---|---|---|---|
| N | 27 | Agricultural Equipment Retrofits | Require agricultural equipment to be retrofitted with emissions controls. | No | Yes | - | - | - | - | No | Will not provide reductions by May 2008 |
| N | 28 | Agricultural Equipment Use Restrictions | Ban use of agricultural equipment on Air Quality Action Days. | Yes | No | Yes | No | No | - | No | Not feasible |
| N | 29 | Low-emissions Agricultural Equipment | Require sale of low-emissions agricultural equipment in region. | No | Yes | - | No | No | - | No | Will not provide reductions by May 2008 |
| N | 30 | Industrial Equipment Retrofits | Require industrial equipment to be retrofitted with emissions controls. | No | Yes | - | - | No | - | No | Will not provide reductions by May 2008 |
| N | 31 | Low-emissions Commercial and Industrial Equipment | Require sale of low-emissions commercial and industrial equipment in region. | No | Yes | - | - | - | Yes | No | Will not provide reductions by May 2008 |
| N | 32 | Idling Restrictions for Commercial and Industrial Equipment | Limit idling by commercial and industrial equipment. | No | No | Yes | No | Yes | Yes | No | Not economically feasible |
| N | 33 | Control Light Commercial Equipment | Require zero emission forklifts where feasible. | No | No | - | No | Yes | No | No | Not economically feasible |
| N | 34 | Control Commercial Marine Sources | Tug/Push Boat Activity Reductions. | No | Yes | Yes | No | No | - | No | Potential adverse impacts |
| N | 35 | Biodiesel for Off-Road Equipment | Increase use of biodiesel in off-road diesel equipment during ozone season. | Yes | No | - | - | - | - | No | No creditable emission reduction |
| N | 36 | High Cetane Fuel | Require High Cetane Diesel Fuel for Off-road Vehicles. | No | Yes | Yes | No | Yes | - | No | Will not provide reductions by May 2008 |
| N | 37 | Require low-NOx fuel for recreational equipment | Require recreational equipment to use low-NOx fuel additives during ozone season. | Yes | Yes | Yes | Yes | - | - | No | Will not advance attainment date |
| N | 38 | Low-NOx Fuel for Lawn & Garden Equipment | Require diesel-fired lawn & garden equipment to use low-NOx fuel additives during ozone season. | No | No | - | No | Yes | - | No | No creditable emission reduction |
| N | 39 | Low-NOx Fuel for Recreational Marine Equipment | Require diesel-fired recreational marine equipment to use low-NOx fuel additives during ozone season. | Yes | Yes | Yes | Yes | Yes | - | No | No creditable emission reduction |
| N | 40 | Require Low-NOx Fuel for Airport GSE | Require airport GSE to use low-NOx fuel additives during ozone season. | Yes | Yes | Yes | Yes | Yes | - | No | No creditable emission reduction |
| N | 41 | Require Low-NOx Fuel for Industrial Equipment | Require industrial equipment to use low-NOx fuel additives during ozone season. | Yes | Yes | Yes | Yes | Yes | - | No | No creditable emission reduction |
| N | 42 | Require Low-NOx Fuel for Light Commercial Equipment | Require light commercial equipment to use low-NOx fuel during ozone season, if applicable. | Yes | Yes | Yes | Yes | Yes | - | No | No creditable emission reduction |

**Table 7-1. Potential RACM Measures**

| List # | | Measure | Description | RACM: Implementation by May 2008? | RACM: Enforceable? | RACM: Technologically Feasible? | RACM: Economically Feasible? | RACM: No Adverse Impacts? | RACM: Reductions >0.1tpd? | RACM: Yes/No? | RACM: Explanation |
|---|---|---|---|---|---|---|---|---|---|---|---|
| N | 43 | Episodic Low-NOx Fuel for Construction Equipment | Require diesel-fired construction equipment operating in region to use low-NOx fuel additives during ozone season. | Yes | Yes | Yes | Yes | Yes | - | No | No creditable emission reduction |
| N | 44 | Episodic Low-NOx Fuel for Construction Equipment | Require diesel-fired construction equipment operating on state or local government contracts to use low-NOx fuel additives during ozone season. | Yes | Yes | Yes | Yes | Yes | - | No | No creditable emission reduction |
| N | 45 | Episodic Low-NOx Fuel for Construction Equipment | Voluntary use of low-NOx fuel additives by diesel-fired construction equipment during ozone season. | Yes | Yes | Yes | Yes | Yes | - | No | No creditable emission reduction |
| N | 46 | Control Recreational Equipment Emissions | Increase registration fee on recreational vehicles (dedicate fee to clean air fund). | No | Yes | Yes | No | Yes | - | No | Not economically feasible |
| N | 47 | Control Upwind Port Emissions | Emission Fee Program for Port-Related Mobile Sources | No | Yes | Yes | - | Yes | - | No | No creditable emission reductions |
| N | 48 | Graduated registration fees for recreational boats | Levee additional registration fee for registration of boats with old, high-emission engines. | No | Yes | Yes | No | - | - | No | Will not provide reductions by May 2008 |
| N | 49 | Airport Congestion Pricing | Charge higher aircraft landing fees during busy times of day to reduce airport delays and congestion. | No | Yes | Yes | No | Yes | Yes | No | Not economically feasible |
| N | 50 | Gas Tax Increase | Implement a fuel tax on off-road gasoline. | No | Yes | Yes | No | - | - | No | Not economically feasible |
| N | 51 | Diesel Tax Increase | Implement a fuel tax on off-road diesel. | No | Yes | Yes | No | - | - | No | Not economically feasible |
| N | 52 | Episodic Restrictions on Lawn & Garden Equipment (mandatory) | Restrict use of lawn and garden equipment during Air Quality Action days. | No | - | Yes | - | No | Yes | No | No creditable emission reduction |
| N | 53 | Episodic Restrictions on Recreational Equipment Use (mandatory) | Restrict use of recreational equipment during Air Quality Action days. | No | - | Yes | - | No | Yes | No | No creditable emission reduction |
| N | 54 | Episodic Restrictions on Use of Commercial and Industrial Equipment (mandatory) | Restrict use of commercial and industrial equipment during Air Quality Action Days. | No | - | Yes | - | No | Yes | No | No creditable emission reduction |
| N | 55 | Episodic Commercial Lawn & Garden Equipment Use Restrictions (voluntary) | Encourage restricted use of commercial lawn and garden equipment on Air Quality Action Days. | Yes | No | Yes | - | Yes | Yes | No | No creditable emission reduction |
| N | 56 | Episodic Residential Lawn & Garden Equipment Use Restrictions (voluntary) | Encourage restricted use of residential lawn & garden equipment on Air Quality Action Days. | Yes | No | Yes | - | Yes | Yes | No | No creditable emission reduction |

**Table 7-1. Potential RACM Measures**

| List # | | Measure | Description | RACM: Implementation by May 2008? | RACM: Enforceable? | RACM: Technologically Feasible? | RACM: Economically Feasible? | RACM: No Adverse Impacts? | RACM: Reductions >0.1tpd? | RACM: Yes/No? | RACM: Explanation |
|---|---|---|---|---|---|---|---|---|---|---|---|
| N | 57 | Episodic Commercial and Industrial Equipment Use Restrictions (voluntary) | Encourage restricted use of commercial and industrial equipment during Air Quality Action Days. | Yes | No | Yes | - | Yes | Yes | No | No creditable emission reduction |
| N | 58 | Episodic No Mow Policy on Code Red Days (voluntary) | Voluntary reduction in mowing on Code Red Days. | Yes | No | Yes | - | Yes | Yes | No | No creditable emission reduction |
| N | 59 | Episodic Recreational Marine Equipment Use Restrictions (mandatory) | Ban use of recreational marine equipment on Code Red Air Quality Action Days. | Yes | Yes | Yes | No | No | - | No | Potential adverse impacts |
| N | 60 | Episodic Recreational Marine Equipment Use Restrictions (voluntary) | Encourage restricted use of all recreational marine equipment on Air Quality Action Days. | Yes | No | Yes | Yes | Yes | - | No | Will not advance attainment date |
| N | 61 | Episodic Recreational Marine Idling Restrictions (mandatory) | Ban idling by recreational marine equipment on Code Red Air Quality Action Days. | Yes | Yes | Yes | No | Yes | - | No | Will not advance attainment date |
| N | 62 | Episodic Recreational Marine Idling Restrictions (voluntary) | Encourage reduced idling by recreational marine equipment on Air Quality Action Days. | No | No | Yes | No | Yes | - | No | No creditable emission reductions |
| N | 63 | Episodic Recreational Marine Idling Restrictions (mandatory) | Ban idling by recreational marine equipment during ozone season. | Yes | Yes | Yes | No | Yes | - | No | Will not advance attainment date |
| N | 64 | Recreational Marine Idling Restrictions | Ban idling by recreational marine equipment year-round. | Yes | Yes | Yes | No | Yes | - | No | Will not advance attainment date |
| N | 65 | "Cash for Clunkers" 2-cycle Engines | Implement a 2-cycle Engine Replacement Program. | Yes | No | Yes | No | Yes | - | No | No creditable emission reductions |
| N | 66 | "Cash for Clunkers" Lawn & Garden Equipment | Offer cash for consumers to turn in lawnmowers or lawn tractors and purchase electric or push mowers. | Yes | No | Yes | No | Yes | - | No | No creditable emission reductions |
| N | 67 | "Cash for Clunkers" Outboard Motors | Offer cash for consumers to turn in old outboard motors and purchase new ones. | Yes | No | Yes | No | Yes | - | No | No creditable emission reductions |
| N | 68 | "Cash for Clunkers" Recreational Equipment Program | Offer small cash reward for owners to turn in old, high-emission recreational equipment. | Yes | No | Yes | No | Yes | - | No | No creditable emission reductions |
| N | 69 | Control Emissions from Lawn and Garden Equipment (xeriscaping) | Adopt measures to reduce lawn area and mower usage. Xeriscaping. | Yes | No | Yes | Yes | Yes | - | No | No creditable emission reductions |
| N | 70 | Agricultural Equipment Use Restrictions (voluntary) | Voluntary moratorium on use of agricultural equipment on Air Quality Action Days. | Yes | No | Yes | No | Yes | - | No | No creditable emission reductions |
| N | 71 | Low Maintenance Landscape Initiative | "Lawn Care for Cleaner Air": increase use of low maintenance landscapes. | Yes | No | Yes | Yes | Yes | - | No | No creditable emission reduction |
| **Mobile Sources** | | | | | | | | | | | |
| M | 1 | Voluntary Diesel Retrofit Program: Local Vehicles | Retrofit diesel local vehicles. | Yes | No | Yes | - | Yes | - | No | No creditable emission reduction |

**Table 7-1. Potential RACM Measures**

| List # | | Measure | Description | RACM: Implementation by May 2008? | RACM: Enforceable? | RACM: Technologically Feasible? | RACM: Economically Feasible? | RACM: No Adverse Impacts? | RACM: Reductions >0.1tpd? | RACM: Yes/No? | RACM: Explanation |
|---|---|---|---|---|---|---|---|---|---|---|---|
| M | 2 | Voluntary Diesel Retrofit Program: Commercial Vehicles | Retrofit diesel commercial vehicles. | Yes | No | Yes | - | Yes | - | No | No creditable emission reduction |
| M | 3 | Low-emission Vehicle Purchase Program: Buses | Accelerate adoption of low-emission vehicles. Consider hydrid and CNG buses. | Yes | No | Yes | - | Yes | - | No | No creditable emission reduction |
| M | 4 | Low-emission Vehicle Purchase Program: Refuse Haulers | Accelerate Adoption of Low-emission Vehicles. Consider CNG refuse haulers instead of new diesel. | Yes | No | Yes | - | Yes | - | No | No creditable emission reduction |
| M | 5 | Voluntary Diesel Retrofit Program: School Buses | Retrofit diesel school buses. | Yes | No | Yes | - | Yes | - | No | No creditable emission reduction |
| M | 6 | Voluntary Diesel Retrofit Program: State Vehicles | Retrofit diesel state vehicles. | Yes | No | Yes | - | Yes | - | No | No creditable emission reduction |
| M | 7 | Voluntary Diesel Retrofit Program: International Green Diesel Retrofit | Fit transit buses running on ultra low sulfur diesel with a quad-catalytic filter. | Yes | No | Yes | - | Yes | - | No | No creditable emission reduction |
| M | 8 | Low-emission Vehicle Purchase Program: State and Local Fleets | Accelerate adoption of low-emission vehicles, including hybrids. Focus on state and local fleets. | Yes | No | Yes | Yes | Yes | - | No | Not enforceable |
| M | 9 | Low-emission Vehicle Purchase Program: Private Owners Fleet | Accelerate adoption of low-emission vehicles. Consider use of tax incentives. | Yes | No | Yes | - | Yes | - | No | Not enforceable |
| M | 10 | Electric Vehicle Tax Incentives | Establish incentives to purchase electric vehicles. | Yes | No | Yes | - | Yes | - | No | Not enforceable |
| M | 11 | Low-emission Vehicle Purchase Program: Rental Cars | Accelerate Adoption of Low-emission Vehicles. Target rental car fleets. | Yes | No | Yes | - | Yes | - | No | No creditable emission reduction |
| M | 12 | Low-emission Vehicle Purchase Program: Taxicabs | Accelerate Adoption of Low-emission Vehicles. Target taxicab fleets. | Yes | No | Yes | - | Yes | - | No | No creditable emission reduction |
| M | 13 | OTC Corridor Strategy | Implement truck stop electrification projects and Heavy-Duty Engine Engine Control Module (ECM) Recalibration (chip reflash) along the I-95 corridor. | Yes | No | Yes | - | Yes | - | No | No creditable emission reduction |
| M | 14 | Truck Idling Reduction: Truck Stop Electrification (TSE) | Implement projects to electrify truck stops. | Yes | No | Yes | - | Yes | - | No | No creditable emission reduction |
| M | 15 | Truck Idling Reduction: Auxilliary Power Units (APU) | Increase market penetration of APUs to reduce truck idling. | Yes | No | Yes | Yes | Yes | - | No | No creditable emission reduction |
| M | 16 | Control Bus Emissions | Provide electrified parking spaces or APUs for tour buses. | Yes | No | - | - | Yes | - | No | No creditable emission reductions |

**Table 7-1. Potential RACM Measures**

| List # | | Measure | Description | RACM: Implementation by May 2008? | RACM: Enforceable? | RACM: Technologically Feasible? | RACM: Economically Feasible? | RACM: No Adverse Impacts? | RACM: Reductions >0.1tpd? | RACM: Yes/No? | RACM: Explanation |
|---|---|---|---|---|---|---|---|---|---|---|---|
| M | 17 | 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. | Yes | No | Yes | - | Yes | No | No | No creditable emission reductions |
| M | 18 | Incentives for Mixed Use at Transit Centers | Include incentives for mixed-use development at transit centers to reduce sprawl and VMT. | No | Yes | Yes | - | Yes | Yes | No | Will not provide reductions by May 2008 |
| M | 19 | Infill Development | Implement an infill development program throughout the Washington region. | No | No | Yes | - | Yes | - | No | Will not provide reductions by May 2008 |
| M | 20 | Convenience Commercial Centers in Residential Areas | Change zoning ordinances to allow neigborhood-serving retail establishments in residential areas. | No | Yes | Yes | - | No | - | No | Will not provide reductions by May 2008 |
| M | 21 | Control Growth and Development | Encourage mixed-use development. | Yes | No | Yes | - | Yes | Yes | No | No creditable emission reductions |
| M | 22 | Proximity Commute: Job Swap | Encourage employees of the same firm to swap jobs, permitting each to work at a location closer to home. | Yes | No | Yes | - | Yes | - | No | No creditable emission reductions |
| M | 23 | Proximity Commute: Live Near Your Work | Provides financial incentives to homebuyers moving to designated neighborhoods near their workplaces. | Yes | No | Yes | - | Yes | - | No | No creditable emission reductions |
| M | 24 | Telecommuting Centers and Telework Program | Telecommuting centers, including marketing activity, consultant support, commuter and employer information and assistance. | Yes | No | Yes | - | Yes | - | No | No creditable emission reductions |
| M | 25 | Telecourses at Local Colleges and Universities | Encourage local colleges and universities to offer telecourses to reduce vehicle trips. | Yes | No | Yes | - | Yes | - | No | No creditable emission reductions |
| M | 26 | Safe Routes to School Program | Implement a safe pedestrian and bicycle routes to school program to reduce VMT. | - | No | Yes | - | Yes | No | No | No creditable emission reduction |
| M | 27 | Commuter Operations Center | Provides commuter assistance services, including carpool and vanpool ridematching. | Yes | No | Yes | - | Yes | - | No | No creditable emission reductions |
| M | 28 | Guaranteed Ride Home | Provides free rides home in event of unexpected emergency or unscheduled overtime to commuters using public transport. | Yes | No | Yes | - | Yes | - | No | No creditable emission reductions |
| M | 29 | Access to Jobs Program | Identifies gaps in transit service between places of residence and places of work for low wage workers. | - | No | Yes | - | Yes | No | No | No creditable emission reduction |

**Table 7-1. Potential RACM Measures**

| List # | | Measure | Description | RACM: Implementation by May 2008? | RACM: Enforceable? | RACM: Technologically Feasible? | RACM: Economically Feasible? | RACM: No Adverse Impacts? | RACM: Reductions >0.1tpd? | RACM: Yes/No? | RACM: Explanation |
|---|---|---|---|---|---|---|---|---|---|---|---|
| M | 30 | Integrated Rideshare | Provides transit, park & ride, and telecenter information to all commuters on a matchlist. | Yes | No | Yes | - | Yes | - | No | No creditable emission reductions |
| M | 31 | Interactive Rideshare Kiosks | Transportation Information Kiosks in Maryland, Virginia and the District of Columbia. | Yes | No | Yes | - | Yes | - | No | No creditable emission reductions |
| M | 32 | Vanpool Programs | Create programs and incentives designed to increase the number of vanpools in the region. | Yes | - | Yes | - | Yes | Yes | No | No creditable emission reduction |
| M | 33 | Free Parking for Carpools/Vanpools | Provide free reserved parking spaces for all carpools or vanpools. | Yes | No | Yes | No | Yes | - | No | No creditable emission reductions |
| M | 34 | Employer Metro Shuttle Bus Services | Provide incentives for businesses to provide employee shuttle service to the nearest rail or transit stop. | Yes | No | Yes | - | Yes | - | No | No creditable emission reduction |
| M | 35 | 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 | Yes | - | Yes | No | No | No creditable emission reduction |
| M | 36 | Bicycle Racks in DC | Install bicycle racks at various locations throughout the region. | Yes | No | Yes | - | Yes | No | No | No creditable emission reductions |
| M | 37 | Bike Lockers at Metro Stations, Park & Ride Lots, Other Locations | Expand existing bike lockers at Metrorail stations, install bicycle storage spaces in parking lots. | Yes | No | Yes | - | Yes | No | No | No creditable emission reduction |
| M | 38 | Bike Racks on Transit Buses | Provide external bike racks on WMATA and other local transit buses. | Yes | No | Yes | - | Yes | No | No | No creditable emission reduction |
| M | 39 | 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. | Yes | No | Yes | - | Yes | No | No | No creditable emission reduction |
| M | 40 | Bike/Pedestrian Paths | Fund construction of additional bicycle/pedestrian paths in the region. | No | No | Yes | - | Yes | No | No | No creditable emission reduction |
| M | 41 | Employers Provide Free Bicycles for Midday Use | Require employers to provide one bicycle per 50 employees for mid-day business or personal use. | Yes | No | Yes | - | Yes | No | No | No creditable emission reduction |
| M | 42 | Car Sharing Program | Fund incentives for new car sharing customers (i.e., Flexcar or Zipcar services). | Yes | No | Yes | - | Yes | No | No | No creditable emission reduction |
| M | 43 | Vehicle Share Programs: Transit Stations | Develop a transit station car/low emission vehicle share program. | Yes | No | Yes | - | Yes | No | No | No creditable emission reduction |

**Table 7-1. Potential RACM Measures**

| List # | | Measure | Description | RACM: Implementation by May 2008? | RACM: Enforceable? | RACM: Technologically Feasible? | RACM: Economically Feasible? | RACM: No Adverse Impacts? | RACM: Reductions >0.1tpd? | RACM: Yes/No? | RACM: Explanation |
|---|---|---|---|---|---|---|---|---|---|---|---|
| M | 44 | Vehicle Share Programs: Neighborhoods | Implement a neighborhood electric vehicle share program. | Yes | No | Yes | - | Yes | No | No | No creditable emission reduction |
| M | 45 | Clean Commute/Try Transit Week | Promotes use of alternative transportation, including transit, by daily commuters for one week per year. | Yes | No | Yes | - | Yes | - | No | No creditable emission reductions |
| M | 46 | Student & staff based college & university rideshare programs | Create rideshare program focused on students and staff at regional universities. | Yes | No | Yes | - | Yes | No | No | No creditable emission reduction |
| M | 47 | Establish Restricted Zones in Downtown Areas and Transit Centers | Restrict private vehicle use in certain areas during business hours, encouraging pedestrian, bicycle, and transit use. | No | Yes | Yes | - | No | Yes | No | Will not provide reductions by May 2008 |
| M | 48 | 4 Day Work Week/Flexible Work Schedules | Encourage employers to adopt a shorter work week, with employees working 4 10-hour days. | Yes | No | Yes | - | Yes | - | No | No creditable emission reductions |
| M | 49 | Expand Peak Period Metrorail Service | Extend peak-period service on Metrorail so trains run more frequently between 6-11 am and 3-8 pm. | No | No | - | - | Yes | - | No | Will not provide reductions by May 2008 |
| M | 50 | Expand VRE Train Service | Expand VRE train service to include additional departures. | No | No | - | - | Yes | - | No | Will not provide reductions by May 2008 |
| M | 51 | Support Rail to Dulles and BWI Airports | Provide funding to expand metro rail services to Dulles and BWI airports. | No | No | Yes | - | Yes | - | No | Will not provide reductions by May 2008 |
| M | 52 | 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 | No | - | - | Yes | - | No | Will not provide reductions by May 2008 |
| M | 53 | Provide Additional Transit Service to Core | Increase funding for transit services to expand core service. | No | No | - | - | Yes | - | No | Will not provide reductions by May 2008 |
| M | 54 | Provide Additional Transit Service Access | Increase funding for enhancing access to transit services. | Yes | No | Yes | - | Yes | No | No | No creditable emission reductions |
| M | 55 | Regional Bus Service Expansion | Expansion of Metrobus and other regional bus services. | No | No | Yes | - | Yes | - | No | Will not provide reductions by May 2008 |
| M | 56 | Express Buses From Outyling Areas | Implement direct bus service from outlying Park & Ride lots and far suburbs to major work centers. | Yes | No | Yes | - | Yes | - | No | No creditable emission reductions |
| M | 57 | Express Reverse Commuter Buses | Implement reverse commute express buses from the District to major outlying work centers. | Yes | No | Yes | - | Yes | - | No | No creditable emission reductions |
| M | 58 | New Surface Parking at Transit Centers | Add new parking spaces at transit centers (bus, Metrorail, MARC, VRE) parking lots. | No | No | Yes | - | Yes | No | No | No creditable emission reductions |

**Table 7-1. Potential RACM Measures**

| List # | | Measure | Description | RACM: Implementation by May 2008? | RACM: Enforceable? | RACM: Technologically Feasible? | RACM: Economically Feasible? | RACM: No Adverse Impacts? | RACM: Reductions >0.1tpd? | RACM: Yes/No? | RACM: Explanation |
|---|---|---|---|---|---|---|---|---|---|---|---|
| M | 59 | Build Park & Ride Lots at Major Intersections of Commuter Highways | Construct new park & ride commuter lots along HOV facilities. | Yes | Yes | Yes | - | Yes | - | No | No creditable emission reductions |
| M | 60 | 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 | No | - | - | Yes | - | No | No creditable emission reductions |
| M | 61 | New MARC Coaches | Purchase additional coaches for MARC to accommodate increased ridership. | No | No | Yes | - | Yes | - | No | Will not provide reductions by May 2008 |
| M | 62 | Additional Transit Stores | Establish additional stationary transit stores in the region. | Yes | No | Yes | - | Yes | No | No | No creditable emission reductions |
| M | 63 | ATM Machines Installed at Metro Stations | Install ATMs near metro stations for rider convenience. | Yes | No | Yes | - | Yes | - | No | No creditable emission reductions |
| M | 64 | Traffic Signal Optimization | Regularly optimize traffic signals to reduce idling and low-speed emissions. | Yes | Yes | Yes | - | Yes | - | No | No creditable emission reductions |
| M | 65 | 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. | Yes | No | Yes | - | Yes | No | No | No creditable emission reductions |
| M | 66 | Manage Roadway Usage: Traffic Incident Management | Regional Travel Information System/Driver Assistance. Enhance real time traffic information to allow drivers to make better decisions about when and where to travel. | - | No | - | - | Yes | - | No | No creditable emission reductions |
| M | 67 | Replace Traffic Signals with Lesser Controls | Install roundabouts in place of signals at low volume intersections. | No | Yes | Yes | - | Yes | - | No | Will not provide reductions by May 2008 |
| M | 68 | 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. | Yes | Yes | Yes | - | Yes | - | No | No creditable emission reductions |
| M | 69 | Extend Ramp Metering | Install signals to control flow of vehicles at selected freeway ramp entrances to maintain level of service. | Yes | Yes | Yes | - | - | No | No | No creditable emission reductions |
| M | 70 | Expand HOV Network on the Freeway System | Construct additional HOV lanes on regional freeways. | No | - | Yes | - | Yes | - | No | Will not provide reductions by May 2008 |

**Table 7-1. Potential RACM Measures**

| List # | | Measure | Description | RACM: Implementation by May 2008? | RACM: Enforceable? | RACM: Technologically Feasible? | RACM: Economically Feasible? | RACM: No Adverse Impacts? | RACM: Reductions >0.1tpd? | RACM: Yes/No? | RACM: Explanation |
|---|---|---|---|---|---|---|---|---|---|---|---|
| M | 71 | Manage Roadway Usage: Dedicated Bus Lanes | Dedicate roadway lanes for use by buses. | No | Yes | Yes | - | No | - | No | Potential adverse impacts |
| M | 72 | Value Pricing (HOT lanes) | Implement value pricing strategies on busy freeways during rush hour. | No | Yes | Yes | - | - | - | No | Will not provide reductions by May 2008 |
| M | 73 | Green Curb Initiative | Restricted Access/ "Green Curb". Differential fees and access permits applied during periods of high congestion. Target delivery/loading zones and carpool/vanpool pickup areas. | No | Yes | Yes | - | - | No | No | Will not provide reductions by May 2008 |
| M | 74 | Congestion Pricing on Low Occupancy Vehicles | Impose a fee on vehicles containing two or fewer persons that use designated roadways, tunnels, and bridges during the peak AM periods. | No | Yes | Yes | - | - | - | No | Will not provide reductions by May 2008 |
| M | 75 | Establish Clean Air Fund | Sell Clean Air License Plates to fund air quality programs (similar to "Save the Bay" tags). | No | Yes | Yes | Yes | Yes | - | No | Will not provide reductions by May 2008 |
| M | 76 | Electronic Tolling | Expand interoperability of electronic tolling systems. | Yes | Yes | Yes | - | Yes | - | No | No creditable emission reductions |
| M | 77 | Annual Gasoline Vehicle Pollution Fee | Levy an annual fee on petroleum-powered vehicles based on mileage driven and emission rates (odometer tax). | No | Yes | - | - | - | - | No | Will not provide reductions by May 2008 |
| M | 78 | VMT-Based Car Tax | Charge VMT fee for all vehicles registered or garaged in the region. | No | Yes | - | - | - | - | No | Will not provide reductions by May 2008 |
| M | 79 | Graduated Car Tax: Additional Vehicles | Charge higher car tax on each additional vehicle registered by a household. | No | Yes | Yes | - | - | - | No | Will not provide reductions by May 2008 |
| M | 80 | Graduated Car Tax: Miles Per Gallon | Charge graduated car taxes based on a vehicle's EPA miles per gallon rating. | No | - | - | - | - | - | No | Will not provide reductions by May 2008 |
| M | 81 | Graduated Car Tax: Petroleum-Based Vehicles only | Implement region-wide car tax for petroleum-fueled vehicles. | No | Yes | Yes | - | - | - | No | Will not provide reductions by May 2008 |
| M | 82 | 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 | Yes | - | - | - | - | No | Will not provide reductions by May 2008 |
| M | 83 | Pay-as-you-drive auto insurance ($/gal) | Offer auto insurance rates linked to number of gallons of fuel consumed by vehicle. | No | Yes | - | - | - | - | No | Will not provide reductions by May 2008 |

**Table 7-1. Potential RACM Measures**

| List # | | Measure | Description | RACM: Implementation by May 2008? | RACM: Enforceable? | RACM: Technologically Feasible? | RACM: Economically Feasible? | RACM: No Adverse Impacts? | RACM: Reductions >0.1tpd? | RACM: Yes/No? | RACM: Explanation |
|---|---|---|---|---|---|---|---|---|---|---|---|
| M | 84 | Mobile Source Mitigation Fees: Vehicle Garage | Collect a fee from each homeowner with a vehicle garage. | No | Yes | - | - | - | - | No | Will not provide reductions by May 2008 |
| M | 85 | Mobile Source Mitigation Fees: Ozone Season VMT Surcharge | Require a surcharge to be paid by drivers during the summer season based on the number of driving miles. | No | Yes | - | - | - | - | No | Will not provide reductions by May 2008 |
| M | 86 | Area Pricing: Entry Fees | Collect fees from drivers to enter a pre-defined area. | No | Yes | Yes | - | - | - | No | Will not provide reductions by May 2008 |
| M | 87 | Gas Tax Increase | Implement a fuel tax on on-road gasoline. | No | Yes | Yes | - | No | - | No | Will not provide reductions by May 2008 |
| M | 88 | Diesel Tax Increase | Implement a fuel tax on on-road diesel. | No | Yes | Yes | - | No | - | No | Will not provide reductions by May 2008 |
| M | 89 | Commuter Parking Tax: Employees | Implement daily tax on employees using commuter parking spaces. | No | No | Yes | No | No | - | No | Will not provide reductions by May 2008 |
| M | 90 | Commuter Parking Tax: Employers with No Discounted Commuter Parking Spaces | Implement daily tax on employers providing free or discounted commuter parking spaces. | No | No | Yes | No | No | - | No | Will not provide reductions by May 2008 |
| M | 91 | Commuter Parking Tax: Employers with No Transit Benefits | Implement daily tax on employers who do not provide transit benefits to employees. | No | Yes | Yes | No | No | - | No | Potential adverse impacts |
| M | 92 | Market Based Parking Charge at Federal Facilities | Negotiate agreement with federal government to charge market rate for daily parking for all employees. | No | No | Yes | - | Yes | - | No | Will not provide reductions by May 2008 |
| M | 93 | Parking Impact Fee: All Parking | Levy annual impact fee on every parking space in nonattainment area. | No | No | Yes | - | No | - | No | Will not provide reductions by May 2008 |
| M | 94 | Parking Impact Fee: Commuter Parking | Levy an annual fee on every commuter parking space in the Washington nonattainment area. | No | No | Yes | No | No | - | No | Will not provide reductions by May 2008 |
| M | 95 | 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 | No | Yes | No | No | - | No | Will not provide reductions by May 2008 |
| M | 96 | Episodic Parking Fee Increases | Increase fees for parking garages and meter during episodes. | No | No | Yes | No | No | - | No | Will not provide reductions by May 2008 |
| M | 97 | Universal Transportation Access | 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 | - | - | Yes | - | No | Will not provide reductions by May 2008 |
| M | 98 | Commuter Choice - State & Local Government Employees | Provide the region's local, state and municipal employees with transit benefits. | Yes | No | Yes | - | Yes | - | No | No creditable emission reductions |

**Table 7-1. Potential RACM Measures**

| List # | | Measure | Description | RACM: Implementation by May 2008? | RACM: Enforceable? | RACM: Technologically Feasible? | RACM: Economically Feasible? | RACM: No Adverse Impacts? | RACM: Reductions >0.1tpd? | RACM: Yes/No? | RACM: Explanation |
|---|---|---|---|---|---|---|---|---|---|---|---|
| M | 99 | 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. | Yes | No | Yes | No | Yes | No | No | No creditable emission reductions |
| M | 100 | Metrorail Feeder Bus Service & Fare Buydown | Improve Metrorail feeder bus service at underutilized park & ride lots, implement fare buydown program. | Yes | No | Yes | - | Yes | No | No | No creditable emission reduction |
| M | 101 | Flat Fare For All Transit Trips | Single price all public transit services with free transfers all day, 7 days per week. | - | No | - | - | Yes | - | No | Will not provide reductions by May 2008 |
| M | 102 | Subsidize Transit Usage | Expand MetroChek to all public sector employees | Yes | No | Yes | - | Yes | - | No | Will not advance attainment date |
| M | 103 | Free Bus Service Off-Peak | Institute free off-peak bus service from 10-2 on weekdays and all day on weekends. | - | No | Yes | - | Yes | - | No | Will not provide reductions by May 2008 |
| M | 104 | 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 | Yes | - | Yes | - | No | Will not provide reductions by May 2008 |
| M | 105 | Free Rail Use 10-3 | Free Metrorail trips for all riders from 10AM-3PM on weekdays. | - | No | Yes | - | Yes | - | No | Will not provide reductions by May 2008 |
| M | 106 | Employer Parking Cash-Out: Voluntary | Implement voluntary program encouraging employers to provide the value of subsidized parking to employees who use alternative commute strategies. | Yes | No | Yes | - | No | - | No | No creditable emission reductions |
| M | 107 | Free Transit Passes to Students | Free transit passes for high school and college students, subsidized by schools or through student registration fee. | - | No | Yes | - | Yes | - | No | Will not provide reductions by May 2008 |
| M | 108 | 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 | Yes | - | Yes | - | No | Will not provide reductions by May 2008 |
| M | 109 | 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. | Yes | No | Yes | - | Yes | - | No | Will not advance attainment date |
| M | 110 | Discount Multi-Trip Bus Fares | Introduce discount programs reducing cost of multiple bus rides through purchase of pass books (e.g. 10-trip tickets). | Yes | No | Yes | - | Yes | - | No | Will not advance attainment date |
| M | 111 | Vanpool Insurance | Establish a special risk pool to underwrite the cost of vanpool insurance. | Yes | No | Yes | - | Yes | - | No | No creditable emission reduction |

**Table 7-1. Potential RACM Measures**

| List # | | Measure | Description | RACM: Implementation by May 2008? | RACM: Enforceable? | RACM: Technologically Feasible? | RACM: Economically Feasible? | RACM: No Adverse Impacts? | RACM: Reductions >0.1tpd? | RACM: Yes/No? | RACM: Explanation |
|---|---|---|---|---|---|---|---|---|---|---|---|
| M | 112 | Commuter Choice Tax Credit | Employers subsidize employees' monthly transit or vanpool costs and receive a tax credit for incurred expenses. | Yes | No | Yes | - | Yes | - | No | No creditable emission reductions |
| M | 113 | Rebate for Purchase of Hybrid Vehicles | Issue rebate for purchase and registration of hybrid vehicles. | Yes | No | Yes | - | Yes | - | No | No creditable emission reduction |
| M | 114 | Real-Time Bus Schedule Information | Expand trials of real-time bus schedule information to local transit providers. | Yes | No | Yes | - | Yes | No | No | No creditable emission reductions |
| M | 115 | Automatic Bus Locator System | System would provide bus location information to transit dispatchers. This would decrease wait time and improve on-time arrival/departure. | Yes | No | Yes | - | Yes | - | No | No creditable emission reductions |
| M | 116 | 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. | Yes | No | Yes | - | Yes | No | No | No creditable emission reductions |
| M | 117 | CAL LEV II Standards | Adopt CAL LEV II Standards, which will require increased zero emission vehicles with marginal VOC and CO2 reductions in 2010. | No | Yes | Yes | - | Yes | - | No | Will not provide reductions by May 2008 |
| M | 118 | Expand Remote Sensing Program | Expand the Adoption of a Remote Sensing Program to Maryland and the District of Columbia. | No | Yes | Yes | - | Yes | - | No | Will not provide reductions by May 2008 |
| M | 119 | Control Heavy Duty Diesel Engines | Heavy-duty engine Engine Control Module (ECM) recalibration (chip reflash). | Yes | No | Yes | - | Yes | - | No | No creditable emission reduction |
| M | 120 | Zero I/M waivers and exemptions | Eliminate all waivers and exemptions in the I/M program. | No | Yes | Yes | - | - | - | No | Will not provide reductions by May 2008 |
| M | 121 | Motorcycle I/M Program | End the motorcycle smog check exemption. | No | Yes | Yes | - | Yes | - | No | Will not provide reductions by May 2008 |
| M | 122 | Diesel I/M Program | Perform community-based inspections of trucks and buses. | Yes | No | Yes | No | Yes | - | No | No creditable emission reduction |
| M | 123 | Expand I/M Requirements to Upwind Counties | Expand Inspection and Maintenance Requirements. | No | Yes | Yes | - | Yes | Yes | No | Will not provide reductions by May 2008 |
| M | 124 | Mandatory Diesel Retrofit Program: Public Fleets | Require retrofit of on-road diesel vehicles in public fleets. | No | Yes | Yes | - | Yes | Yes | No | Will not provide reductions by May 2008 |
| M | 125 | Mandatory Diesel Retrofit Program: Private Fleets | Require retrofit of on-road diesel vehicles in private fleets. | No | Yes | Yes | - | Yes | Yes | No | Will not provide reductions by May 2008 |

**Table 7-1. Potential RACM Measures**

| List # | | Measure | Description | RACM: Implementation by May 2008? | RACM: Enforceable? | RACM: Technologically Feasible? | RACM: Economically Feasible? | RACM: No Adverse Impacts? | RACM: Reductions >0.1tpd? | RACM: Yes/No? | RACM: Explanation |
|---|---|---|---|---|---|---|---|---|---|---|---|
| M | 126 | On-road Heavy-Duty Diesel Smoke Testing and I/M Program | Implement a smoke testing and/or Inspection/Maintenance Program for on-road heavy-duty diesel engines. | No | Yes | Yes | - | Yes | No | No | Will not provide reductions by May 2008 |
| M | 127 | Clean Fuels Program: CNG Fueling Stations for DC Metro Region | Build new modular CNG fueling stations. | Yes | No | Yes | - | Yes | - | No | No creditable emission reduction |
| M | 128 | Biodiesel Fuel | Expand use of biodiesel fuel for on-road vehicles. | Yes | No | Yes | - | Yes | - | No | No creditable emission reduction |
| M | 129 | High Cetane Fuel | Require high-Cetane diesel fuel for on-road vehicles. | No | Yes | Yes | No | Yes | - | No | Will not provide reductions by May 2008 |
| M | 130 | Low-NOx Diesel Fuel | Require regional use of low-NOx fuel additives for on-road diesel vehicles | No | No | - | No | Yes | - | No | Will not provide reductions by May 2008 |
| M | 131 | Low-NOx On-Road Diesel Fuel in Ozone Season | Require use of low-NOx additive in on-road diesel fuel during ozone season. | No | No | - | No | Yes | - | No | Will not provide reductions by May 2008 |
| M | 132 | Low-NOx On-Road Diesel Fuel in Ozone Season | Require use of low-NOx additive by state or local diesel vehicles during ozone season. | No | No | - | No | Yes | - | No | Will not provide reductions by May 2008 |
| M | 133 | Fuel Additives to Reduce Emissions | Use emulsified diesel fuel in diesel burning heavy duty vehicles. | Yes | No | - | No | Yes | - | No | Not enforceable |
| M | 134 | CARB Diesel Fuel | Implement CARB diesel fuel standards. | No | Yes | Yes | No | Yes | - | No | Will not provide reductions by May 2008 |
| M | 135 | Enhanced Enforcement: Bus and Truck Idling | Step-up enforcement of existing regulations to prevent extended bus and truck idling. | Yes | No | Yes | - | Yes | No | No | No creditable emission reduction |
| M | 136 | Enhanced Enforcement: On-road Idling | Increase enforcement of regional idling restrictions for on-road vehicles. | Yes | No | Yes | - | Yes | No | No | No creditable emission reduction |
| M | 137 | Enhanced Enforcement of Mobile Source Regulations | Increase smoking vehicle enforcement. | Yes | No | Yes | - | Yes | No | No | No creditable emission reduction |
| M | 138 | Enhanced Enforcement: Speed Limits | Increase speed limit enforcement so that more vehicles are traveling at or below the posted limit. | Yes | No | Yes | - | Yes | No | No | No creditable emission reduction |
| M | 139 | Control Vehicle Idling | No Idling Rule – Restriction. Limits idling to 5 minutes for all non-commercial, consumer operated vehicles within the Washington NAA. Establish exemptions where required. | No | Yes | Yes | - | Yes | No | No | Will not provide reductions by May 2008 |
| M | 140 | Permit Right Turn on Red | Reduce vehicle idling time by permitting right turn on red, where safety allows. | Yes | Yes | Yes | - | Yes | No | No | No creditable emission reductions |

**Table 7-1. Potential RACM Measures**

| List # | | Measure | Description | RACM: Implementation by May 2008? | RACM: Enforceable? | RACM: Technologically Feasible? | RACM: Economically Feasible? | RACM: No Adverse Impacts? | RACM: Reductions >0.1tpd? | RACM: Yes/No? | RACM: Explanation |
|---|---|---|---|---|---|---|---|---|---|---|---|
| M | 141 | Control Vehicle Speeds: Automated Enforcement | Automate speed enforcement and lower the speed limit to 55 mph for heavy duty vehicles. | No | Yes | Yes | - | Yes | - | No | Will not provide reductions by May 2008 |
| M | 142 | Control Vehicle Speeds: Lower Limits | Speed Limit Restriction: Regional speed limit of 55 mph on all roads which previously had posted speeds of greater than 55 mph. | No | Yes | Yes | - | Yes | Yes | No | Will not provide reductions by May 2008 |
| M | 143 | Clean Air Partners: Air Quality Action Days | Take a variety of actions on Air Quality Action Days to reduce emissions and improve air quality (free transit, telework, carpool). | Yes | No | Yes | - | Yes | - | No | No creditable emission reductions |
| M | 144 | Government Actions (air quality action day similar to snow day) | Implement a liberal leave policy for local, state and federal employees on Air Quality Action Days, permitting employees to work from home or take unscheduled leave. | Yes | No | Yes | - | Yes | - | No | No creditable emission reductions |
| M | 145 | Clean Air Partners: Public Outreach and Education | Implement Strategic Communication Campaigns to Increase Public Awareness (reduce vehicle use). | Yes | No | Yes | - | Yes | - | No | No creditable emission reductions |
| M | 146 | Local Government Education Campaign | Implement Strategic Communication Campaigns to Increase Local Government Air Quality Improvement Efforts (reduce vehicle use). | Yes | No | Yes | - | Yes | - | No | No creditable emission reductions |
| M | 147 | Mass Marketing Campaign | Marketing effort involving business-to-business advertising campaign in print media and on world wide web. | Yes | No | Yes | - | Yes | - | No | No creditable emission reductions |
| M | 148 | "Cash for Clunkers" On-Road Vehicles | Fund voluntary program paying car owners to turn in old vehicles for scrappage. Target pre-1980 vehicles with minimal/no emissions control. | Yes | No | Yes | No | Yes | - | No | Not economically feasible |
| M | 149 | "Cash for Clunkers" Early Bus Engine Replacement | Replaces high-polluting diesel engines in WMATA buses with new diesel engines. | Yes | No | Yes | No | Yes | - | No | Not economically feasible |
| M | 150 | "Cash for Clunkers" Taxicab Replacement - Conventional Vehicles | Replace taxicabs with new "conventional" LDGVs. | Yes | No | Yes | No | Yes | - | No | Not economically feasible |
| M | 151 | "Cash for Clunkers" Gas Caps Program | Provide free replacement gas caps to light- and medium-duty vehicle owners. | Yes | No | Yes | - | Yes | - | No | No creditable emission reduction |
| M | 152 | Control Delivery Truck Emissions | Establish voluntary emission reduction program with delivery fleets. | Yes | No | Yes | - | Yes | - | No | No creditable emission reduction |
| M | 153 | Rush Hour Shift | Shift Metrorail AM and PM rush hours to start 30 min earlier and end 30 min later. | Yes | No | - | - | Yes | - | No | No creditable emission reduction |

| Table 7-1. Potential RACM Measures | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| List # | | Measure | Description | RACM: Implementation by May 2008? | RACM: Enforceable? | RACM: Technologically Feasible? | RACM: Economically Feasible? | RACM: No Adverse Impacts? | RACM: Reductions >0.1tpd? | RACM: Yes/No? | RACM: Explanation |
| M | 154 | Mandatory Employee Commute Reduction | Mandatory employer trip reduction to reduce employee vehicle trips. | No | No | Yes | No | No | - | No | Potential adverse impacts |
| M | 155 | Manage Roadway Usage: No Drive Days | Odd/Even License Plate no Drive Days. Prohibit drivers from traveling during certain periods, based on vehicle tags or other easily identifiable criteria. Can be a permanent or episodic control. | No | Yes | - | - | No | Yes | No | Will not provide reductions by May 2008 |
| M | 156 | Transportation Funding Initiatives | Require that Congestion Mitigation Air Quality (CMAQ) funds be used only for projects that improve air quality. | No | No | Yes | No | Yes | - | No | Will not provide reductions by May 2008 |
| M | 157 | Restrict Parking at Schools | Restrict high school students from driving to and parking at high schools when bus service is available. | Yes | No | Yes | No | No | No | No | No creditable emission reduction |
| M | 158 | Restrict Construction of New Parking | Restrict construction of new parking at employment centers based on distance from transit and urban core. | No | Yes | Yes | - | No | - | No | No creditable emission reduction |
| M | 159 | Eliminate or Restrict Airport Parking | Eliminate airport parking and replace with alternative fuel shuttle buses. | No | No | Yes | - | No | - | No | Will not provide reductions by May 2008 |
| M | 160 | Employer Parking Cash-Out: Mandatory | Implement program requiring employers to provide the value of subsidized parking to employees who use alternative commute strategies. | No | Yes | Yes | - | No | - | No | No creditable emission reductions |
| M | 161 | Remove Trash Trucks From Area Streets | Reduce use of trash trucks through transport of trash by barge. | - | No | - | - | Yes | - | No | No creditable emission reductions |
| M | 162 | Increase Intermodal Transport | Increase use of intermodal options for transporting goods. | Yes | No | Yes | Yes | Yes | - | No | No creditable emission reduction |
| M | 163 | Fleet ILEV for light-duty gasoline vehicles | Require fleets operating in nonattainment area to be comprised of a percentage of Inherently Low Emission Vehicles (ILEV). | No | Yes | Yes | No | No | - | No | Will not provide reductions by May 2008 |
| M | 164 | Control Vehicle Technology | Install systems on gasoline vehicles to reduce emissions (e.g., Bose high-speed centrifugal separation system). | No | - | - | - | Yes | - | No | Will not provide reductions by May 2008 |
| M | 165 | Control VOC Content of Automotive Products | Windshield Wiper Fluid – lower VOC. Establish evaporative standards that are lower than those set by the EPA – 35 weight-percent VOC. | No | - | - | - | Yes | - | No | Will not provide reductions by May 2008 |

| Table 7-1. Potential RACM Measures | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| List # | | Measure | Description | RACM: Implementation by May 2008? | RACM: Enforceable? | RACM: Technologically Feasible? | RACM: Economically Feasible? | RACM: No Adverse Impacts? | RACM: Reductions >0.1tpd? | RACM: Yes/No? | RACM: Explanation |
| M | 166 | Gasoline Engine Retrofit Program | Retrofit with 3-way catalysts on gasoline-burning heavy duty trucks that currently have 2-way catalysts or no catalysts. | Yes | No | - | - | Yes | No | No | No creditable emission reduction |
| M | 167 | Improve Truck Fleet Fuel Economy | Encourage adoption of technologies that increase truck fleet fuel economy. | Yes | No | - | Yes | Yes | - | No | No creditable emission reduction |
| Note: * Under discussion at IAQC. | | | | | | | | | | | |

## 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).

## 8.0 MOBILE SOURCE CONFORMITY

In order to balance growth in metropolitan nonattainment regions and their expanding transportation systems with improving air quality, the Clean Air Act requires that transportation modifications in a nonattainment area must not impair progress made in air quality improvements.[1] EPA issued rules for transportation conformity in its Transportation Conformity rule on November 24, 1993 in the Federal Register.[2] The Transportation Conformity rule has been amended several times, in recent years to incorporate changes resulting from transportation legislation passed in 2005, and EPA guidance for implementing the 8-hour ozone and $PM_{2.5}$ national air quality standards. The rule provides guidance for performing a conformity determination, to assure that transportation modifications "conform" to air quality planning goals established in air quality SIP documents. With the exception of mobile source budgets identified for specific years, the summary of federal conformity requirements as included in the SIP is provided for information only and does not constitute a control measure or program. The requirements are subject to change and may be amended in future updates to federal, state and/or local regulations.

In general, to be found in "conformity" with air quality plans before the attainment plan is approved by EPA, the VOC, NOx, and carbon monoxide, and fine particle 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 budgets established in the SIP;
- In 8-hour ozone areas that have approved 1-hour ozone SIPs, prior to adequate or approved 8-hour SIP budgets, the 1-hour budgets must be used for 8-hour conformity.[3]

In 2005 federal transportation legislation, SAFETEA-LU [3], established new transportation conformity requirements. Conformity for plans and TIPs are required a minimum of every four years. Conformity for plans and Transportation Improvement Programs (TIPs) must be re-determined not later than two years after new emissions budgets are found adequate. Metropolitan Planning Organizations (MPOs) are required to demonstrate conformity for the year the mobile budgets are established, for the final year of the transportation plan, and for appropriate interim years to ensure that anyalysis years are no more than ten years apart. Transportation Control Measures (TCMs) can be substituted in approved SIPs with the concurrence of the MPO, the air agencies and EPA. A conformity lapse will not occur until 12 months after an applicable deadline has passed.

The 2005 legislation requires MPOs to consult with agencies responsible for land use management, natural resources, environmental protection, and conservation and historic

[1] CAA §176(c), 42 USC §§7401-7671(q)
[2] 40 CFR Parts 51 and 93.
[3] SAFETEA-LU, Public Law 109-56, August 10, 2005. Safe, Accountable, Flexible and Efficient Transportation Equity Act—A Legacy for Users.

preservation. In addition a public participation plan is required for approval of a transportation plan. Public comment is required before the conformity determination and transportation plans can be approved.

The Clean Air Act provides penalties for MPOs in nonattainment areas that do not demonstrate conformity. SAFETEA-LU requires MPOs to perform a conformity determination at least every four years. A conformity lapse occurs when the conformity determination for a transportation plan or TIP has expired. During a conformity lapse, only Transportation Control Measures (TCMs), exempt projects and non-federal regionally significant projects may advance.

Highway sanctions may result if the SIP is not submitted, if EPA finds the SIP incomplete or disapproves the control strategy. In the event of a SIP disapproval without a protective finding for the mobile budgets, a conformity freeze occurs immediately upon notification of the disapproval. In a conformity freeze, no new projects may proceed. As for a conformity lapse, a conformity freeze has some exceptions, similar to those in a conformity lapse. Those exceptions are listed in the Transportation Conformity Rule and amendments.

## 8.1 Mobile Emissions Budget and the Washington Area Transportation Conformity Process

In the metropolitan Washington region, regional growth requires that the Transportation Improvement Program (TIP) and the Constrained Long Range Plan (CLRP) be updated and revised and approved on an annual basis. The TIP includes transportation modifications and improvements on a six-year program cycle. Mobile source emissions in the CLRP and six-year TIP cannot exceed the mobile emissions budgets established in the SIP for the short-term TIP years, as well as for the 20-year forecast period of the long-range plan. The regional emissions analysis of the transportation plan must include all projects to be initiated in the Transportation Improvement Program's timeframe.

Modifications to the existing regional transportation network are advanced through the Transportation Planning Board (TPB) by state, regional and local transportation agencies. 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. The conformity rule requires interagency consultation between the environmental body preparing the air quality plan and the MPO.

## 8.2 Budget Level for On-Road Mobile Source Emissions

In developing the SIP, MWAQC consults with the Transportation Planning Board (TPB), to establish mobile source emissions budgets. These budgets 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. For the 8-hour ozone standard, the projected mobile source emissions for 2008

(Reasonable Further Progress) and 2009 (attainment) less Transportation Control Measures and other and vehicle technology, fuel, or maintenance-based measures become the mobile emissions budgets for the region unless MWAQC takes actions to set other budget levels.

The 2008 and 2009 mobile emissions inventories reflect the most recent models available, EPA's MOBILE6.2.03 and the Travel Demand Model Version 2.1d#50, used by COG's Transportation Planning Department, along with the most recent data available, namely 2005 vehicle registration data. The methodology used to project the 2009 attainment year mobile inventory and to recalculate mobile inventories for milestone years is discussed in Section 3.2.3 and Section 4.1.4. See the appendices for detailed input parameters used in modeling the inventories.

The mobile emissions budgets for 2008 Reasonable Further Progress and 2009 attainment are based on the projected 2008 and 2009 mobile source emissions accounting for all the mobile control measures, including Transportation Control Measures, vehicle technology, fuel, or maintenance-based measures, and projected regional growth.

### 8.2.1 Reasonable Further Progress Mobile Budgets

The mobile emissions budgets for the 2008 Reasonable Further Progress are based on the projected 2008 mobile source emissions accounting for all the mobile control measures, including Transportation Control Measures and vehicle technology, fuel, or maintenance-based measures. The mobile emissions budgets for the 2008 Reasonable Further Progress are 70.8 tons/day VOC and 159.8 tons/day NOx.

The Mobile Emissions Budget for 2008 Reasonable Further Progress, based upon the projected 2008 mobile source emissions accounting for all the mobile control measures, including the Transportation Control Measures and vehicle technology, fuel, or maintenance-based measures:

VOC = 70.8 tons/day NOx = 159.8 tons/day

### 8.2.2 Attainment Year Mobile Budgets

The mobile emissions budgets for the 2009 attainment year are based on the projected 2009 mobile source emissions accounting for all the mobile control measures, including Transportation Control Measures and vehicle technology, fuel, or maintenance-based measures. The mobile emissions budgets for the 2009 Attainment Year are 66.5 tons/day VOC and 146.1 tons/day NOx.

The Mobile Emissions Budget for 2009 attainment year, based upon the projected 2009 mobile source emissions accounting for all the mobile control measures, including the Transportation Control Measures and vehicle technology, fuel, or maintenance-based measures:

VOC = 66.5 tons/day  NOx = 146.1 tons/day

### 8.2.3 Contingency Budget

The mobile emissions budgets for the 2010 year are based on the projected 2009 mobile source emissions accounting for all the mobile control measures, including Transportation Control Measures and vehicle technology, fuel, or maintenance-based measures, minus the reductions required for the contingency plan discussed in Chapter 11. The mobile emissions budgets for the 2009 Attainment Year are 66.5 tons/day VOC and 146.1 tons/day NOx. The required reduction amount to satisfy the contingency plan is 1.8 tpd NOx.

The Mobile Emissions Budget for 2010, based upon the projected 2009 mobile source emissions accounting for all the mobile control measures, including the Transportation Control Measures and vehicle technology, fuel, or maintenance-based measures, less the contingency requirement:

VOC = 66.5 tons/day  NOx = 144.3 tons/day

## 8.3 Transportation Control Measures (TCMs) and TERMs

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 0.11 tpd VOC and 0.25 tpd NOx in 2008 and 0.10 tpd VOC and 0.22 tpd NOx in 2009. In addition, Vehicle technology, fuel or maintenance-based measures are also credited in the mobile budgets. Vehicle technology, fuel or maintenance-based measures account for 0.08 tpd VOC and 0.24 tpd NOx in 2008 and 0.08 tpd VOC and 0.23 tpd NOx in 2009. Further information on TCMs and Vehicle technology, fuel or maintenance-based measures can be found in Section 6.4 and in Appendix F.

TERMS, or Transportation Emissions Reduction Measures, are used to mitigate mobile emissions if the conformity analysis demonstrates that mobile emissions will exceed the mobile budgets established in the SIP. 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). The TERMS are used as needed in the event of a TIP and CLRP that exceed the mobile emissions limits set by the air quality plan. TERMs are used for conformity; TCMs are SIP measures and, as such, are permanent.

## 8.4 Trends in Mobile Emissions

The mobile emissions budgets for 2008 and 2009 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 8.2 reflect declines of 39.3 percent and 40 percent for VOC and NOx, respectively, over the period from 2002 to 2008; and declines of 43 percent and 45 percent of VOC and NOx respectively from 2002 to 2009.

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.

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 a steady increase in population, employment and vehicle miles traveled (VMT) within the Washington region. Between 2002 and 2009, regional household population is expected to show a 12 percent increase, while daily VMT estimates show a 9 percent increase. 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.

Trends toward increasing population, employment and VMT are expected to remain strong well beyond 2009. The regional cooperative forecasting process predicts that from 2002 to 2020, regional population will grow by 31 percent and employment will grow by 31 percent. Regional VMT is predicted to increase by 31 percent over this time. 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 Constrained Long Range Plan (CLRP)[4] indicate that for both pollutants, mobile emission reductions in excess of 50 percent will occur during this period.

[4] Draft Air Quality Conformity Determination of the 2006 Constrained Long-Range Plan (CLRP) and FY 2007-2012 Transportation Improvement Program (TIP) for the Metropolitan Washington Region. Metropolitan Washington Council of Governments, National Capital Region Transportation Planning Board, Washington, DC.

## 9.0 MODERATE 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 6 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 9-1, 9-2, 9-3 and 9-4 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 (b) for moderate nonattainment areas are shown in Tables 9-5, 9-6, and 9-7.

### 9.1 Schedules of Adopted Control Measures

**Table 9-1**
**District of Columbia Schedule of Adopted Control Measures**
**Washington Nonattainment Area**

| No. | Control Measure | Mandate | Regulation Number | Effective Date |
|---|---|---|---|---|
| | *Point Source Controls* | | | |
| 6.1.1 | Non-CTG VOC RACT | Federal Regulation | 20 DCMR Sec 715 | 10/2/98 |
| 6.1.2 | State NOx RACT Requirements and Regional Transport NOx Reductions | Federal Regulation | 20 DCMR Sec. 805<br><br>20 DCMR Ch. 10<br><br>20 DCMR Chapter 11 | 11/19/93<br><br>1/20/2000<br><br>No later than Jan. 1, 2009 |
| | *Area Source Controls* | | | |
| 6.2.1 | Reformulated Surface Coatings | Federal Regulation | 63 FR 48849<br>64 FR 34997<br>65 FR 7736 | 9/11/98<br>6/30/99<br>2/16/00 |
| 6.2.2 | Reformulated Consumer Products | Federal Regulation | 63 FR 48848 | 9/11/98 |
| 6.2.3 | Reformulated Industrial Cleaning Solvents | Federal Regulation | 20 DCMR Sec 708 | 10/2/98 |

| No. | Control Measure | Mandate | Regulation Number | Effective Date |
|---|---|---|---|---|
| 6.2.4 | Surface Cleaning/Degreasing for Machinery/Automobile Repair | State Regulation | 20 DCMR Sec. 743-745 | 5/1/99 |
| 6.2.5 | Landfill Regulations | N/A | N/A | N/A |
| 6.2.6 | Seasonal Open Burning Restrictions | State Regulation | 20 DCMR Sec. 604 | 2/1/85 |
| 6.2.7 | Stage I Expansion | N/A | N/A | N/A |
| 6.2.8 | Stage II Vapor Recovery Nozzle | Federal Regulation | 20 DCMR Sec. 705 | 2/1/85 |
| 6.2.9 | Graphic Arts Controls | State Regulation | 20 DCMR Sec. 716 | 5/1/99 |
| 6.2.10 | Auto and Light Duty Truck Coating Operations | Federal Regulation | | 8/14/98 |
| 6.2.11 | Mobile Equipment Repair and Refinishing Rule | State Regulation/OTC Model Rule | 20 DCMR Sec. 718 | 4/04 |
| 6.2.12 | Portable Fuel Containers Rule: Phase I | State Regulation/OTC Model Rule | 20 DCMR Sec. 735-741 | 4/04 |
| 6.2.13 | Architectural and Industrial Maintenance Coatings Rule | State Regulation/OTC Model Rule | 20 DCMR Sec. 749-754 | 4/04 |
| 6.2.14 | Reformulated Consumer Products Rule: Phase I | State Regulation/OTC Model Rule | 20 DCMR Sec. 719-734 | 4/04 |
| 6.2.15 | Solvent Cleaning Operations Rule | State Regulation/OTC Model Rule | 20 DCMR Sec. 742-748 | 4/04 |
| 6.2.16 | Industrial Adhesives and Sealants Rule | State Regulation/OTC Model Rule | 20 DCMR 738-743 | No later than May 1, 2008 |
| 6.2.17 | Portable Fuel Containers Rule: Phase II | State Regulation/`OTC Model Rule | 20 DCMR Sec. 744-752 | No later than May 1, 2008 |
| 6.2.18 | Reformulated Consumer Products Rule: Phase II | State Regulation/OTC Model Rule | 20 DCMR Sec. 719-737 | No later than May 1, 2008 |
| | *Nonroad Source Controls* | | | |

| No. | Control Measure | Mandate | Regulation Number | Effective Date |
|---|---|---|---|---|
| 6.3.1 | EPA Non-Road Gasoline Engines Rule | Federal Regulation | 40 CFR parts 90 and 91 | 12/3/96 |
| 6.3.2 | EPA Non-Road Diesel Engines Rule | Federal Regulation | 40 CFR Part 9 et al. | Model Year 2000-2008 depending on engine size |
| 6.3.3 | EPA Nonroad Spark Ignition Marine Engine Rule | Federal Regulation | 40 CFR Parts 89, 90, 91 | 1998 Model Year |
| 6.3.4 | EPA Large Spark Ignition Engines Rule | Federal Regulation | 40 CFR Parts 89, 90, 91, 94, 1048, 1051, 1065, and 1068 | 11/8/2002 |
| 6.3.5 | Reformulated Gasoline (off-road) | Federal Regulation with State Opt-in | CAA Section 211 (k) | 1/1/95 |
| 6.3.6 | Emissions Controls for Locomotives | Federal Regulation | 63 FR 18998 | 6/15/98 |
| | *On-road Measures* | | | |
| 6.4.1 | Phase II Volatility Controls of Refueling Emissions | Federal Regulation with State Opt-in | 42 U.S.C. 7545 | 1992 |
| 6.4.1 | Reformulated Gasoline Phase I and II (on-road) | Federal Regulation with State Opt-in | 42 U.S.C. 7545 | 1/1/95 |
| 6.4.2 | High Tech Inspections & Maintenance | Federal Regulation | 18 DCMR** Chapters 4, 6, 7, 10, 11; 26 DCMR Chapter 26 | 4/30/99 |
| 6.4.3 | Federal Tier I Vehicle Standards and new Car Evaporative Standards | Federal Regulation | 40 CFR part 86 | Model Year 1994-1996; Evap Stds. 1996 |
| 6.4.4 | National Low Emissions Vehicle Program | Federal Regulation | 20 DCMR, Sec 915 | 1/20/2000 |

| No. | Control Measure | Mandate | Regulation Number | Effective Date |
|---|---|---|---|---|
| 6.4.5 | Tier 2 Motor Vehicle Emission Standards | Federal Regulation | 65 FR 6698 | 2/10/2000 |
| 6.4.6 | Heavy-Duty Diesel Engine Rule | Federal Regulation | 62 FR 54694 | 12/22/97 |

* This information was obtained from the District Department of the Environment.
**District of Columbia Municipal Regulations.
*** For measures not yet adopted, an anticipated schedule for adoption is provided.

**Table 9-2**
**Maryland Schedule of Adopted Control Measures**
**Washington Nonattainment Area**

| No. | Control Measure | Mandate | Regulation Number | Effective Date |
|---|---|---|---|---|
| | *Point Source Controls* | | | |
| 6.1.1 | Non-CTG RACT | Federal Regulation | See Table 9-3 | - |
| 6.1.1 | Expanded Point Source Regulations to 25 tpy | Federal Regulation | 26.11.19.01B(4) | 5/8/95 |
| 6.1.2 | NOx Phase II Controls | Federal Regulation | 26.11.27 & .28<br>26.11.29 & 30 | 10/18/99 |
| 6.1.2 | State NOx RACT Requirements | Federal Regulation | 26.11.29.08<br><br>26.11.27 | 5/10/93<br><br>No later than Jan.1, 2009 |
| | *Area Source Controls* | | | |
| 6.2.1 | Reformulated Surface Coatings | Federal Regulation | 63 FR 48849<br>64 FR 34997<br>65 FR 7736 | 9/11/98<br>6/30/99<br>2/16/00 |
| 6.2.2 | National Volatile Organic Compound Emission Standards for Consumer Products | Federal Regulation | 63 FR 48848 | 9/11/98 |
| 6.2.3 | Reformulated Industrial Cleaning Solvents | Federal Regulation | 42 U.S.C. 7511 | 2001 |
| 6.2.4 | Surface Cleaning/Degreasing for Machinery/Automobile Repair | State Regulation | 26.11.19.09 | 6/5/95 |
| 6.2.5 | Landfill Regulations | Federal Regulation | 26.11.19.20 | 3/9/98 |
| 6.2.6 | Seasonal Open Burning Restrictions | State Regulation | 26.11.07 | 5/22/95 |
| 6.2.7 | Stage I Expansion | Federal Regulation | 26.11.13.04C | 4/26/93 |
| 6.2.8 | Stage II Vapor Recovery Nozzle | Federal Regulation | 26.11.24 | 2/15/93 |
| 6.2.9 | Graphic Arts Controls | State Regulation/CTG | 26.11.19.11 & .18 | 6/5/95 & 11/7/94 |
| 6.2.10 | Auto and Light Duty Truck Coating Operations | State Regulation | 26.11.19.23 | 5/22/95 |

| No. | Control Measure | Mandate | Regulation Number | Effective Date |
|---|---|---|---|---|
| 6.2.11 | Control of VOC Emissions from Vehicle Refinishing | State Regulation | 26.11.19.23 | 5/22/95 |
| 6.2.12 | Portable Fuel Containers Rule: Phase I | State Regulation/OTC Model Rule | 26.11.13.07 | 1/21/02 |
| 6.2.13 | Architectural and Industrial Maintenance Coatings Rule | State Regulation/OTC Model Rule | 26.11.33 | 3/29/04 |
| 6.2.14 | Reformulated Consumer Products Rule: Phase I | State Regulation/OTC Model Rule | 26.11.32 | 8/18/03 |
| 6.2.15 | Control of VOC Emissions from Cold and Vapor Degreasing | State Regulation/OTC Model Rule | 26.11.19.09 | 6/5/1995 |
| 6.2.16 | Industrial Adhesives and Sealants Rule** | State Regulation/OTC Model Rule | [Regulation Number Pending] | 5/1/2008 |
| 6.2.17 | Portable Fuel Containers Rule: Phase II** | State Regulation/OTC Model Rule | 21.11.13.07 | 5/1/2008 |
| 6.2.18 | Reformulated Consumer Products Rule: Phase II** | State Regulation/OTC Model Rule | 26.11.32 | 5/1/2008 |
| | *Non-road Source Controls* | | | |
| 6.3.1 | EPA Non-Road Gasoline Engines Rule | Federal Regulation | 40 CFR parts 90 and 91 | 12/3/96 |
| 6.3.2 | EPA Non-Road Diesel Engines Rule | Federal Regulation | 40 CFR Part 9 et al. | Model Year 2000-2008 depending on engine size |
| 6.3.3 | EPA Nonroad Spark Ignition Marine Engine Rule | Federal Regulation | 40 CFR Parts 89, 90, 91 | 1998 Model Year |
| 6.3.4 | EPA Large Spark Ignition Engines Rule | Federal Regulation | 40 CFR Parts 89, 90, 91, 94, 1048, 1051, 1065, and 1068 | 11/8/2002 |
| 6.3.5 | Reformulated Gasoline (off-road) | Federal Regulation with State Opt-in | CAA Section 211 (k) | 1/1/95 |

| No. | Control Measure | Mandate | Regulation Number | Effective Date |
|---|---|---|---|---|
| 6.3.6 | Emissions Controls for Locomotives | Federal Regulation | 63 FR 18998 | 6/15/98 |
| | *On-road Source Controls* | | | |
| 6.4.1 | Phase II Volatility Controls of Refueling Emissions | Federal Regulation with State Opt-in | 03.03.03.05 | 10/26/92 |
| 6.4.1 | Reformulated Gasoline Phase I and Phase II (on-road) | Federal Regulation with State Opt-in | 42 U.S.C. 7545 | 1/1/95 & 1/1/2000 |
| 6.4.2 | High Tech Inspections & Maintenance | Federal Regulation | 11.14.08 | 1/2/95 & 1/1/2000 |
| 6.4.3 | Federal Tier I Vehicle Standards and new Car Evaporative Standards | Federal Regulation | 40 CFR part 86 | Model Year 1994-1996; Evap Stds. 1996 |
| 6.4.4 | National Low Emissions Vehicle Program | Federal Regulation | 26.11.20.04 | 3/22/99 |
| 6.4.5 | Tier 2 Motor Vehicle Emission Standards | Federal Regulation | 65 FR 6698 | 2/10/2000 |
| 6.4.6 | Heavy-Duty Diesel Engine Rule | Federal Regulation | 63 FR 54694 | 12/22/97 |

*This information was obtained from the Maryland Department of the Environment.
** For measures not yet adopted, an anticipated schedule for adoption is provided.

**Table 9-3**
**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 9-4**
**Virginia Schedule of Adopted Control Measures**
**Washington Nonattainment Area**

| No. | Control Measure | Mandate | Regulation Number | Effective Date |
|---|---|---|---|---|
| | *Point Source Controls* | | | |
| 6.1.1 | Non-CTG RACT - VOC | Federal Regulation | 9 VAC 5-40-5220 | 1/1/93 |
| 6.1.1 | Expanded Point Source Regulations to 25 tpy - VOC | Federal Regulation | 9 VAC 5-40-300 | 4/1/96 |
| 6.1.2 | State NOx RACT Requirements | Federal Regulation | 9 VAC 5-40-310; 9 VAC 5-40-311 | 1/1/93 |
| 6.1.2 | Regional Transport NOx Reduction Controls | Federal Regulation | By permit or compliance agreement<br><br>9 VAC 5 Chapter 130 | 6/25/98<br><br>No later than Jan.1, 2009 |
| | *Area Source Controls* | | | |
| 6.2.1 | Reformulated Surface Coatings | Federal Regulation | 63 FR 48849<br>64 FR 34997<br>65 FR 7736 | 9/11/98<br>6/30/99<br>2/16/00 |
| 6.2.2 | Reformulated Consumer Products | Federal Regulation | 63 FR 48848 | 9/11/98 |
| 6.2.3 | Reformulated Industrial Cleaning Solvents | Federal Regulation | 42 U.S.C. 7511 | 2001 |
| 6.2.4 | Surface Cleaning/Degreasing for Machinery/Automobile Repair | State Regulation | 9 VAC 5-40-3260 et. seq. | 4/1/96 |
| 6.2.5 | Landfill Regulations | Federal Regulation | 9 VAC 5-40-5800 et. seq. | 4/1/96 |
| 6.2.6 | Seasonal Open Burning Restrictions | State Regulation | 9 VAC 5-40-5630 | 4/1/96 |
| 6.2.7 | Stage I Expansion | Federal Regulation | 9 VAC 5-40-5200 | 1/1/99 |
| 6.2.8 | Stage II Vapor Recovery Nozzle | Federal Regulation | 9 VAC 5–40-5220 | 1/1/93 |

| No. | Control Measure | Mandate | Regulation Number | Effective Date |
|---|---|---|---|---|
| 6.2.9 | Graphic Arts Controls | State Regulation/CTG | 9 VAC 5-40-7800 et. seq. | 4/1/96 |
| 6.2.10 | Auto and Light Duty Truck Coating Operations | State Regulation | 9 VAC 5 40-3860 et. seq. | 7/1/91 |
| 6.2.11 | Mobile Equipment Repair and Refinishing Rule | State Regulation | 9 VAC 5-40-6970 et. seq. | 3/24/04 |
| 6.2.12 | Portable Fuel Containers Rule: Phase I | State Regulation/OTC Model Rule | 9 VAC 5-40-5700 et. seq. | 3/24/04 |
| 6.2.13 | Architectural and Industrial Maintenance Coatings Rule | State Regulation/OTC Model Rule | 9 VAC 5-40-7120 et. seq. | 3/24/04 |
| 6.2.14 | Reformulated Consumer Products Rule: Phase I | State Regulation/OTC Model Rule | 9 VAC 5-40-7240 et. seq. | 3/9/05 |
| 6.2.15 | Solvent Cleaning Operations Rule | State Regulation/OTC Model Rule | 9 VAC 5-40-6820 et. seq. | 3/24/04 |
| 6.2.16 | Industrial Adhesives and Sealants Rule** | State Regulation/OTC Model Rule | 9 VAC 5 Chapter 40 | 5/1/2009 |
| 6.2.17 | Portable Fuel Containers Rule: Phase II** | State Regulation/OTC Model Rule | 9 VAC 5 Chapter 40 | 5/1/2009 |
| 6.2.18 | Reformulated Consumer Products Rule: Phase II** | State Regulation/OTC Model Rule | 9 VAC 5 Chapter 40 | 5/1/2009 |
| | *Non-road Source Controls* | | | |
| 6.3.1 | EPA Non-Road Gasoline Engines Rule | Federal Regulation | 40 CFR parts 90 and 91 | 12/3/96 |
| 6.3.2 | EPA Non-Road Diesel Engines Rule | Federal Regulation | 40 CFR part 9 et al. | Model Year 2000-2008 depending on engine size |
| 6.3.3 | EPA Nonroad Spark Ignition Marine Engine Rule | Federal Regulation | 40 CFR Parts 89, 90, 91 | 1998 Model Year |
| 6.3.4 | EPA Large Spark Ignition Engines Rule | Federal Regulation | 40 CFR Parts 89, 90, 91, 94, 1048, 1051, 1065, and | 11/8/2002 |

| No. | Control Measure | Mandate | Regulation Number | Effective Date |
|---|---|---|---|---|
| | | | 1068 | |
| 6.3.5 | Reformulated Gasoline Phase I and Phase II (non-road) | Federal Regulation with State Opt-in | CAA Section 211 (k) | 1/1/95 |
| 6.3.6 | Emissions Controls for Locomotives | Federal Regulation | 63 FR 18998 | 6/15/98 |
| | *On-road Measures* | | | |
| 6.4.1 | Phase II Volatility Controls of Refueling Emissions | Federal Regulation with State Opt-in | 2 VAC 5 420-10 | 7/28/93 |
| 6.4.1 | Reformulated Gasoline Phase I and Phase II (on-road) | Federal Regulation with State Opt-in | 42 U.S.C. 7545 | 1/1/95 & 1/1/2000 |
| 6.4.2 | High Tech Inspection & Maintenance | Federal Regulation | 9 VAC 5 Chapter 91 | 4/2/97 |
| 6.4.3 | Federal Tier I Vehicle Standards and new Car Evaporative Standards | Federal Regulation | 40 CFR part 86 | Model Year 1994-1996; Evap Stds. 1996 |
| 6.4.4 | National Low Emissions Vehicle Program | Federal Regulation | 9 VAC 5-200 | 4/14/99 |
| 6.4.5 | Tier 2 Motor Vehicle Emission Standards | Federal Regulation | 65 FR 6698 | 2/10/2000 |
| 6.4.6 | Heavy-Duty Diesel Engine Rule | Federal Regulation | 63 FR 54694 | 12/22/97 |

*This information was obtained from the Virginia Department of Environmental Quality.
** For measures not yet adopted, an anticipated schedule for adoption is provided.

## 9.2 Stationary Source Threshold Revisions

The Clean Air Act Amendments, Section 182 (d) required 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 adopted these measures, listed in Table 9-5, on the schedule shown.

Under the moderate designation for the 8-hour ozone standard, the permit threshold is 50 tons per year VOC and 100 tons per year NOx. Virginia will adopt the thresholds corresponding to the moderate designation. Maryland and the District are committed to maintaining the permit threshold at 25 tons per year for both VOC and NOx.

**Table 9-5**
**Schedule of Stationary Source Revisions**
**Washington Nonattainment Area**

| No. | State | Control Measure | Regulation Number | Effective Date |
|---|---|---|---|---|
| | Maryland | Control of NOx Emissions for Major Stationary Sources | COMAR 09.08 | Adoption: 10/03 |
| | Virginia | Control of NOx Emissions for Major Stationary Sources | 9 VAC 5-20-204 9 VAC 5-80-2000 | Adopted: 4/7/03 Effective: 6/4/03 |
| | District of Columbia | Major Source Thresholds | 20 DCMR Sections 715.2,715.3,715.4 (VOC RACT) | 8/29/03 |

## 9.3 New RACT Rules Applicability

When the Washington, DC region was designated as severe nonattainment for ozone, Virginia, Maryland and the District adopted additional reasonably available control technology (RACT) rules for sources subject to the lower major source applicability size threshold of 25 tpy. The requirements for VOCs have been in the regulations for some time due to earlier regulatory actions. The RACT threshold will remain at 25 tpy for Virginia, Maryland and the District. The states are also recertifying RACT for facilities that have the potential to emit more than 50 tpy VOC or 100 tpy NOx.

**Table 9-6**
**New RACT Rules Applicability**
**Washington Nonattainment Area**

| No. | State | Control Measure | Regulation Number | Date |
|---|---|---|---|---|
| | Virginia | Non-CTG RACT | 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) | Adopted: 4/7/03 Effective: 6/4/03 |
| | Maryland | Control of NOx Emissions | COMAR 9.08 | 10/03 |
| | District of Columbia | Major Source Thresholds | 20 DCMR sections 805.1,805.6,805.7 (NOx RACT) | 8/29/03 |

## 9.4 Revision of New Source Review (NSR) Regulations

When designated as severe nonattainment of the ozone standard, the states were required to lower the thresholds for defining "Major" sources to require controls for facilities with the potential to emit more than 25 tons per year (from 50 tons per year) and to revise New Source Review (NSR) regulations to apply the 1:1.3 offset requirement to major stationary sources of VOC and NOx.

The Washington, DC region is designated as moderate nonattainment for the 8-hour ozone standard. Under the current moderate designation, the NSR thresholds are 50 tpy VOC and 100 tpy NOx. The 1:1.15 offset requirement would apply.

The New Source Review permit regulations in Virginia are structured so that the pertinent requirements such as major source threshold and offset ratio are self-implementing depending upon changes to the nonattainment area classification. The NSR threshold will remain at 25 tpy for both VOC and NOx for Maryland and the District and the 1:1.3 offset requirement will apply.

**Table 9-7**
**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 | Adoption: 10/03 |
| 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 | Adopted: 6/31/81<br>Effective: 12/1/04 |
| Virginia | Nonattainment Areas (NSR permit regulations) | 9 VAC 5-20-204 | Effective: 5/4/2005 |
| District of Columbia | Nonattainment Areas (NSR Permit Regulations) | 20 DCMR section 204 | 8/29/03 |

## 10.0 Attainment Demonstration

The 8-Hour Ozone Standard Attainment Plan analyzes the potential of the Washington metropolitan area to achieve attainment of the 8-hour ozone standard. The demonstration of achieving the 8-hour ozone standard is based on both the Community Multiscale Air Quality Model (CMAQ) and Weight of Evidence (WOE) analysis supporting the attainment modeling results. Photochemical modeling and the WOE analyses provide strong evidence that the region will attain the 8-hour ozone standard by 2009. Details of both the CMAQ model and the WOE tests are being provided below.

## 10.1 Modeling Study Overview: Background and Objectives

On June 15, 2005, EPA revoked the 1-hour ozone standard and re-designated the Washington D.C. MSA as a "Moderate" ozone non-attainment area for the new 8-hour ozone standard. Moderate ozone non-attainment areas are required to demonstrate attainment of the new 8-hour ozone standard using photochemical modeling and WOE analyses.

The objective of the photochemical modeling study is to enable the air agencies to analyze the efficacy of various control strategies, and to demonstrate that the measures adopted as part of the State Implementation Plan will result in attainment of the ozone standard by June 2010. The modeling exercise predicts future 2009 air quality conditions based on the worst episodes in the base year 2002, and applies control measures to demonstrate the effectiveness of new measures in reducing air pollution.

For the reason mentioned above, a photochemical modeling study was undertaken by Virginia Department of Environmental Quality (VADEQ) on behalf of the Washington metropolitan area to demonstrate attainment of the 8-hour ozone NAAQS. The attainment modeling project was directed by the Technical Advisory Committee (TAC) and the Metropolitan Washington Air Quality Committee (MWAQC), a policy committee. EPA's Community Multi-scale Air Quality (CMAQ) was the model used for the attainment demonstration.

Table 10-1 identifies all jurisdictions that EPA has designated as non-attainment within the Washington MSA.

**Table 10-1. Washington MSA Designations for 8-hour Ozone Standard**

| Jurisdiction | Counties | Classification | Maximum Attainment Date (from June 15, 2004) |
|---|---|---|---|
| District of Columbia | District of Columbia | Moderate | June 15, 2010 |
| Maryland | Calvert<br>Charles<br>Frederick<br>Montgomery<br>Prince George's | | |
| Virginia | Alexandria City<br>Arlington<br>Fairfax City<br>Fairfax<br>Falls Church City<br>Loudoun<br>Manassas City<br>Manassas Park City<br>Prince William | | |

The modeling analyses set forth in this report have been conducted in accordance with the EPA (2006).[1]

### 10.1.1 Relationship to Regional Modeling Protocols

The state members of the committees for this study are also members of the OTC and ASIP modeling committees. This membership has allowed them to coordinate the analyses performed for Washington, D.C. with the regional modeling analyses conducted by OTC and ASIP.

VADEQ, in consultation with the MDE, DCDOE, and MWCOG, was responsible for conducting CMAQ runs for the Washington, D.C. domain. VADEQ's modeling runs were done in coordination with the Ozone Transport Commission's (OTC) modeling for the 12-state Ozone Transport Region (OTR) and with the ASIP modeling, done for the southeastern states. Modeling centers for OTC included the New York State Department of Environmental Conservation (NYSDEC), the University of Maryland, NESCAUM and VADEQ. Technical support documents for the OTC modeling performed for the OTR are included in Appendix G. Modeling inventories were developed, updated and shared among the regional modeling centers and provided by MARAMA, MANE-VU and VISTAS.

Installation of the models at VADEQ and all participating modeling centers was completed and diagnostic procedures were run successfully. The model has been benchmarked against other modeling platforms across the region to ensure accurate results.

The Policy Committee and the TAC oversaw the modeling work and made appropriate reports to the full MWAQC through regular briefings and offered other information in cases where specific technical decisions had policy implications. The Technical Committee members and members of

[1] Guidance on the Use of Models and Other Analyses for Demonstrating Attainment of Air Quality Goals for Ozone, PM2.5, and Regional Haze (Draft 3.2- September 2006).

other committees involved in the project who are also members of OTC and ASIP made sure to the extent practicable that there was consistency between the regional and urban modeling efforts.

### 10.1.2 Conceptual Description

EPA recommends that a conceptual description of the area's ozone problem be developed prior to the initiation of any air quality modeling study. A "conceptual description" is a qualitative way of characterizing the nature of an area's non-attainment problem. Within the conceptual description of a particular modeling exercise, it is recommended that the specific meteorological parameters that influence air quality be identified and qualitatively ranked in importance.

The conceptual model for this study was prepared by the Northeast States for Coordinated Air Use Management (NESCAUM) for use by the OTC member States. The conceptual model document, The Nature of the Ozone Air Quality Problem in the Ozone Transport Region: A Conceptual Description (NESCAUM, October 2006), is provided in Appendix G. This document provides the conceptual description of the ozone problem in the OTR states, consistent with the EPA's guidance.

## 10.2 Domain and Database Issues

### 10.2.1. Episode Selection

The procedures for selecting 8-hr ozone modeling episodes seek to achieve a balance between good science and regulatory needs and constraints. Modeling episodes, once selected, influence technical and policy decisions for many years. Clearly, both the direct and implicit procedures used in selecting episodes warrant full consideration.

The rationale for the selection of 2002 meteorology as input to the air quality simulations includes a qualitative analysis (Ryan and Piety 2002)[2] and a quantitative analysis (Environ 2005)[3]. These documents are provided in Appendix G Attachment 2.

Recent research has shown that model performance evaluations and the response to emissions controls need to consider modeling results from long time periods, in particular full synoptic cycles or even full ozone seasons. Based on this factor the entire ozone season was simulated for the 2002 and 2009 State Implementation Plan (SIP) modeling runs (May 1 to September 30). As a result, the total number of days examined for the complete ozone season far exceeds EPA recommendations, and provides for better assessment of the simulated pollutant fields.

---

[2] Ryan, W.F., Piety, C. 2002. Summary of 2002 Pollution Episodes in the Mid-Atlantic. The Pennsylvania State University Department of Meteorology, State College, Pennsylvania and the University of Maryland Department of Meteorology, College Park, Maryland.

[3] Environ. 2005. Ozone Episode Classification Project for Ozone Transport Commission (Task 2b), Stoeckenius, T., Kemball-Cook, S, ENVIRON International Corporation, Novato, California.

### 10.2.2. Size of the Modeling Domain

In defining the modeling domain, one must consider the location of the local urban area, the downwind extent of the elevated ozone levels, the location of large emission sources, and the availability of meteorological and air quality data. The domain or spatial extent to be modeled includes as its core the non-attainment area. Beyond this, the domain includes enough of the surrounding area such that major upwind sources fall within the domain and emissions produced in the non-attainment area remain within the domain throughout the day.

The boundaries of the modeling domain are provided in Appendix G Attachment 3. This domain covers the Northeast region including northeastern, central and southeastern US as well as Southeastern Canada. The final SIP modeling analysis utilized the modeling domain boundaries established by OTC.

### 10.2.3 Horizontal Grid Size

The OTC platform used for the Washington, D.C. modeling analysis utilized a coarse grid continental United States (US) domain with a 36-km horizontal grid resolution. The CMAQ domain is nested in the MM5 domain. A larger MM5 domain was selected for both MM5 simulations to provide a buffer of several grid cells around each boundary of the CMAQ 36 km domain. This was designed to eliminate any errors in the meteorology from boundary effects in the MM5 simulation at the interface of the MM5 model. A 12-km inner domain was selected to better characterize air quality in OTC and surrounding Regional Planning Organization (RPO) regions. Appendix G Attachment 4 contains the horizontal grid definitions for the MM5 and CMAQ modeling domains.

### 10.2.4 Vertical Resolution

The CMAQ vertical structure is primarily defined by the vertical grid used in the MM5 modeling. The MM5 model employed a terrain following coordinate system defined by pressure. The layer averaging scheme adopted for CMAQ is designed to reduce the computational cost of the CMAQ simulations. The effects of layer averaging have a relatively minor effect on the model performance metrics when compared to ambient monitoring data.

Appendix G Attachment 5 contains the vertical layer definitions for the MM5 and CMAQ modeling domains.

### 10.2.5 Initial and Boundary Conditions

The objective of a photochemical grid model is to estimate the air quality given a set of meteorological and emissions conditions. When initializing a modeling simulation, the exact concentration fields are unknown in every grid cell for the start time. Therefore, typically photochemical grid models are started with clean conditions within the domain and allowed to stabilize before the period of interest is simulated. In practice this is accomplished by starting the model several days prior to the period of interest.

The winds move pollutants into, out of, and within the domain. The model handles the movement of pollutants within the domain and out of the domain. An estimate of the quantity of pollutants moving into the domain is needed. These are called boundary conditions. To estimate the boundary conditions for the modeling study, three-hourly boundary conditions for the outer 36-km domain were derived from an annual model run performed by researchers at Harvard

University using the GEOS-CHEM global chemistry transport model. The influence of boundary conditions was minimized by using a 15-day ramp-up period which is sufficient to establish pollutant levels that are encountered in the beginning of the ozone episode.

### 10.2.6 Meteorological Model Selection and Configuration

The Pennsylvania State University/National Center for Atmospheric Research (PSU/NCAR) Mesoscale Meteorological Model (MM5) was selected for application in the Washington, D.C. non-attainment modeling analysis. MM5 is a non-hydrostatic, prognostic meteorological model routinely used for urban- and regional-scale photochemical regulatory modeling studies.

Based on model validation and sensitivity testing, the MM5 configurations provided in Appendix G Attachment 6 were selected. Results of the University of Maryland's detailed performance evaluation of the MM5 modeling used in conjunction with the OTC platform are provided in Appendix G Attachment 7.

### 10.2.7 Emissions Model Selection and Configuration

Significant coordination efforts took place between MANE-VU and VISTAS in the development of the emissions inventories used in the modeling study. All analyses conducted in support of the Washington, D.C. modeling analysis were coordinated between the Technical and Policy Committees along with TAC.

These inventories include a base case (2002) which serves as the "parent" inventory off which all future year inventories (i.e., 2009) are based. The future year inventories include emissions growth due to any projected increase in economic activity as well as the implementation of control measures. Detailed descriptions of both base case 2002 and attainment year 2009 inventories are provided in Attachment 12 and Attachment 13 respectively of the Appendix G.

The Sparse Matrix Operator Kernel Emissions (SMOKE) Emissions Processing System was selected for application in the Washington, D.C. non-attainment area modeling analysis.

SMOKE (Version 2.1) was used for the Washington DC attainment modeling demonstration. 2002 base case and 2009 future base case emissions data files were provided by OTC and ASIP. Wherever possible, the mobile source emission inventories (in VMT format) were replaced with SCC-specific county level emissions to more accurately reflect actual emissions for typical ozone season day.

A detailed description of all SMOKE input files such as area, mobile, fire, point and biogenic emissions files is provided in Appendix G Attachment 8. The SMOKE model configuration is also provided.

### 10.2.8 Air Quality Model Selection and Configuration

EPA's Models-3/Community Multi-scale Air Quality (CMAQ) modeling system was selected for the attainment demonstration primarily because it is a "one-atmosphere" photochemical grid model capable of addressing ozone at regional scale and is considered one of the preferred models for regulatory modeling applications. The model is also recommended by the Guidance on the Use of Models and Other Analyses for Demonstrating Attainment of Air Quality Goals for Ozone, PM2.5, and Regional Haze (Draft 3.2- September 2006).

The CMAQ configuration is provided in Appendix G Attachment 9.

### 10.2.9 Quality Assurance

All air quality, emissions, and meteorological data were reviewed to ensure completeness, accuracy, and consistency before proceeding with modeling. Any errors, missing data or inconsistencies, were addressed using appropriate methods that are consistent with standard practices. All modeling was benchmarked through the duplication of a set of standard modeling results.

Quality Assurance (QA) activities were carried out for the various emissions, meteorological, and photochemical modeling components of the modeling study. Emissions inventories obtained from the Regional Planning Organizations (RPO) were examined to check for errors in the emissions estimates. When such errors were discovered, the problems in the input data files were corrected.

The MM5 meteorological and CMAQ air quality model inputs and outputs were plotted and examined to ensure accurate representation of the observed data in the model-ready fields, and temporal and spatial consistency and reasonableness. Both MM5 and CMAQ underwent operational and scientific evaluations in order to facilitate the quality assurance review of the meteorological and air quality modeling procedures and are discussed in greater detail throughout this document.

## 10.3 Model Performance Evaluation

There are many aspects of model performance. This section will focus primarily on the methods and techniques recommended by EPA for evaluating the performance of the air quality model. It should be noted that the other parts of the modeling process, the emissions and meteorology, also undergo an evaluation. It is with this knowledge and the desire to keep the report concise, that the air quality model became the primary focus of this section.

The first step in the modeling process is to verify the model's performance in terms of its ability to predict the ozone in the right locations and at the right levels. To do this, the model predictions for the base year simulation are compared to the ambient data observed in the historical episode. This verification is a combination of statistical and graphical evaluations. If the model appears to be producing ozone in the right locations for the right reasons, then the model can be used as a predictive tool to evaluate various control strategies and their effects on

ozone. The purpose of the model performance evaluation is to assess how accurately the model predicts ozone levels observed in the historical episode.

The results of a model performance evaluation were evaluated prior to using modeling to support the attainment demonstration. The performance of CMAQ was evaluated using both operational and diagnostic methods. Operational evaluation refers to the model's ability to replicate observed concentrations of ozone and/or precursors (surface and aloft), whereas diagnostic evaluation assesses the model's accuracy with respect to characterizing the sensitivity of ozone to changes in emissions (i.e., relative response factors).

The New York State DEC, Division of Air Resources, conducted a performance evaluation of the 2002 base case CMAQ simulation (May 15-September 30) on behalf of the OTC member States. Appendix G Attachment 10 provides comprehensive operational and diagnostic evaluation results, including spreadsheets containing the assumptions made to compute statistics. Highlights of this evaluation are provided in the following sections.

### 10.3.1 Diagnostic and Operational Evaluation

The issue of model performance goals for ozone is an area of ongoing research and debate. To evaluate model performance, EPA recommends that several statistical metrics be developed for air quality modeling. Two of the common metrics that are most often used to assess performance are the mean normalized gross error and the mean normalized bias. The mean normalized gross error parameter provides an overall assessment of model performance and can be interpreted as precision, and the mean normalized bias parameter measures a model's ability to reproduce observed spatial and temporal patterns and can be interpreted as accuracy. EPA suggests the following criteria: a mean normalized bias (MNB) of $< \pm 15\%$, and a mean normalized gross error (MNGE) of $< 35\%$ above a threshold of 40-60 ppb. These results are presented in Table 10-2 below for the local non-attainment area and in Tables 10-3 and 10-4 on a monitor-by-monitor basis averaged over all days for the 40 ppb and 60 ppb thresholds. Figure 10-1 shows the location of the monitors.

**Table 10-2. Washington, D.C. MSA Statistics for 8-hour Ozone**

| Location | Ozone Cutoff Threshold (ppb) | Mean Normalized Gross Error (MNGE) (%) | Mean Normalized Bias (MNB) (%) |
|---|---|---|---|
| Washington, | 40 | 13.34 | -0.43 |

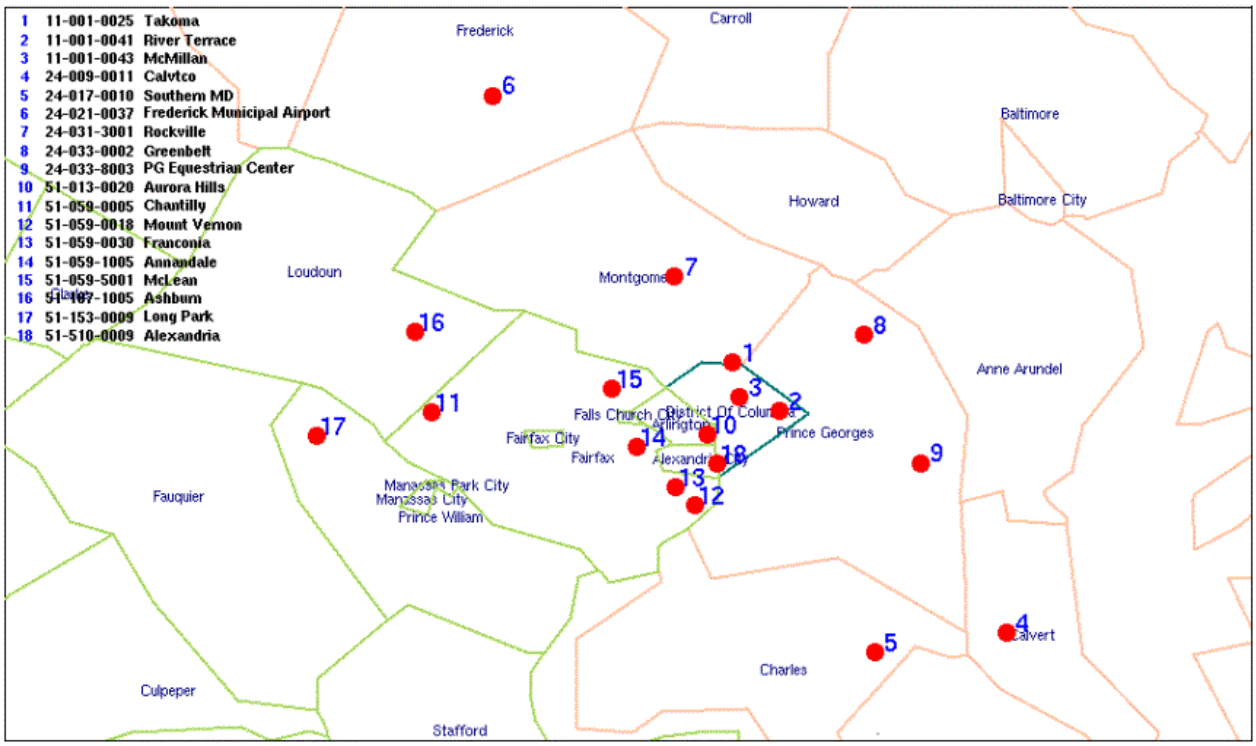
**Table 10-3. Individual Site Statistics for 8-hour Ozone using 40 ppb Cutoff**

| AIRS ID | Site Name | Jurisdiction | State | MNGE (%) | MNB (%) |
|---|---|---|---|---|---|
| 11-001-0025 | Takoma | District of Columbia | --- | 12.77 | 6.85 |
| 11-001-0041 | River Terrace | District of Columbia | --- | 12.08 | -3.13 |
| 11-001-0043 | McMillan | District of Columbia | --- | 14.85 | -12.04 |
| 24-009-0010 | Calvert | Calvert | MD | NA | NA |
| 24-017-0010 | Southern MD | Charles | MD | 12.3 | 0.55 |
| 24-021-0037 | Frederick Municipal Airport | Frederick | MD | 12.29 | -0.22 |
| 24-031-3001 | Rockville | Montgomery | MD | 13.57 | 7.6 |
| 24-033-0002 | Greenbelt | Prince George's | MD | 12.82 | 1.54 |
| 24-033-8003 | PG Equestrian Center | Prince George's | MD | 13.48 | 3.38 |
| 51-013-0020 | Aurora Hills | Arlington County | VA | 12.73 | -6.33 |
| 51-059-0005 | Chantilly | Fairfax County | VA | 13.23 | -8.31 |
| 51-059-0018 | Mount Vernon | Fairfax County | VA | 14.63 | 4.93 |
| 51-059-0030 | Franconia | Fairfax County | VA | 12.57 | -3.57 |
| 51-059-1005 | Annandale | Fairfax County | VA | 12.01 | -2.94 |
| 51-059-5001 | McLean | Fairfax County | VA | 17.87 | 11.99 |
| 51-107-1005 | Ashburn | Loudoun County | VA | 13.18 | -8.54 |
| 51-153-0009 | Long Park | Prince William County | VA | 12.55 | -4.23 |
| 51-510-0009 | Alexandria | Alexandria City | VA | 14.14 | 9.2 |

**Table 10-4. Individual Site Statistics for 8-hr Ozone using 60 ppb Cutoff**

| AIRS ID | Site Name | Jurisdiction | State | MNGE (%) | MNB (%) |
|---|---|---|---|---|---|
| 11-001-0025 | Takoma | District of Columbia | --- | 9.37 | 2.8 |
| 11-001-0041 | River Terrace | District of Columbia | --- | 11.28 | -7.57 |
| 11-001-0043 | McMillan | District of Columbia | --- | 15.61 | -13.66 |
| 24-009-0010 | Calvert | Calvert | MD | NA | NA |
| 24-017-0010 | Southern MD | Charles | MD | 11.22 | -5.62 |
| 24-021-0037 | Frederick Municipal Airport | Frederick | MD | 10.9 | -4.27 |
| 24-031-3001 | Rockville | Montgomery | MD | 11.3 | 3.24 |
| 24-033-0002 | Greenbelt | Prince George's | MD | 11.42 | -2.6 |
| 24-033-8003 | PG Equestrian Center | Prince George's | MD | 11.46 | -3.87 |
| 51-013-0020 | Aurora Hills | Arlington County | VA | 13.36 | -9.79 |
| 51-059-0005 | Chantilly | Fairfax County | VA | 13.71 | -12.57 |
| 51-059-0018 | Mount Vernon | Fairfax County | VA | 11.02 | -2.63 |
| 51-059-0030 | Franconia | Fairfax County | VA | 11.99 | -7.42 |
| 51-059-1005 | Annandale | Fairfax County | VA | 11.88 | -7.5 |
| 51-059-5001 | McLean | Fairfax County | VA | 13.54 | 5.59 |
| 51-107-1005 | Ashburn | Loudoun County | VA | 14.18 | -12.84 |
| 51-153-0009 | Long Park | Prince William County | VA | 12.6 | -11.7 |

**Figure 10-1. Location of Ozone Monitors in the Washington, D.C. Area**




The following statistics for the OTC domain have also been provided in Appendix G Attachment 11.

1. Archive file containing time series of 8-hour average observed and predicted ozone organized by state.
2. Observed and predicted composite diurnal variations of selected species, including but not limited to ozone at SLAMS/NAMS sites, ozone at CASTNet and other sites, VOC species such as ethene, isoprene, formaldehyde and gas phase compounds such as CO, NO and $NO_2$.
3. Statistical evaluation of daily maximum 8-hour ozone at SLAMS/NAMS sites and CASTNet/other sites; statistics are computed using two different thresholds for observed daily maximum ozone - 40 and 60 ppb; statistics are computed by date (all sites on a given day) and by site (one site over all days).
4. Statistical evaluation of daily maximum 8-hour ozone at SLAMS/NAMS sites that fall within non-attainment counties; statistics are computed by non-attainment area.
5. Statistical evaluation of daily average CO, NO, $NO_2$, and $SO_2$ at SLAMS/NAMS and other sites; statistics are computed by date and by site.
6. Statistical evaluation of daily average ethene, isoprene, and formaldehyde at SLAMS/NAMS and other sites; statistics are computed by date and by site.

7. Plots of composite time series for daily max 8-hour ozone, root mean square error and mean bias for illustrative purposes.
8. Daily tile plots of daily 8-hour maximum predicted ozone across the modeling domain compared with actual observations.

### 10.3.2 Summary of Model Performance

CMAQ was employed to simulate ozone for the 2002 season (May 15 through September 30). A comparison of the temporal and spatial distributions of ozone and its precursors was conducted for the study domain with additional focus placed on performance in the Washington D.C. area.

The CMAQ model performance for surface ozone is quite good with low bias and error. Model performance is generally consistent from day to day. The results the 2002 ozone season show that the modeling system tends to over-predict minimum concentrations and slightly under-predict peak concentrations. The over-prediction of minimum concentrations is not of great regulatory concern since attainment tests are based on the application of relative response factors to daily peak concentrations. It is still important to appropriately model the over-night ozone removal processes and regional transport to accurately estimate peak concentrations.

The model performance for the Washington D.C. area averaged over all stations and all days meet the guidelines suggested by EPA. The criteria for acceptable model performance are met on most individual days as well.

No significant differences in model performance for ozone and its precursors were encountered across the OTC. While there are some differences between the spatial data between sub-regions, there is nothing to suggest a tendency for the model to respond in a systematically different manner between regions. Examination of the statistical metrics by sub-region confirms the absence of significant performance problems arising in one area but not in another, building confidence that the CMAQ modeling system is operating consistently across the full OTC domain.

The modeling system is doing a good job of appropriately estimating 8-hour average surface ozone throughout the OTC and in the Washington D.C. area. This confidence in the modeling results allows for the modeling system to be used to support the development of emissions control scenarios and State Implementation Plan to meet the 8-hour ozone NAAQS.

## 10.4 Attainment Demonstration

The Washington region’s demonstration of achieving the 8-hour ozone standard is based on two bodies of evidence: (1) the Community Multi-scale Air Quality Model (CMAQ) and (2) a number of WOE tests supporting the attainment modeling results. Details of both the CMAQ model and the WOE tests are provided below.

### 10.4.1 Modeling Attainment Test

The modeled attainment test applied at each monitor was performed using the following equation:

$$(DVF)_I = (RRF)_I (DVB)_I$$

Where:

$(DVB)_I$ = the baseline concentration monitored at site I, in ppb
$(RRF)_I$ = the relative response factor (RRF), calculated near site I
$(DVF)_I$ = the estimated future design value for the time attainment is required, in ppb.

**Table 10-5. Modeling Attainment Test Using EPA Preferred Methodology**

| AIRS ID | Site Name | Jurisdiction | State | DVB | RRF | DVF |
|---|---|---|---|---|---|---|
| 11-001-0025 | Takoma | District of Columbia | --- | 88.7 | 0.892 | 79 |
| 11-001-0041 | River Terrace | District of Columbia | --- | 89.0 | 0.883 | 78 |
| 11-001-0043 | McMillan | District of Columbia | --- | 92.7 | 0.883 | 81 |
| 24-009-0010 | Calvert | Calvert | MD | NA | 0.836 | NA |
| 24-017-0010 | Southern MD | Charles | MD | 93.0 | 0.808 | 75 |
| 24-021-0037 | Frederick Municipal Airport | Frederick | MD | 87.3 | 0.846 | 73 |
| 24-031-3001 | Rockville | Montgomery | MD | 86.7 | 0.881 | 76 |
| 24-033-0002 | Greenbelt | Prince George's | MD | 94.0 | 0.869 | 81 |
| 24-033-8003 | PG Equestrian Center | Prince George's | MD | 94.0 | 0.865 | 81 |
| 51-013-0020 | Aurora Hills | Arlington County | VA | 96.7 | 0.891 | 86 |
| 51-059-0005 | Chantilly | Fairfax County | VA | 87.0 | 0.867 | 75 |
| 51-059-0018 | Mount Vernon | Fairfax County | VA | 96.7 | 0.883 | 85 |
| 51-059-0030 | Franconia | Fairfax County | VA | 95.0 | 0.88 | 83 |
| 51-059-1005 | Annandale | Fairfax County | VA | 94.0 | 0.88 | 82 |
| 51-059-5001 | McLean | Fairfax County | VA | 88.0 | 0.883 | 77 |
| 51-107-1005 | Ashburn | Loudoun County | VA | 90.0 | 0.869 | 78 |
| 51-153-0009 | Long Park | Prince William County | VA | 85.0 | 0.871 | 74 |
| 51-510-0009 | Alexandria | Alexandria City | VA | 90.0 | 0.883 | 79 |

Current design values were calculated using the EPA method of averaging the three design value periods which include the baseline inventory year. Specifically, the average design value was calculated using the 2000-2002, 2001-2003, and 2002-2004 periods.

In the event that there was less than five years of available data at a monitoring site the following procedure was used:

1. 3 years of data - The current design value was based on a single design value.
2. 4 years of data - The current design value was based on an average of two design value periods.

3. Less than 3 years of data – The site was not used in the attainment test.

A 3x3 array of grid cells surrounding each monitor was used in the modeled attainment test as recommended by EPA for 12-km grid resolution modeling to calculate RRFs.

The predicted 8-hour daily maximum concentrations from each modeled day were used in the modeled attainment test with the nearby grid cell with the highest predicted 8-hour daily maximum concentration with baseline emissions for each day considered in the test, and the grid cell with the highest predicted 8-hour daily maximum concentration with the future emissions for each day in the test.

The RRFs used in the modeled attainment test were computed by taking the ratio of the mean of the 8-hour daily maximum predictions in the future to the mean of the 8-hour daily maximum predictions with baseline emissions, over all relevant days.

The following rules shall were applied to determine the number of days and the minimum threshold at each ozone monitor:

1. If there were 10 or more days with daily maximum 8-hour average modeled ozone > 85 ppb an 85 ppb threshold was used.
2. If there was less than 10 days with daily maximum 8-hour average modeled ozone > 85 ppb the threshold was reduced to as low as 70 ppb until there was 10 days in the mean RRF calculation.
3. If there was less than 10 days with daily maximum 8-hour average modeled ozone > 70 ppb then all days > 70 ppb were used.
4. No RRF calculations shall be performed for sites with less than 5 days > 70 ppb.

### 10.4.2 Unmonitored Area Analysis

An "unmonitored area analysis" using model adjusted spatial fields was performed. The basic steps of this process were as follows:

1. Interpolated ambient ozone design value data to create a set of spatial fields.
2. Adjusted the spatial fields using gridded model output gradients (base year values).
3. Applied gridded model RRFs to the model adjusted spatial fields.
4. Determined if any unmonitored areas are predicted to exceed the NAAQS in the future.

Recommended EPA guidance was utilized in the "unmonitored area analysis".

### 10.4.3 Emissions Inventories

For areas with an attainment date of no later than June 15, 2010, the emission reductions need to be implemented no later than the beginning of the 2009 ozone season. A determination of attainment will likely be based on air quality monitoring data collected in 2007, 2008, and 2009. Therefore, the year to project future emissions should be no later than the last year of the three year monitoring period; in this case 2009.

The 2002 base year emissions inventory were projected to 2009 using standard emissions projection techniques. Future year 2009 inventories were provided by two Regional Planning Organizations (RPO's), the MidAtlantic Visibility Union (MANE-VU) and the Visibility Improvement State and Tribal Association of the Southeast (VISTAS) were used in the attainment demonstration.

Emission inventory guidance documents were followed for developing projection year inventories for point, area, mobile, and biogenic emissions. These procedures addressed projections of spatial, temporal, and chemical composition change between the base year and projection year.

The alternative control strategies for evaluation in the attainment demonstration were selected by MWAQC. These were selected from groups of strategies developed by the technical subcommittees responsible for identifying and developing the regulations and/or control measures.

Consideration was given to maintaining consistency with control measures likely to be implemented by other modeling domains. Also, technology-based emission reduction requirements mandated by the Clean Air Act were included in the future year model runs.

### 10.4.4 Attainment Modeling Results

Applying EPA's preferred methodology to CMAQ model results, the future design values for 2009 shown in Table 10-5 indicate only two monitors will be at or slightly above 84 parts per billion (ppb). All other monitors (sixteen) will be below 85 ppb. These results place the Washington, DC-MD-VA region well within EPA's range, 82-87 ppb, where WOE will contribute significantly to the region's attainment demonstration.[4]

## 10.5 Weight of Evidence (WOE) Analysis

All photochemical models including the CMAQ model 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. Therefore, EPA photochemical modeling guidance document provides for other evidence (Weight of Evidence) to address these model uncertainties so that proper assessment of the probability to attain eight-hour ozone standard can be made.

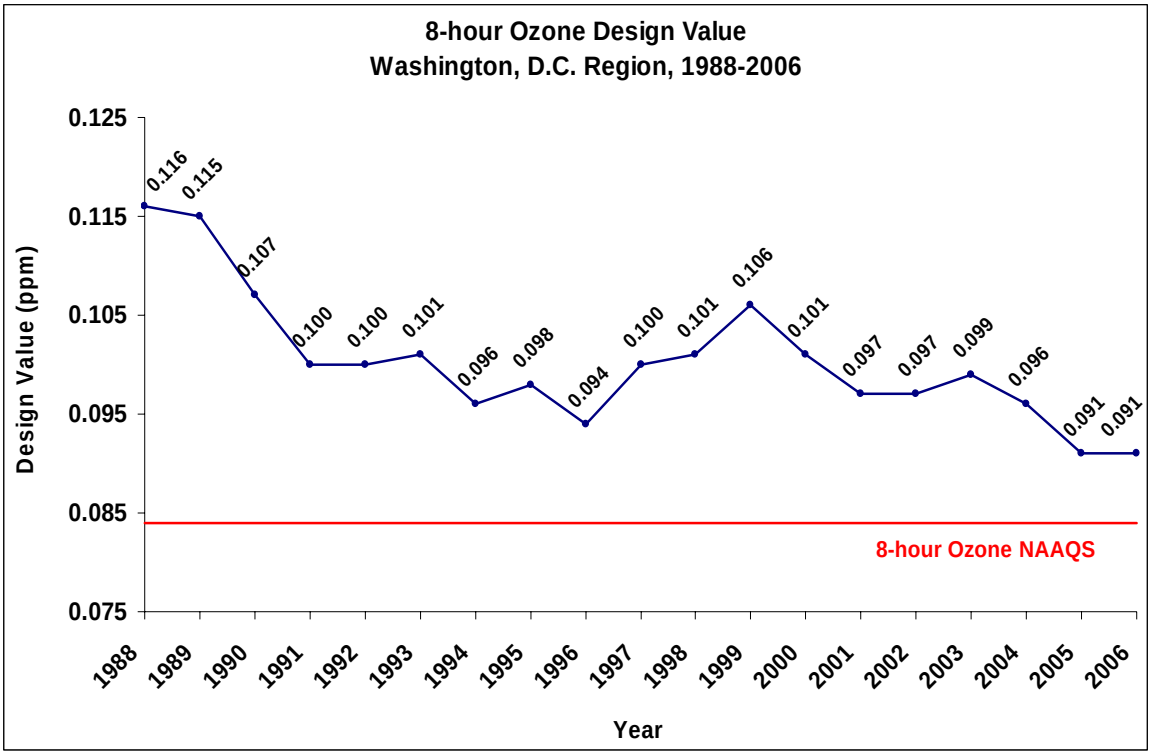
There were number of WOE tests employed to test the potential of Washington, D.C. area to attain the eight-hour standard in 2009. Details of each of these tests are being provided below.

[4] Guidance on the Use of Models and Other Analyses in Attainment Demonstrations for the 8-hour Ozone NAAQS, EPA-454/R-05-002, October 2005, "Table 2-1: Guidance for Weight of Evidence Determinations," p. 9.

### 10.5.1 Trend in 8-hour Ozone Design Value

Trend in the 8-hour ozone design values between 1988 and 2006 is shown in Figure 10-2. It is clear that the design value has significantly decreased during this period from 0.116 ppm in 1988 to 0.091 ppm in 2006.

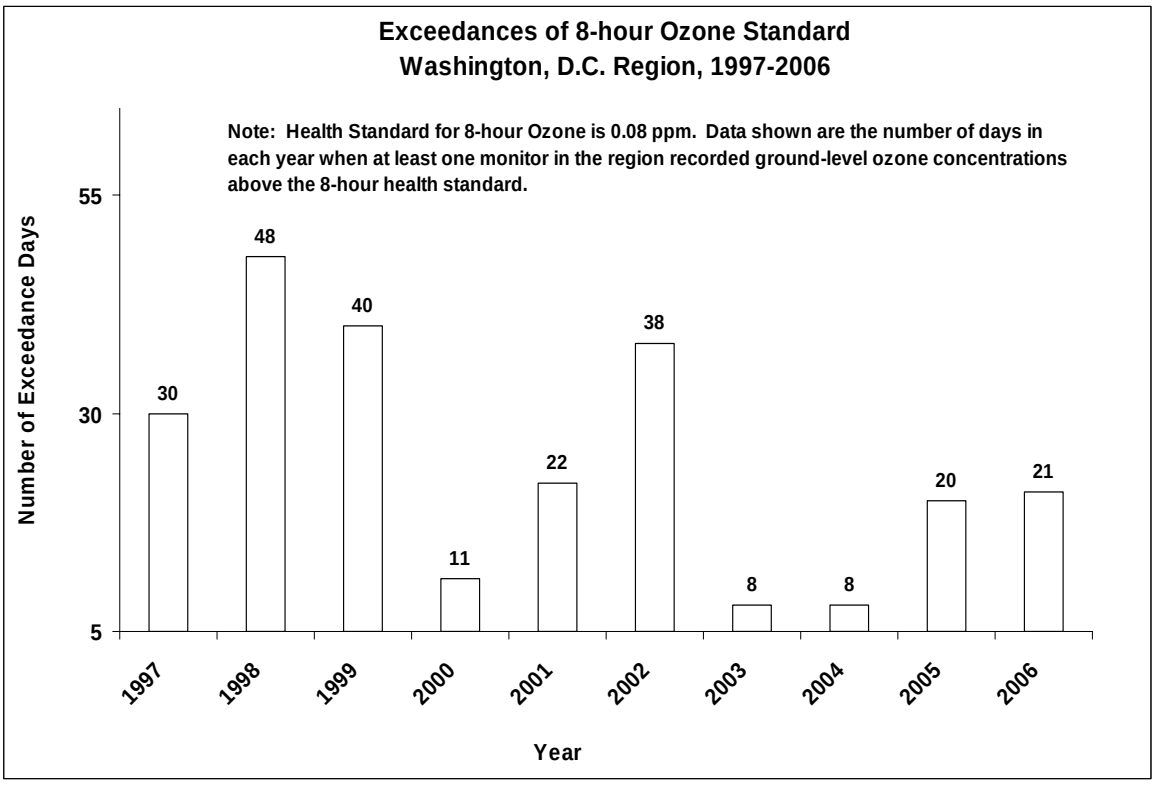
**Figure 10-2. Trend in 8-Hour Ozone Design Value in the Washington, DC-MD-VA Nonattainment Area**



### 10.5.2 Trend in Exceedance Count across All Monitors

The trend in the total number of exceedances across all monitors between 1997 and 2006 is shown in Figure 10-3. Monitor exceedances occur whenever a monitor's 8-hour ozone concentration is greater than or equal to 0.08 ppm. Though the number of monitors in the Washington, DC-MD-VA 8-hour nonattainment area has actually increased by 20 percent (15 in 1997 to 18 in 2006), the number of exceedances decreased by 30 percent (30 in 1997 to 21 in 2006).

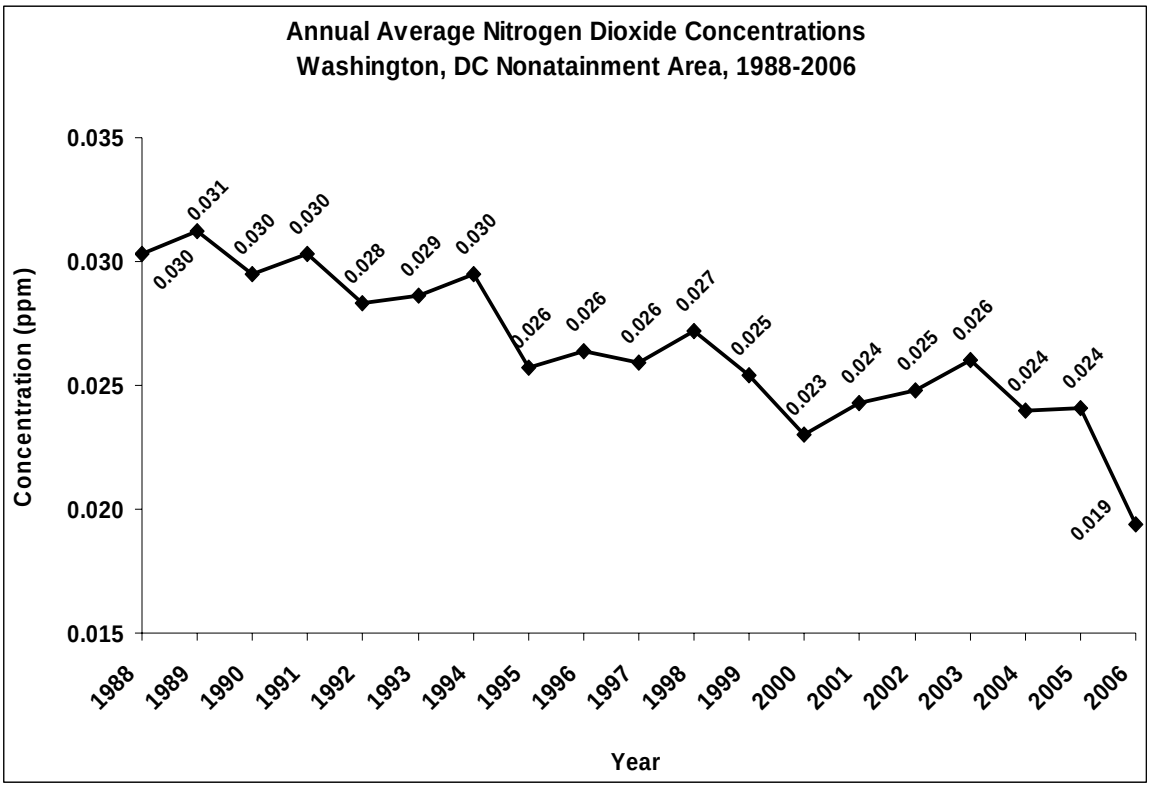
**Figure 10-3. Trend in Monitored Exceedances across All Monitors in the Washington, DC-MD-VA Nonattainment Area**



### 10.5.3 Trend in Nitrogen Dioxide Levels

The trend in nitrogen dioxide levels between 1988 and 2006 is shown in Figure 10-4. It is clear from the figure that the levels overall have been declining between 1988 and 2006. A significant (0.011 ppm) decrease is apparent between the two years (1988-2006). Implementation of NOx SIP call has brought down significantly the nitrogen dioxide emissions in power plants in upwind areas after 2003. As a result, nitrogen dioxide concentration levels have also been reduced, which is clearly seen after 2003 in the figure below. The NAAQS for $NO_2$ (Annual Mean Concentration) is 0.053 ppm and therefore the region is well below the standard. As $NO_2$ is a very important factor in ozone formation, its decline over the years has been the one of the main reasons behind the reduction in ozone levels in the region.

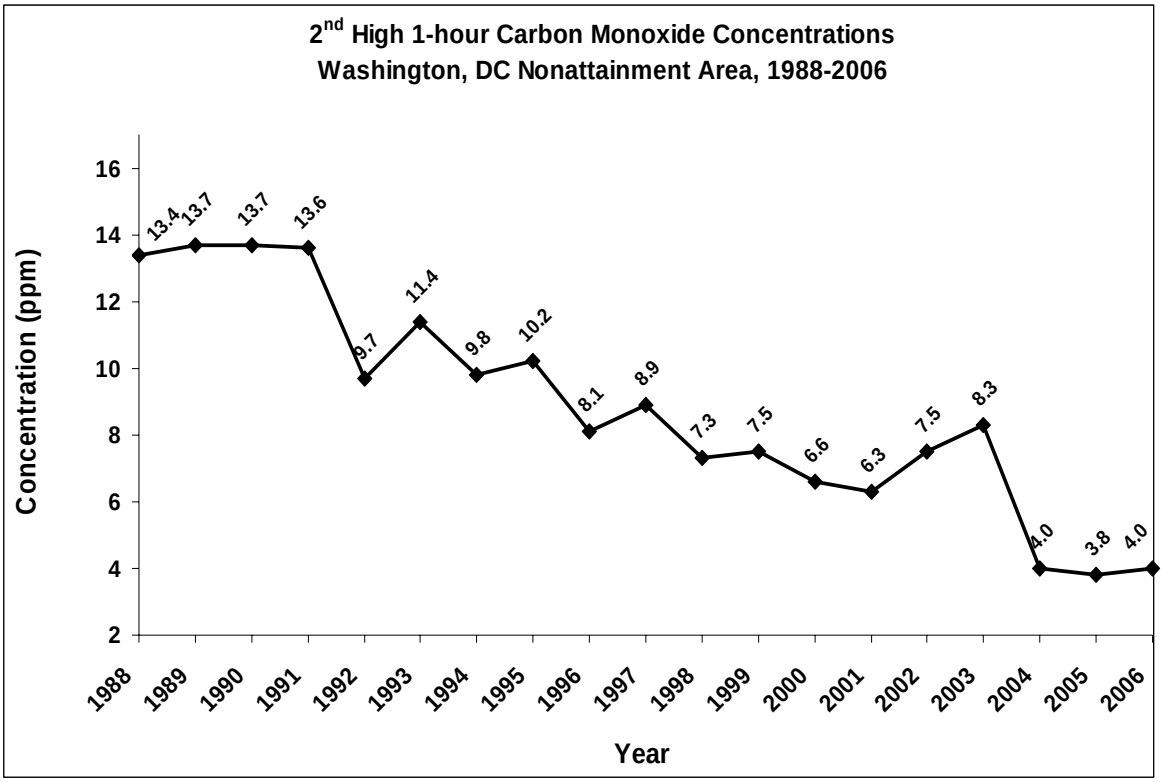
**Figure 10-4. Trend in Nitrogen Dioxide Annual Average Concentration in the Washington, DC-MD-VA Nonattainment Area**



### 10.5.4 Trend in Carbon Monoxide Levels

The trend in carbon monoxide levels between 1988 and 2006 is shown in Figure 10-5. It is clear from the figure that the levels have been declining between 1988 and 2006. A significant (9.4 ppm) decrease is apparent between the two years (1988-2006). Though not very significant, carbon monoxide does play a role in ozone formation and so its decline over the years has certainly helped reduce ozone levels in the region.

**Figure 10-5. Trend in 2nd High 1-Hour Carbon Monoxide Concentration in the Washington, DC-MD-VA Nonattainment Area**



### 10.5.5 Trend in VOC and NOx Emissions

Comparison of VOC and NOx emissions in the years 2002, 2008, and 2009 are shown in Figures 10-6 and 10-7 respectively.

It is clear from Figure 10-6 that total VOC emissions are projected to decrease significantly in 2008 and 2009 from 2002 levels. VOC emissions are projected to decrease between 2002 and 2009 for area, nonroad and onroad sources. Point source VOC emission will be increasing a small amount bit in 2008 and 2009.

Figure 10-7 shows that total NOx emissions are projected to decrease significantly in 2008 and 2009 from 2002 levels. NOx emissions are projected to decrease between 2002 and 2009 for point, nonroad and onroad sources. Area source NOx emission will be increasing a small amount in 2008 and 2009.

**Figure 10-6. VOC Emissions in the Washington, DC-MD-VA Nonattainment Area**

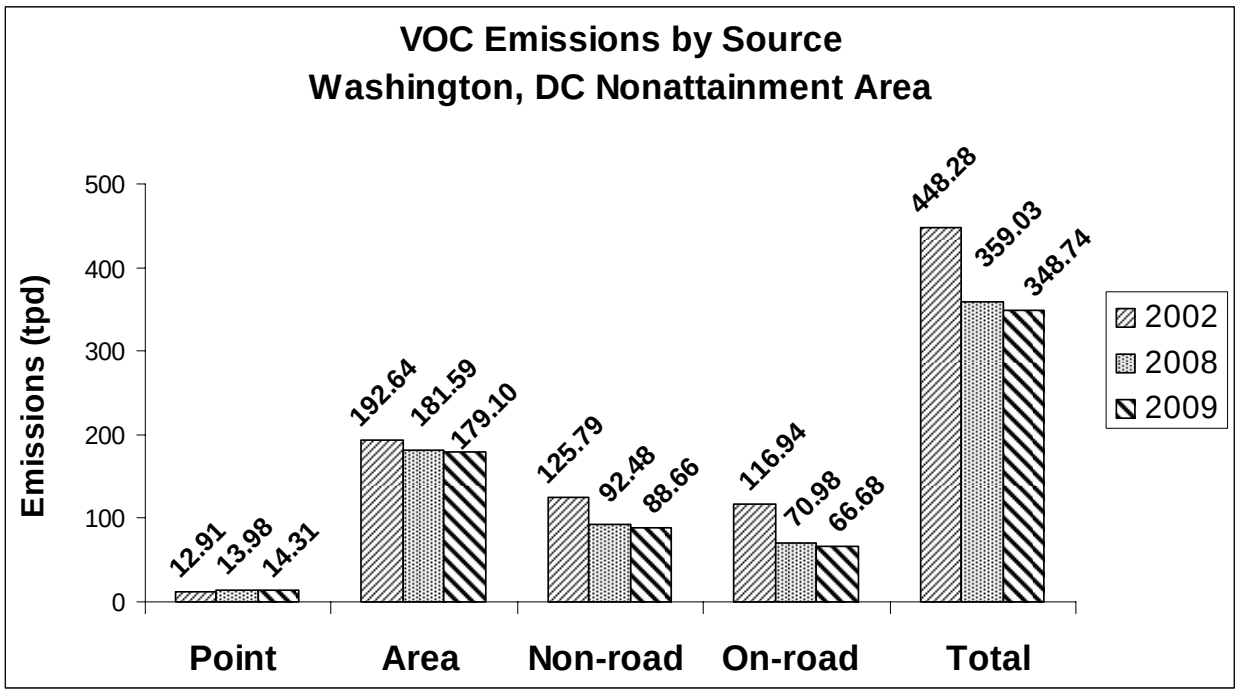
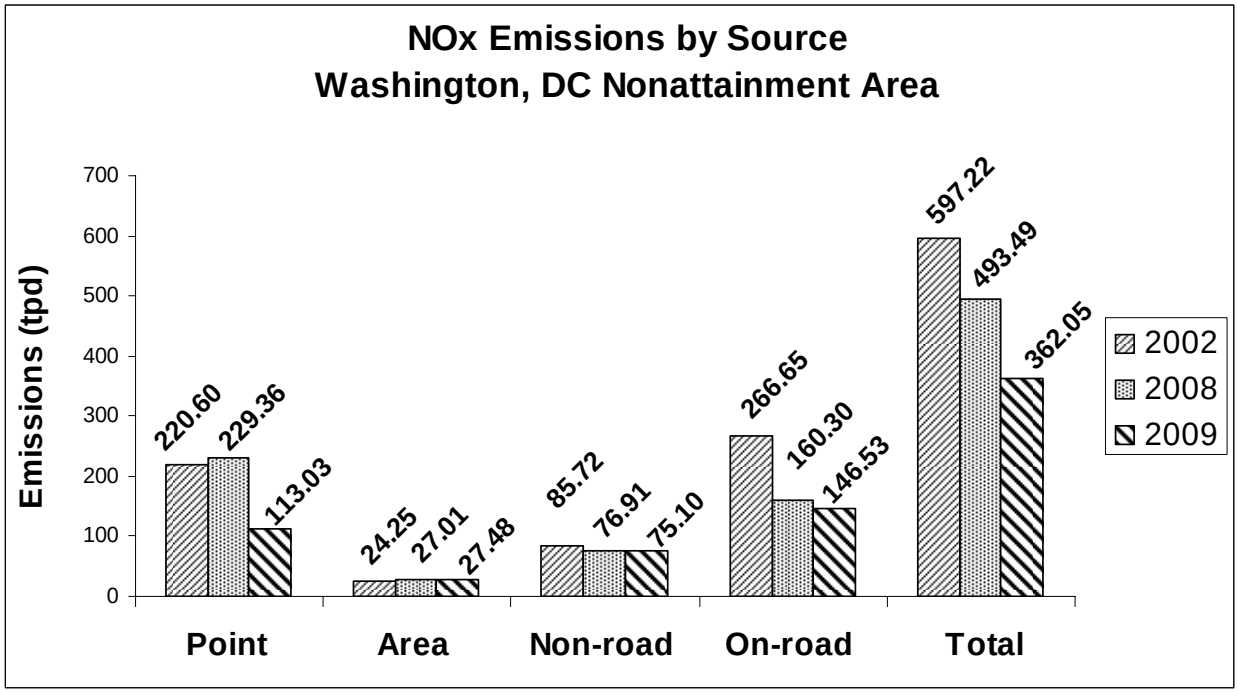


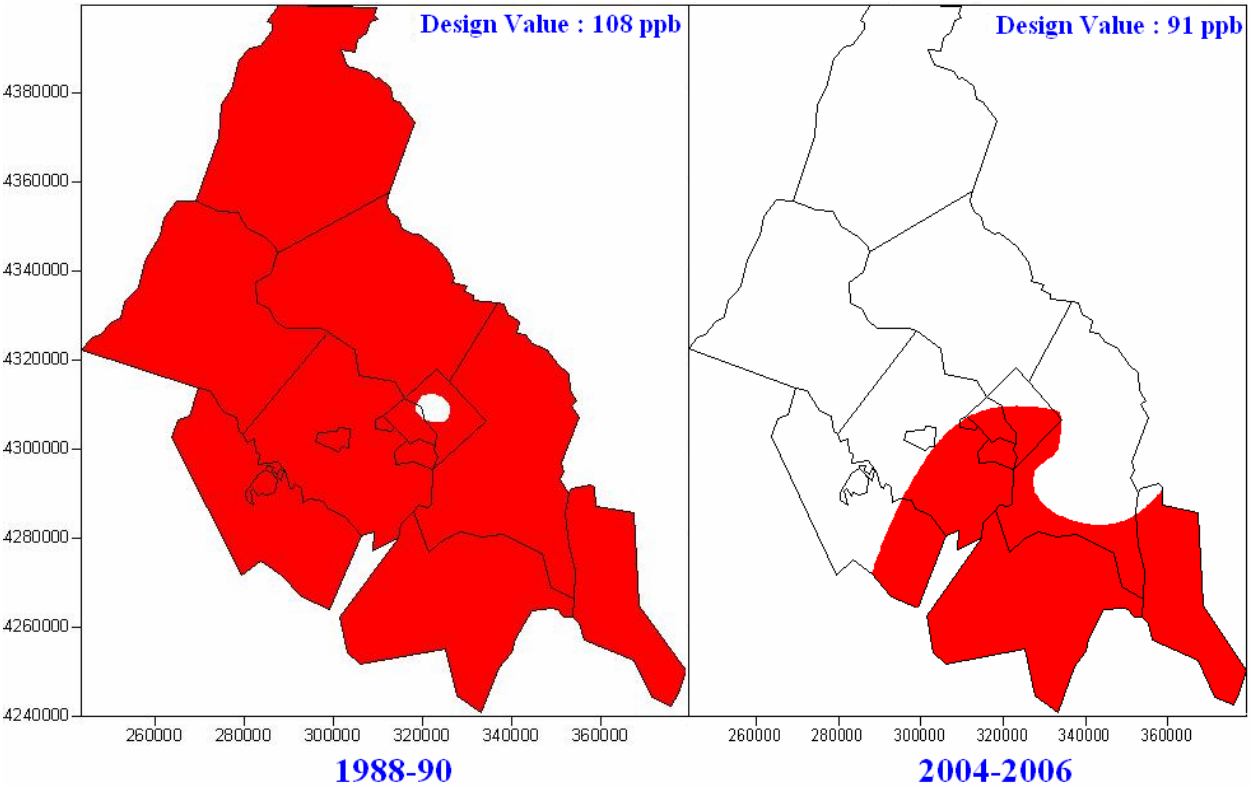
**Figure 10-7. NOx Emissions in the Washington, DC-MD-VA Nonattainment Area**




### 10.5.6 Spatial Extent of NAAQS Violations

The Washington, DC-MD-VA nonattainment area's geographical extent of violation has been decreasing in size since 1990. Figure 10-8 shows a decrease in the spatial extent of the nonattainment zone within the Washington, DC-MD-VA nonattainment region between 1990 and 2006. The actual nonattainment geographical area exceeding 8-hour ozone design value of 0.08 ppm (84 ppb) has been shown in red color in the figure. It is clear that almost entire Washington, DC metropolitan region was in nonattainment during 1988-1990. The 2004-2006 data show that the geographical extent of this area has reduced in size to portions of the District of Columbia, the city of Alexandria, and Arlington, Fairfax, Prince Williams, Charles, Calvert, and Prince George's counties. Ozone levels observed in these areas are not only the product of local emissions but are also impacted a great deal by the transport of ozone and its precursors from upwind areas. Not only the nonattainment zone in 2006 has been reduced to less than half in size compared to 1990, but also the design value has also been reduced by about 16 percent from 108 ppb to 91 ppb.

**Figure 10-8. Comparison of Nonattainment Zones within Washington, DC-MD-VA Nonattainment Area (1990 – 2006)**




### 10.5.7 Trend in 8-Hour Ozone Exceedance Days and High Temperature Days

Ozone concentrations are quite dependent on meteorological conditions especially temperature. High temperatures help drive ozone production. Correlations can be made between ozone concentrations and meteorological variables such as the number of 90ºF days. Hot dry summers can produce long periods of elevated ozone concentrations while ozone production can be limited during cool and wet summers.

Temperature data from the Dulles International Airport were reviewed during years considered warmer than normal to determine any trends between 8-hour ozone values and high temperature days. The years analyzed were 1998, 2002, 2005, and 2006. During these years, there were more than 30 days when temperatures equaled or exceeded 90ºF. Table 10-6 lists the number of 8-hour ozone exceedance days and the days with temperatures ≥ 90ºF in each of the four years mentioned above in the Washington, DC-MD-VA nonattainment area. In comparing these years to 1998, there has been a decline of 21% (2002), 58% (2005) and 56% (2006) in the number of 8-hour ozone exceedance days. The ratio of 8-hour exceedance days and days with maximum temperature ≥ 90ºF (fraction of the days with temperatures over 90ºF that had exceedances) is also declining through these years.

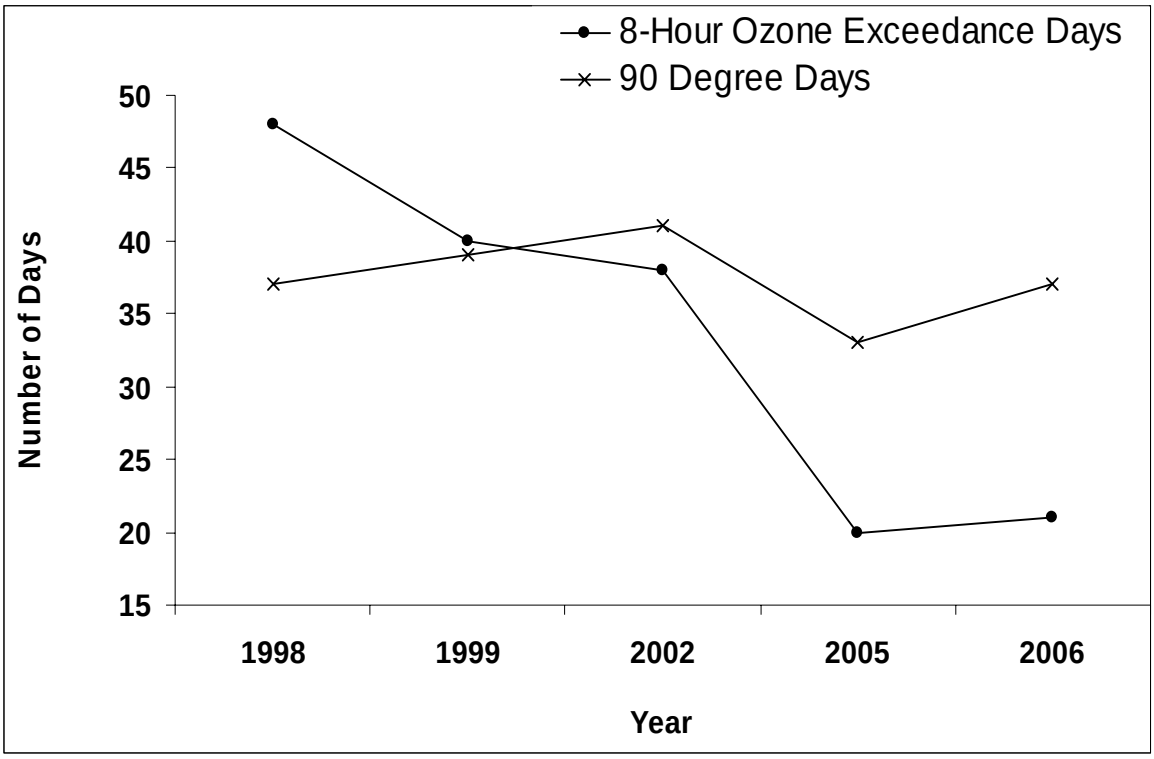
**Table 10-6. Temperature and 8-Hour Ozone Exceedances in the Washington, DC-MD-VA Ozone Nonattainment Area**

| Year | 8-Hour Ozone Exceedance Days | Days with Max. Temp ≥ 90ºF | Ratio of 8-Hour Exceedance Days and days with Max. Temp ≥ 90ºF |
|---|---|---|---|
| 1998 | 48 | 37 | 1.30 |
| 2002 | 38 | 41 | 0.92 |
| 2005 | 20 | 33 | 0.60 |
| 2006 | 21 | 37 | 0.57 |

Trend in the number of 8-hour ozone exceedance days and the number of days with maximum temperature ≥ 90ºF is shown in Figure 10-9. A close look at the Figure 10-9 reveals the number of ozone exceedance days on decline since 1998 even though the number of high temperature days has remained high and at more or less the same level in the four analysis years. The reason behind fewer ozone exceedance days after 1998 can be attributed to lower emission levels. While during 1998 temperatures below 90ºF were able to cause an exceedance, beginning 1999 exceedances occurred only when temperature reached more than 90ºF due to lower emission levels.

It is clear that the emission levels have been decreasing over the years and since 1999 they have been reduced to a level that the temperature must be more than 90ºF in order to exceed. A number of federal control measures such as, Acid Rain Program (Phase 1 – 1996 & Phase 2 – 2000) and NOx SIP Call (2004) were implemented during 1996-2004 to control emissions level. Also a wide range of local and regional control measures were implemented by Maryland, Virginia, and the District of Columbia beginning 1996, full benefits of which began in 1998. Emissions reductions from all the above mentioned measures combined resulted in the decrease in the number of ozone exceedance days since 1998.

**Figure 10-9. 8-Hour Ozone Exceedance Days and High Temperature Days (≥ 90ºF) in the Washington, DC-MD-VA Nonattainment Area**

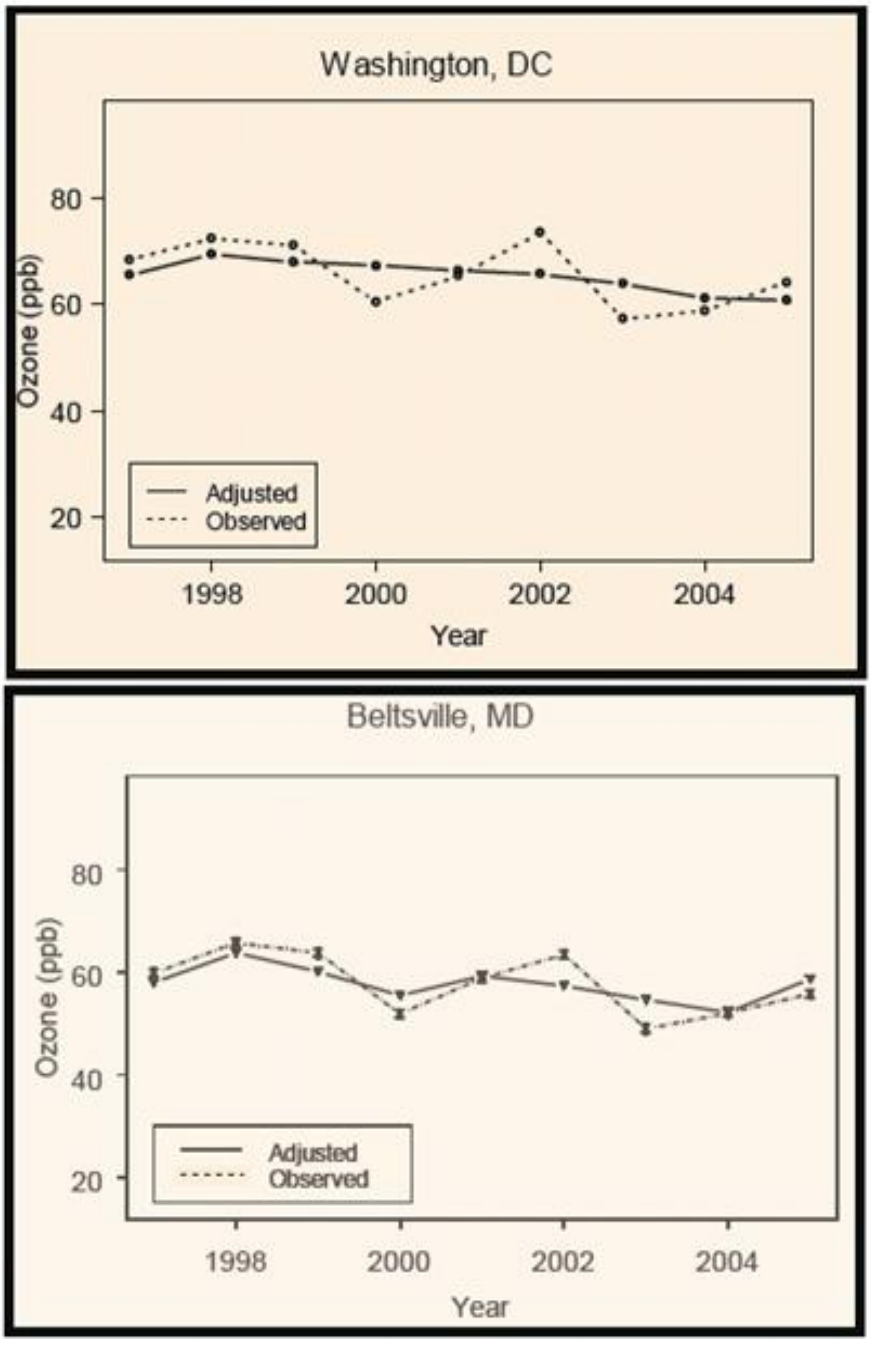



### 10.5.8 Trend in Meteorology-Adjusted Ozone Levels

Cox and Chu developed an advanced statistical technique, which allows the effects of meteorology (temperature, humidity, etc.) to be separated from the 8-hour ozone levels. EPA applied this technique at a number of monitors across the country to develop meteorology adjusted 8-hour daily maximum ozone levels and compared them to the observed 8-hour daily maximum ozone levels. This analysis was published in the EPA's ozone trend report titled *"Weather Makes a Difference: 8-hour Ozone Trends for 1997-2005"* in August 2006 and is available at http://www.epa.gov/air/airtrends/weather.html.

EPA performed this analysis for Washington, DC and Beltsville (Maryland) in Washington, DC-MD-VA ozone non-attainment area. Figure 10-10 shows the results for these two sites. It is quite clear from the two figures that a consistently declining trend is observed in ozone levels in response to consistently declining VOC and NOx emissions levels once the effect of meteorology has been removed. With emissions further projected to decline in 2009, ozone levels will also decline in the attainment year.

**Figure 10-10. Meteorology Adjusted Ozone Season Average 8-Hour Daily Maximum Ozone Trend (1997-2005)**




Source: Cox, William M. and Shao-Hang Chu. (1996). "Assessment of Interannual Ozone Variation in Urban Areas from a Climatological Perspective." *Atmospheric Environment*, 30.14, 2615-2625.

### 10.5.9 Alternative Design Value Calculation Techniques

#### 10.5.9.1 Methodologies for Calculating Baseline Design Values

The baseline measured concentrations at each monitoring site is the anchor point for future year projected concentrations. The baseline design values are projected to the future using RRFs. In practice, the choice of the baseline design value can be critical to the determination of the estimated future year design values. Therefore, careful consideration should be given to the calculation of baseline values.

EPA guidance also states that there are several possible methodologies to calculate baseline design values. Although EPA recommends using the average of the three design value periods which include the baseline inventory year, there is a high degree of uncertainty that this approach best represents baseline concentrations. Specifically, there is concern that weighting the 2002 concentrations three times in the calculation arbitrarily places too much weight on an individual year of meteorology and does not accurately reflect climate variability which has a significant impact on future design value projections.

Ideally, a statistical model that analyzes the inter-annual variability of pollutant concentrations due solely to meteorology fluctuations[5,6] should be used to predict the probability of future violation of the NAAQS at any monitoring site. In the absence of this statistical modeling analysis, a series of baseline design value calculations were performed in order to assess the effect on future design value projections. The following three calculation techniques were performed:

1. EPA Recommended Method - Baseline design values were calculated using the weighted average approach, using the three design value periods which include the baseline inventory year. Specifically, the average design values were calculated using the 2000-2002, 2001-2003, and 2002-2004 periods as described in Section 10.4.1.
2. 2001-2003 Design Value - Baseline design values were calculated using the design value period which straddles the 2002 baseline inventory year. This approach is an alternative approach in the EPA guidance. Sites that did not have adequate data available to calculate a design value for this period were excluded.
3. 2000-2004 Straight Average Design Value - Baseline design values were calculated using a straight average of the 5 year period centered on the 2002 baseline inventory year. Sites with less than 5 years of data were averaged over the number of available years of data. This approach provides a reasonable period of record to assess the inter-annual variability of meteorology without arbitrarily placing emphasis on any one year of meteorology.

[5] Cox, William M. and Shao-Hang Chu. 1993. *Meteorologically Adjusted Ozone Trends in Urban Areas: A Probabilistic Approach.* Atmospheric Environment: Part B: Urban Atmosphere (ATMOS. ENVIRON., PART B). Vol. 27B, no. 4, pp. 425-434. 1993.
[6] Cox, William M. and Shao-Hang Chu. 1996. *Assessment of Interannual Ozone Variation in Urban Areas from a Climatological Perspective.* Atmospheric Environment: 30.14, 2615-2625.

**Table 10-7. Methodologies for Calculating Baseline Design Values**

| AIRS ID | Site Name | Jurisdiction | State | EPA Method DVB | 2001-2003 DVB | 2000-2004 Straight Average DVB |
|---|---|---|---|---|---|---|
| 11-001-0025 | Takoma | District of Columbia | --- | 88.7 | 88 | 87.6 |
| 11-001-0041 | River Terrace | District of Columbia | --- | 89.0 | 92 | 85.2 |
| 11-001-0043 | McMillan | District of Columbia | --- | 92.7 | 94 | 89.6 |
| 24-009-0010 | Calvert | Calvert | MD | NA | NA | NA |
| 24-017-0010 | Southern MD | Charles | MD | 93.0 | 94 | 91.6 |
| 24-021-0037 | Frederick Municipal Airport | Frederick | MD | 87.3 | 88 | 85.8 |
| 24-031-3001 | Rockville | Montgomery | MD | 86.7 | 88 | 85.2 |
| 24-033-0002 | Greenbelt | Prince George's | MD | 94.0 | 93 | 92.5 |
| 24-033-8003 | PG Equestrian Center | Prince George's | MD | 94.0 | NA | 94.7 |
| 51-013-0020 | Aurora Hills | Arlington County | VA | 96.7 | 99 | 92.8 |
| 51-059-0005 | Chantilly | Fairfax County | VA | 87.0 | 89 | 85.2 |
| 51-059-0018 | Mount Vernon | Fairfax County | VA | 96.7 | 97 | 95.4 |
| 51-059-0030 | Franconia | Fairfax County | VA | 95.0 | 97 | 91.8 |
| 51-059-1005 | Annandale | Fairfax County | VA | 94.0 | NA | 94.0 |
| 51-059-5001 | McLean | Fairfax County | VA | 88.0 | 88 | 86.0 |
| 51-107-1005 | Ashburn | Loudoun County | VA | 90.0 | 92 | 87.0 |
| 51-153-0009 | Long Park | Prince William County | VA | 85.0 | 87 | 83.6 |
| 51-510-0009 | Alexandria | Alexandria City | VA | 90.0 | 92 | 86.8 |

### 10.5.9.2 Methodologies for Calculating Relative Response Factors

In addition to the variability associated with base design value calculations, there is also uncertainty in the calculation of relative response factors (RRFs). As a result, three techniques were used to calculate the RRFs to assess the impact on future design value projections. RRF calculations for each of the following techniques are provided in Table 10-8.

1. EPA Recommended Method – Utilizes the default recommendations for "nearby" grid cells, with a 3x3 grid cell array for 12-km resolution modeling. The relative response factor (RRF) used in the modeled attainment test is computed by taking the ratio of the mean of the 8-hour daily maximum predictions in the future to the mean of the 8-hour daily maximum predictions with baseline emissions, over all relevant days.

   EPA recommends this approach because of the following three reasons:

   a. Consequence of a control strategy may be "migration" of a predicted peak. If a State were to confine its attention only to the cell containing a monitor, it might underestimate the RRF (i.e., overestimate the effects of a control strategy).

   b. Uncertainty in the formulation of the model and the model inputs is consistent with recognizing some leeway in the precision of the predicted location of daily maximum ozone concentrations.

c. Standard practice in defining a gridded modeling domain is to start in the southwest corner of the domain, and determine grid cell location from there. Considering several cells "near" a monitor rather than the single cell containing the monitor diminishes the likelihood of inappropriate results which may occur from the geometry of the superimposed grid system.

2. Grid Cell Average Technique – Utilizes the default recommendations for "nearby" grid cells, with a 3x3 grid cell array for 12-km resolution modeling. The relative response factor (RRF) used in the modeled attainment test is computed by taking the ratio of the mean of the 8-hour daily maximum predictions averaged across the 3x3 grid cell array surrounding the monitor in the future to the mean of the 8-hour daily maximum predictions averaged across the 3x3 grid cell array surrounding the monitor with baseline emissions, over all relevant days.

   The following rules shall were applied to determine the number of days and the minimum threshold at each ozone monitor:

   a. If there were 10 or more days with daily maximum 8-hour average modeled ozone > 85 ppb, averaged over the 3x3 grid cell array, an 85 ppb threshold was used.

   b. If there was less than 10 days with daily maximum 8-hour average modeled ozone > 85 ppb, averaged over the 3x3 grid cell array, the threshold was reduced to as low as 70 ppb until there was 10 days in the mean RRF calculation.

   c. If there was less than 10 days with daily maximum 8-hour average modeled ozone > 70 ppb, averaged over the 3x3 grid cell array, then all days > 70 ppb was used.

   d. No RRF calculations shall be performed for sites with less than 5 days > 70 ppb, averaged over the 3x3 grid cell array.

   This technique is effective in that it only looks at days where the average 8-hour ozone maximum surrounding the monitor exceeds 85 ppb and excludes the evaluation of days that have an isolated peak or a tight concentration gradient in the vicinity of the monitor that can be difficult to model.

3. Grid Cell Only Technique – Utilizes the grid cell where the monitor is located and does not employ an array of grid cells surrounding the monitor. The relative response factor (RRF) used in the modeled attainment test is computed by taking the ratio of the mean of the 8-hour daily maximum predictions in the future to the mean of the 8-hour daily maximum predictions with baseline emissions, over all relevant days.

   There are a few reasons why it might be appropriate to use this technique:

   a. There are occasions where the use of unmonitored grid cells nearby a monitor may not adequately characterize what is happening at the monitor.

   b. Model performance evaluations (MPE) are only conducted for the grid cells containing monitors; therefore, it may be beneficial to have the model attainment test remain consistent with the MPE and only use these grid cells.

c. Calculating RRFs based on nearby cells that change locations between the baseline simulation and future simulation (not paired in space) may lead to erroneous and misleading conclusions.

**Table 10-8. Methodologies for Calculating Relative Response Factors**

| AIRS ID | Site Name | Jurisdiction | State | EPA Method | 9-Cell Average Method | Grid Cell Only Method |
|---|---|---|---|---|---|---|
| 11-001-0025 | Takoma | District of Columbia | --- | 0.892 | 0.874 | 0.886 |
| 11-001-0041 | River Terrace | District of Columbia | --- | 0.883 | 0.872 | 0.909 |
| 11-001-0043 | McMillan | District of Columbia | --- | 0.883 | 0.872 | 0.909 |
| 24-009-0010 | Calvert | Calvert | MD | 0.836 | 0.815 | 0.81 |
| 24-017-0010 | Southern MD | Charles | MD | 0.808 | 0.806 | 0.794 |
| 24-021-0037 | Frederick Municipal Airport | Frederick | MD | 0.846 | 0.833 | 0.844 |
| 24-031-3001 | Rockville | Montgomery | MD | 0.881 | 0.861 | 0.86 |
| 24-033-0002 | Greenbelt | Prince George's | MD | 0.869 | 0.857 | 0.857 |
| 24-033-8003 | PG Equestrian Center | Prince George's | MD | 0.865 | 0.838 | 0.837 |
| 51-013-0020 | Aurora Hills | Arlington County | VA | 0.891 | 0.875 | 0.893 |
| 51-059-0005 | Chantilly | Fairfax County | VA | 0.867 | 0.858 | 0.888 |
| 51-059-0018 | Mount Vernon | Fairfax County | VA | 0.883 | 0.872 | 0.868 |
| 51-059-0030 | Franconia | Fairfax County | VA | 0.88 | 0.873 | 0.877 |
| 51-059-1005 | Annandale | Fairfax County | VA | 0.88 | 0.873 | 0.877 |
| 51-059-5001 | McLean | Fairfax County | VA | 0.883 | 0.869 | 0.864 |
| 51-107-1005 | Ashburn | Loudoun County | VA | 0.869 | 0.872 | 0.874 |
| 51-153-0009 | Long Park | Prince William County | VA | 0.871 | 0.865 | 0.866 |
| 51-510-0009 | Alexandria | Alexandria City | VA | 0.883 | 0.872 | 0.868 |

### 10.5.9.3 Future Design Value Ranges

In order to assess the sensitivity of the future design value calculations, a matrix using relative response factor and base design values. This results in 9 combinations of future design values for each monitor, except where missing data is noted. A summary of the minimum and maximum DVFs for each monitor is provided in Table 10-9.

The minimum DVFs for all monitors fall below the 85 ppb attainment threshold. It is also important to note that there is a high degree of sensitivity in the DVF calculations for the Arlington County monitor, where the range is from 81 ppb to 88 ppb. Detailed calculations are provided in Appendix G Attachment 11 for all runs conducted by the OTC, ASIP, and VADEQ.

**Table 10-9. Future Design Value Ranges (BOTW +VA CAIR Modeling Run)**

| AIRS ID | Site Name | Jurisdiction | State | Minimum DVF | Maximum DVF |
|---|---|---|---|---|---|
| 11-001-0025 | Takoma | District of Columbia | --- | 76 | 79 |
| 11-001-0041 | River Terrace | District of Columbia | --- | 74 | 83 |
| 11-001-0043 | McMillan | District of Columbia | --- | 78 | 84 |
| 24-009-0010 | Calvert | Calvert | MD | NA | NA |
| 24-017-0010 | Southern MD | Charles | MD | 72 | 75 |
| 24-021-0037 | Frederick Municipal Airport | Frederick | MD | 71 | 74 |
| 24-031-3001 | Rockville | Montgomery | MD | 73 | 77 |
| 24-033-0002 | Greenbelt | Prince George's | MD | 79 | 81 |
| 24-033-8003 | PG Equestrian Center | Prince George's | MD | 78 | 81 |
| 51-013-0020 | Aurora Hills | Arlington County | VA | 81 | 88 |
| 51-059-0005 | Chantilly | Fairfax County | VA | 73 | 79 |
| 51-059-0018 | Mount Vernon | Fairfax County | VA | 82 | 85 |
| 51-059-0030 | Franconia | Fairfax County | VA | 80 | 85 |
| 51-059-1005 | Annandale | Fairfax County | VA | 82 | 82 |
| 51-059-5001 | McLean | Fairfax County | VA | 74 | 77 |
| 51-107-1005 | Ashburn | Loudoun County | VA | 75 | 80 |
| 51-153-0009 | Long Park | Prince William County | VA | 72 | 75 |
| 51-510-0009 | Alexandria | Alexandria City | VA | 75 | 81 |

### 10.5.10 Uncertainty in CMAQ Modeling

#### 10.5.10.1 Background

CMAQ is a state-of-the-art air quality modeling tool used to predict future ozone concentrations for use in attainment demonstrations. The University of Maryland assessed the model's performance and examined the implications for the attainment demonstration and weight of evidence. The University of Maryland's research complements the model performance evaluation conducted by the Virginia Dept. of Environmental Quality and described in Section 10.3. The University of Maryland Department of Meteorology's research is summarized below. Details of this research are in Appendix G Attachment 15.

#### 10.5.10.2 Analysis of Model Performance

The University of Maryland found that CMAQ does an excellent job of capturing the mean distribution of surface layer ozone during the ozone season. However, their research identified several characteristics of the model that could impact the conclusions of the attainment modeling results. The University of Maryland analyses involved comparisons of surface and aircraft ozone measurements and CMAQ ozone simulations. As described in more detail in Appendix G, the results of these analyses indicate the following:

- CMAQ underestimates ozone concentrations in upwind areas
- CMAQ underestimates ozone concentrations aloft
- CMAQ overestimates ozone formation in urban areas

- CMAQ biases in upwind areas are larger when air quality is poor
- CMAQ underestimates the contribution of transported pollution on concentrations within the nonattainment area
- CMAQ underestimates the importance of NOx controls in upwind areas.

***CMAQ Underestimates Ozone Concentrations in Upwind Areas.*** CMAQ exhibits its best performance in urban areas (small bias), less success in suburban areas (underestimates ozone, a larger negative bias), and its worst performance in rural areas (underestimates ozone more, larger negative bias). The model's performance is at its worst in upwind, rural areas. In particular, research indicates that the ozone in Virginia and the Ohio River Valley is under-predicted.

***CMAQ may Underestimate Ozone Aloft.*** In comparison to aircraft observations, the base-case model run underestimates the rate of photochemical smog production above about 500 m and overestimates it below this altitude.

***CMAQ Overpredicts Ozone Formation in Urban Areas.*** The CMAQ model tends to overestimate the rate of formation and concentration of ozone, especially in VOC-rich urban plumes. The overall chemistry may therefore be more $NO_x$-limited than CMAQ would suggest. It is believed that the CB4 mechanism used in the version of CMAQ run for this SIP is simplified and missing reactions that were thought to be inconsequential, but are now known or in some instances suspected to play a larger role than previously thought. Altogether, these reactions could sequester at least 1.5 ppbv NOx.

***CMAQ Biases are Larger when Air Quality is Poor.*** Biases between CMAQ-calculated and measured 8-hour ozone concentrations are minimal (1-2 ppbv) when averaged over the summer but there is a large negative bias in rural upwind areas (7-8 ppbv) on days when air quality is poor.

***CMAQ Underestimates the Contribution of Transported Pollution on Ozone Concentrations in the Nonattainment Area.*** The transport of ozone into and within the State of Maryland above the nocturnal boundary layer was examined using a combination of aircraft and ground-based measurements. These aircraft observations indicate that CMAQ underestimates transport. The research indicates that when upwind pollution source regions lay over the Ohio River Valley (~59% of aircraft profiles), transport accounted for 69-82 percent of the afternoon boundary layer ozone.5 When winds were weak (~27% of aircraft profiles), transport only accounted for 58 percent of the afternoon boundary layer ozone.

The ground level ozone data obtained from MDE monitoring stations has also been examined for evidence of downward mixing. On days when the transported ozone is low, peak ozone occurs at about 15:00 EST. However when the transported ozone is large, an earlier peak occurs at about 10:00 EST, corresponding to the breakdown of the nocturnal boundary layer. The rate of increase of ozone within this peak is about four times greater than that due to pure photochemistry.

***CMAQ Underestimates the Importance of Reducing Upwind NOx Emissions and Overestimates the Significance of Local Sources.*** Several studies suggest that CMAQ, and likely photochemical models in general, under-predict the change in ozone concentrations that result from a change in $NO_x$ emissions, particularly those from upwind power plants (and large industrial sources). CMAQ shows that although model simulated $NO_x$ reductions result in ozone reductions, the percentage reductions in ozone were smaller than the percentage reductions in $NO_x$.

Even when compared to results from within the 2002 ozone season, CMAQ under- predicts daily ozone variability, and shows important model performance issues in areas just upwind of Maryland on high ozone days, namely in the Ohio River Valley and central Virginia. A study of the 2003 Northeast Blackout [Marufu et al., 2004] shows that the blackout caused a drop of at least 7 ppbv ozone (partly attributable to decreases in power plant emissions), and likely considerably more, while a modeling study of the same event [Hu et al., 2006] used CMAQ to predict only a 2.2 ppbv change.

Analysis of ozone trends before and after the $NO_x$ SIP Call reveals that Maryland's ozone improved significantly after the $NO_x$ SIP Call. Ozone values were binned according to peak temperature to remove most of the effects of meteorology from the analysis, revealing a consistent 12 percent downward trend in ozone after the SIP Call. An ongoing study by EPA reveals that the $NO_x$ SIP call likely produced double the benefit that CMAQ predicted.

### 10.5.10.3 Implications of CMAQ Performance on Attainment Demonstration

Demonstrated issues with CMAQ's performance, particularly with respect to extreme values and transport, imply that CMAQ predicted future ozone concentrations are overestimated for the Washington, DC-MD-VA non-attainment area. The results imply that the Washington, DC-MD-VA region may be more likely to comply with the ozone standard than the model indicates.

The transport of pollutants from areas outside the region has an extremely important impact on the attainment of the 8-hour ozone standard. The evidence from both the aircraft and the station ozone data clearly points to the importance of transport in the overall quality of the air in the Washington region.7 Upwind power plant emission sources of $NO_x$ and $SO_2$ from West Virginia, Ohio, and Pennsylvania along the Ohio River Valley play a crucial role in the amount of ozone and aerosol measured in the lower troposphere in the Mid-Atlantic region. Due to the higher stack heights of power plants these emissions are more likely to be transporter large distances. The effect of the transported ozone is to add ozone early in the day and hence to expand the time interval over which the ozone levels may exceed 85 ppbv.

In some instances, emissions in the rural/suburban areas upwind of the Washington region are dominated by power-plant emissions. The analysis indicates that ozone after the $NO_x$ SIP Call improved significantly, suggesting that future control programs similar to those implemented

[7] The study of the relative contribution of transported and local photochemistry to the ozone data for six exceedance days in August 2002 suggests that if local photochemistry were the only source of ozone, none of the 6 days examined would have exceeded the 8-hour ozone standard.

over this time period should be highly effective as well. This suggests that $NO_x$ controls, and especially power plant controls are likely to be similarly effective in controlling ozone in the future.

The research also suggests that regional control programs should be more effective than predicted by CMAQ and local programs somewhat less effective. Since the bulk of the control programs in the SIP are regional (e.g. fleet turnover, heavy duty diesels, and the Clean Air Interstate Rule), greater changes in surface ozone can be expected than those predicted by CMAQ, especially given CMAQ's lack of response to changes in emissions.

### 10.5.11 Local Government Voluntary Initiatives

In addition to participating in Clean Air Partners programs (described in the following sections), 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. Programs include:

- Local jurisdictions have committed to purchasing low-emission vehicles reducing emissions from on-road sources.
- Shutdowns of county waste-to-energy facilities reduce stationary source emissions.
- Reducing emissions from peaking units that generate electricity can reduce NOx emissions during periods of poor air quality.
- 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.
- Tree planting programs are being developed by the local jurisdictions in the region as a long term strategy to improve air quality.

Local jurisdictions in the Washington region are making program commitments reflected in the Voluntary Bundle (Chapter 6) or, in the case of low-emission vehicle purchases, are reserving emission reduction credits that the purchases may generate for potential future use in meeting transportation conformity. The City of Alexandria has specifically requested that a variety of programs being implemented by the city, including low-emission vehicle purchases, use of low-VOC paints, Green Building and energy efficiency programs, and episodic programs, be applied in the SIP as weight of evidence.

Though the benefits of episodic programs are not reflected in the region's 2009 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 2009.

### 10.5.11.1 Voluntary Action Campaign: 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 and 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.

The Ozone Action Days employer program was established in 1995 in the Baltimore/Washington region. This program encourages employers and their employees to take voluntary actions to reduce ozone pollution causing emissions. When the Environmental Protection Agency (EPA) designated both Baltimore and Washington, DC metropolitan regions as nonattainment for fine particles, Clean Air Partners' Board of Directors changed the name of the program from Ozone Action Days to Air Quality Action Days (AQAD).

The AQAD program is designed to educate employers and employees to take voluntary actions, specifically on Code Red days. It was argued that voluntary actions taken on the worst days of summer would "shave the peaks," or reduce the high ozone levels on the worst days. Clean Air Partners provides resources and information to a network of AQAD participants. Clean Air Partners assists employers in establishing on-site programs designed to reduce employee travel on bad air days; and encourages voluntary actions by business, industry, government, and individuals to restrict activities that contribute to the formation and risks of bad air. Approximately 600 employers and individuals are registered as AQAD participants and have committed to take voluntary actions to reduce emissions on Code Red days.

Clean Air Partners runs an extensive education campaign throughout the ozone season, May to September, to educate the public about the effects of ground-level ozone and fine particles. The messages tell people what they can do to protect their health and improve air quality. Air quality forecasts are distributed daily by fax and email to the media and Air Quality Action Days participants. The air quality forecast is color-coded for ease of communication, following EPA's regulation for the Air Quality Index (AQI).

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 unhealthy air days. The ad messages target individual emission reduction actions for behavior modification and the heath effects of poor air quality.

### *Evaluation of Voluntary Action Campaign*

Despite improvements in the region's air quality, new challenges lie ahead for the AQAD employer program. Prior to 2006, Clean Air Partners asked its participants to take voluntary actions on Code Red days, which was associated with the 1-hour ozone standard. When EPA set the 8-hour ozone standard to coincide with the Code Orange Air Quality Index it resulted in approximately 20 or more days per year that exceed the standard.

Typically 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 eight times since 1995, is used 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. A 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. Survey results show a steady increase in the public's "willingness to act," with 76 percent of the respondents indicating a belief that the individual can make a difference.

### *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 studied, 1996-2001. Knowledge that Code Red indicates unhealthy air when activity should be limited increased significantly during the period. A 2002 survey showed over 90 percent surveyed knew that today was a "Code Red/Bad Air Day," and 67 percent said the phrase Code Red means "air is unhealthy."

The end-of-season survey results for the Washington metropolitan region show the percentage of residents willing to act grew from 35 percent to 44 percent over a six-year period. The percentage of people reporting changing their behavior in response to the Code Red message grew to 66 percent, an increase of 23 percent from 1996. The findings from the surveys show:

- Increase in knowledge about ground-level ozone and color-code rating system
- Steady increase in "willingness to act" from 35 percent in 1996 to 44 percent 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 percent).[8]

[8] "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.

### 10.5.11.2 Code Red/Code Orange Telework Program

Clean Air Partners is adopting a new program to increase teleworking as an episodic strategy. Beginning in the summer of 2007, Clean Air Partners will promote teleworking throughout government and businesses when air quality is forecasted to be in the unhealthy for sensitive groups range, Code Orange or above. The decision to initiate Clean Air telework days will be guided by forecasts issued using the Air Quality Index (AQI). Three-day forecasts are issued by the Maryland Department of the Environment and the Metropolitan Council of Governments for the Washington region.

Clean Air Partners will develop a toolkit that will assist organizations in promoting, establishing and tracking a telework program and provide resources for keeping abreast of forecasted and current air quality levels in the region. Participants will be asked to track their participation using a web-based system that tracks auto emission reductions resulting from teleworking (NOx, VOC, CO, and $CO_2$).

The University of Maryland (UM) will evaluate the telework program through photochemical modeling by using different assumptions regarding the programs effectiveness at reducing Vehicle Miles Traveled (VMT). Preliminary UM modeling indicates that a strengthened telework program has the potential to reduce VMT and thereby leads to a measurable ozone reduction on the worst days of summer (see Appendix G Attachment 14)

### 10.5.11.3 High Electrical Demand Day Emission Reduction Strategies

Emissions from Electric Generating Units (EGUs) are higher on high electric demand days, resulting in poorer air quality. High electrical demand day (HEDD) operation of EGUs generally have not been addressed under existing air quality control requirements, and these units are called into service on the very hot days of summer and on very cold days of winter when air pollution levels typically reach their peaks.

The Ozone Transport Commission (OTC) has been meeting with state environmental and utility regulators, EPA staff, EGU owners and operators and the independent regional systems operators to assess emissions associated with HEDD during the ozone season and to address excess NOx emissions on HEDDs. The OTC has found that NOx emissions are much higher on a high electrical demand day than on a typical summer day and there is the potential to reduce HEDD emissions by approximately 25 percent in the short term through the application of known control technologies. HEDD units consists of gasoline and diesel combustion turbines, coal and residual oil burning units. A group of six OTC states has agreed to pursue non-regulatory strategies with the EGUs to achieve reductions in NOx emissions associated with HEDD units on high electrical demand days during the ozone season. The six states agreed to achieve these additional reductions beginning with the 2009 ozone season or as soon as feasible thereafter, but no later than 2012.

On March 2, 2007, the OTC states and the District of Columbia agreed to a Memorandum of Understanding (MOU) committing to reductions from the HEDD source sector. The MOU includes specific targets for a group of six states to achieve reductions in NOx emissions associated with HEDD units on high electrical demand days during the ozone season. These states agreed to achieve these reductions beginning with the 2009 ozone season or as soon as feasible thereafter, but no later than 2012. The remaining OTC states including Virginia and the District of Columbia agreed to continue to review the HEDD program and seek reductions where possible but they do not have a formal emissions reduction target in the MOU.

Through the HEDD MOU commitments, significant NOx reductions are anticipated in the Washington DC-MD-VA ozone nonattainment area from the program Maryland expects to develop with EGUs. Maryland has agreed to a specific NOx emission reduction target in the MOU of a state-wide reduction of NOx emissions from HEDD units by 32 percent, or an estimated 23.5 tons per day. The OTC MOU is included in Appendix G.

### 10.5.11.4 Tree Canopy Programs

Large-scale tree-planting programs offer a method to improve air quality across the Washington, DC-MD-VA ozone non-attainment area. Tree cover in urban areas plays an important role in the complex system of ground level ozone production. Results from analysis conducted by the University of Maryland suggest that decreases in ground level ozone concentrations on the order of 1-3 ppbv could be realized with an increase in urban tree cover ranging from 20-40 percent. Corresponding changes in wind speed will occur in modified areas as well. These changes are the result of the lessening of the urban "heat island" effect. Heat islands form as cities replace natural land cover with pavement, buildings, and other infrastructure. The heat in a heat island is the result of the different radiative properties (i.e. the ability of objects to absorb and/or reflect the sun's energy) between urban and rural areas. Urban areas are more efficient at absorbing sunlight than rural areas. The excess energy absorbed by urban areas is eventually reradiated back to the atmosphere in the form of heat (aka infrared radiation). Weakening of the heat island effect results in a transfer of energy from the urban areas to downwind areas which causes some locations to observe a slight increase in surface temperatures (1-2 °C) and in wind speeds (1-2 $ms^{-1}$).

The general consensus from the studies mentioned above suggests that increased tree cover has a beneficial effect on local air quality by reducing ozone in and around urban areas. As discussed in Appendix G, the modeled temperature changes are accompanied by changes in ground level ozone concentrations. Owing to the complexity of the system, changes in ozone, like temperature, are not confined to locations where trees are planted. Different locations downwind of modified areas observed either increased or decreased ozone levels depending on a variety of factors. The reduction of surface temperature (specifically, cooling in urban areas) obtained from the numerical modeling studies was used as the basis for predicting changes in daily mean peak 8-hour ozone levels derived from a multiple linear regression model for the Baltimore Non-Attainment Area.

A large-scale tree-planting program may lead to improved air quality. Given the slow growth rate of trees, large scale tree planting is a long term solution. It is believed that the genera of

trees used to reforest is important, but what species of tree offers the most benefit is not clear and may differ from locale to locale. Other significant, logistical questions also need to be considered when planning a large-scale tree planting program. In the near term, this analysis points to the importance of programs to maintain tree cover and prevent increases in ozone due to loss of tree cover.

## 10.6 Summary and Conclusions of Attainment Demonstration

The photochemical modeling combined with supporting weight-of-evidence analysis provide strong evidence the region will attain the 8-hour ozone standard by 2009.

## 10.7 Procedural Requirements

### 10.7.1 Reporting

Documents, technical memorandums, and data bases developed in this study are available for distribution as appropriate. This report contains the essential methods and results of the conceptual model, episode selection, modeling protocol, base case model development and performance testing, future year and control strategy modeling, quality assurance, WOE analyses, and calculation of 8-hr ozone attainment via EPA's relative response factor (RRF) methodology.

### 10.7.2 Data Archival and Transfer of Modeling Files

All relevant data sets, model codes, scripts, and related software required by any project participant necessary to corroborate the study findings (e.g., performance evaluations, control strategy runs) will be provided in an electronic format approved by the Technical Committee within the framework of MWAQC. The Technical Committee has archived all modeling data relevant to this project. Transfer of data may be facilitated through the combination of a project website and the transfer of large databases via overnight mail. Database transfers will be accomplished using an ftp protocol for smaller datasets, and the use of IDE and Firewire disk drives for larger data sets.

# 11.0 CONTINGENCY PLAN

The General Preamble and EPA guidance 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. Contingency measures are required for each milestone year. Air quality plans must include sufficient contingency measures to account for up to 3% of the base-year inventory adjusted to the appropriate milestone year.

## 11.1 Contingency Measures for the 2008 (RFP) Further Progress Demonstration

### 11.1.1 Background

EPA requires the Washington region to include a contingency plan containing adopted measures that qualify as contingency measures for the 2002-2008 Reasonable Further Progress (RFP). This section fulfills the requirement for the RFP contingency.

### 11.1.2 Required Reductions

The contingency measures for the 2008 RFP and attainment demonstrations must total 3% of the 2002 adjusted base year inventory. A minimum of 0.3 percent VOC must be included. The inventory is calculated as described in Sections 4 and 5. Table 11-1 shows the calculation of the necessary reductions.

**Table 11-1**
**Calculation of VOC and NOx Reductions for RFP Further Progress Contingency**
**(Ozone Season tons per day)**

| Description | VOC | NOx |
|---|---|---|
| 2002 RFP Base-Year Inventory (a) | 448.28 | 597.22 |
| Non-creditable Emissions Reduction (b) | 12.45 | 31.61 |
| Adjusted Base-Year Inventory (c) = (a-b) | 435.83 | 565.61 |
| 0.3% VOC Reduction Required for RFP Contingency (d) = (0.3/100) * (c) | 1.31 | |
| 2.7% NOx Reduction Required for RFP Contingency (e) = (2.7/100) * (c) | | 15.27 |

Contingency reductions must occur on a timetable that is directly related to the RFP SIP schedule. States have no more than one year after notification by EPA of an RFP failure to achieve the contingency plan reductions. For a potential RFP failure, notification would be received in 2009, therefore the contingency reductions must be achieved no later than 2010.

### 11.1.3 Identified Contingency Measures

Table 11-2 lists the contingency measure identified by the District of Columbia, Maryland and Virginia for the 2008 RFP demonstration. This measure delivers a total benefit of 1.3 tons per day (tpd) VOC and 15.3 tpd NOx. The combined reduction equals 3% of the Adjusted Base Year Inventory, therefore meeting the contingency measure requirement calculated in Table 11-1.

**Table 11-2**
**Contingency Measures for 2008 Reasonable Further Progress (RFP)**
**(Ozone Season tons per day)**

| Ref. No. | Contingency Measure | VOC (tons/day) | NOx (tons/day) |
|---|---|---|---|
| 6.2.12<br>6.2.17 | Ozone Transport Commission Portable Fuel Containers Rule | 1.31 | 0 |
| 6.1.2 | Regional Transport NOx Reductions (Clean Air Interstate Rule, Healthy Air Act) | 0 | 15.3 |
| **TOTAL REDUCTIONS** | | **1.31** | **15.3** |

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 11-3 according to the timetable indicated in Chapters 6 and 9. EPA's guidance on early implementation of control measures is as follows:

> *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 RFP demonstration contained in this SIP. They will not be used to meet that milestone requirement. As a result, the states will not be required to backfill any contingency measures that they choose to implement in advance of the requirement.

### 11.1.4 Portable Fuel Containers Rule: Phase I and Phase II

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, the District, and Virginia all adopted Phase I and are in the process of adopting Phase II of the OTC Model Rule for Portable Fuel Containers.

## Implementation

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

## Projected Reductions

| | VOC Emission Reductions (tons per day) | | | |
|---|---|---|---|---|
| | **District of Columbia** | **Maryland** | **Virginia** | **Total** |
| VOC Reductions | 0 | 0.83 | 0.48 | 1.31 |

## Emission Benefit Calculations

Projected reductions are based on an emission reduction factor of 75% after full implementation after 10 years. Implementation began in 2005. In 2008, the emission reduction factor is 30%. In 2009, the emission reduction factor is 37.5%. Phase II reductions are based on an additional 4 percent reduction in emissions of VOC.

Note that the District's OTC VOC rules on all the applicable area source categories are or will be fully adopted, submitted to EPA, and federally enforceable measures. However, the emission reductions arising from these measures in the District are not applied to the emissions inventories presented in this RFP/attainment modeling/contingency demonstration of the Washington DC-MD-VA regional SIP. The District of Columbia's measures are expected to provide additional enhancements to the air quality improvement in the region.

### 11.1.5 Regional NOx Transport Requirements

This section documents contingency credit for NOx emissions reductions attributable to federal and regional NOx requirements on point sources. These credits include:

- EPA's Clean Air Interstate Rule (CAIR); and
- Maryland's Healthy Air Act.

**Control Strategy**

Clean Air Interstate Rule (CAIR)
In 2004, the U.S. EPA promulgated the Clean Air Interstate Rule, which requires reductions in emissions of NOx and SO2 from large fossil fuel-fired electric generating units. The rule is set up in several phases with the first phase of NOx reductions to come by 2009. The rule sets up both an annual emissions budget and an ozone season emissions budget. The rule requires that units with nameplate capacity greater than 25 megawatts emit no more NOx than their allocations determined by the state either through emission controls or banking and trading.

Virginia CAIR
Virginia has adopted state regulations codifying the requirements of the Clean Air Interstate Rule. Virginia's rules create an emissions cap based on the allowances allocated to the facility. The rules do not allow trading as a method of complying with the emissions cap.

Maryland Healthy Air Act
In April of 2006 the Maryland General Assembly and Governor Ehrlich adopted the Healthy Air Act (HAA), a law that requires reductions in NOx, $SO_2$, and Mercury emissions from Maryland's largest and oldest coal fired power plants. Maryland implements the HAA through regulation. The regulation requires reductions in NOx emissions from coal-fired electric generating units (excluding fluidized bed combustion units) starting in 2009. By 2009 Maryland expects an approximate 70 percent reduction in NOx emissions from these regulations when compared to 2002 emissions. To meet the requirements of Maryland's regulations a company's "system" (covered units owned by the same company) must meet a system-wide cap by 2009. Compliance cannot be achieved through the purchase of allowances under the HAA.

District of Columbia CAIR
The District of Columbia is currently drafting its Clean Air Interstate Rule (CAIR). The District of Columbia's CAIR regulations do not allow trading of NOx allowances for achieving the reductions for the facilities within its jurisdiction.

Summary
The point source NOx controls are a phased approach to controlling emissions of NOx from power plants and other large fuel combustion sources. The programs resulting in emission reductions applied for contingency from point sources in the region include: EPA's Clean Air Interstate Rule and Maryland's Healthy Air Act

**Implementation**

District Department of the Environment
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** |
| NOx Reductions | 0.66 | 12.19 | 2.45 | 15.3 |

**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 Department of the Environment, 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).

## 11.2 Contingency Measures for the Attainment Demonstration

### 11.2.1 Background

EPA requires the Washington region to include a contingency plan containing adopted measures that qualify as contingency measures for the 2009 attainment demonstration. This section fulfills the requirement for the 2009 attainment demonstration.

### 11.2.2 Required Reductions

The Washington region must also identify contingency measures to be implemented in the event that the region does not attain the 8-hour ozone standard in 2009. The contingency measures for the attainment demonstration must provide reductions of either VOC or NOx that total 3% of the 2002 Adjusted Base Year Inventory. A minimum of 0.3 percent VOC must be included. The adjusted inventory is calculated as described in Chapters 4 and 5. Table 11-3 shows the calculation of the necessary reductions, based on the minimum VOC reduction required.

**Table 11-3**
**Calculation of VOC and NOx Reductions for Attainment Contingency**
**(Ozone Season tons per day)**

| Description | VOC | NOx |
|---|---|---|
| 2002 Base-Year Inventory (a) | 448.28 | 597.22 |
| Non-creditable Emissions Reduction (b) | 12.45 | 31.61 |
| Adjusted Base-Year Inventory (c) = (a-b) | 435.83 | 565.61 |
| 0.3% VOC Reduction Required for Attainment Contingency (d) = (0.3/100) * (c) | 1.31 | |
| 2.7% NOx Reduction Required for Attainment Contingency (e) = (2.7/100) * (c) | | 15.27 |

Contingency reductions must occur on a timetable that is directly related to the attainment SIP schedule. States have no more than one year after notification by EPA of an attainment failure to achieve the contingency plan reductions. For a potential attainment failure in 2009, notification would be received in 2010, therefore the contingency reductions must be achieved no later than 2011.

### 11.2.3 Identified Contingency Measures

Table 11-4 lists the contingency measures identified by the District of Columbia, Maryland and Virginia for the attainment demonstration. These measures deliver total benefits of 8.46 tpd VOC and 6.05 tpd NOx. The combined reduction equals 3% of the Adjusted Base Year Inventory, meeting the contingency measure requirement calculated in Table 11-3; therefore this measure fulfills the region's contingency measure requirement. All of these control measures will be effective by 2011.

**Table 11-4**
**Contingency Measures for Attainment Demonstration**
**(Ozone Season tons per day)**

| Ref. No. | Contingency Measure | VOC (tons/day) | NOx (tons/day) |
|---|---|---|---|
| 6.4.5 | Tier 2 Motor Vehicle Emission Standards | 0 | 1.77 |
| 6.3.1 | Phase I and Phase II Emissions Standards for Gasoline-Powered Non-Road Utility Engines | 1.49 | 0.04 |
| 6.3.2 | Emissions Standards for Diesel-Powered Non-Road Utility Engines of 50 or More Horsepower | 0.39 | 3.28 |
| 6.3.3 | Emissions Standards for Spark Ignition Marine Engine | 1.42 | 0 |
| 6.3.4 | Emissions Standards for Large Spark Ignition Engines | 0.54 | 0.96 |
| 6.2.12<br>6.2.17 | Ozone Transport Commission Portable Fuel Containers Rule | 4.62 | 0 |
| **TOTAL REDUCTIONS** | | **8.46** | **6.05** |

The contingency reduction from the on-road source is substantiated by a 2010 Mobile Emissions Budget, as specified in Chapter 8. Reductions for the Tier 2 motor vehicle emission standards occur between 2009 and 2010. Reductions for the other identified measures occur between 2009 and 2011.

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 11-4 according to the timetable indicated in Chapters 6 and 9. EPA's guidance on early implementation of control measures is as follows:

> *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 contained in this SIP. They will not be used to meet that milestone requirement. As a result, the states will not be required to backfill any contingency measures that they choose to implement in advance of the requirement.

### 11.2.4 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% cleaner than those built before the rule was promulgated and will reduce the sulfur content of gasoline by up to 90 %. 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 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 was set at 30 ppm, with a corporate average of 90 ppm and a cap of 300 ppm. Finally, in 2006, refiners met 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 % by 2030.

**Implementation**

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

**Projected Reductions**

This measure provides 1.8 tpd NOx reduction applied for contingency purposes. This contingency measure will be implemented via a 2010 mobile source budget as discussed in Chapter 8.

**Emission Benefit Calculations**

The contingency reductions are based on Tier 2 motor vehicle emission standards, for reductions occurring between 2009 and 2010.

### 11.2.5 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* 15207 (March 30, 1999).

#### Implementation

This program is 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** |
| VOC Reductions | 0.08 | 0.68 | 0.73 | 1.49 |
| NOx Reductions | 0.01 | 0.02 | 0.02 | 0.04 |

#### Emission Benefit Calculations

The contingency reductions are estimated using EPA's NONROAD model for reductions occurring between 2009 and 2011.

### 11.2.6 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 are promulgated under §7547 (a).

EPA's first rule on such emissions standards was published in 59 Federal Register 31306 (June 17, 1994), and was effective on July 18, 1994.

Tier 2 and Tier 3 Emission Standards were promulgated in 1998. This program includes the first set of standards for nonroad diesel engines less than 37 kW (phasing in between 1999 and 2000), including marine engines in this size range. It also phases in more stringent "Tier 2" emission standards from 2001 to 2006 for all engine sizes and adds yet more stringent "Tier 3" standards for engines between 37 and 560 kW (50 and 750 hp) from 2006 to 2008.

EPA adopted a comprehensive national program to greatly reduce emissions from future nonroad diesel engines by integrating engine and fuel controls as a system to gain the greatest air quality benefits. This rule was published June 29, 2004. The requirement to reduce sulfur levels in nonroad diesel fuel by more than 99 % will allow for the first time advanced emission control systems to be used on the engines used in construction, agricultural, industrial, and airport service equipment.

**Implementation**

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

**Projected Reductions**

| | Emission Reductions (tons per day) | | | |
|---|---|---|---|---|
| | District of Columbia | Maryland | Virginia | Total |
| VOC Reductions | 0.07 | 0.19 | 0.13 | 0.39 |
| NOx Reductions | 0.57 | 1.34 | 1.37 | 3.28 |

**Emission Benefit Calculations**

The contingency reductions are estimated using EPA's NONROAD model for reductions occurring between 2009 and 2011.

### 11.2.7 Emissions Standards for Spark Ignition (SI) 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 is implemented by the EPA under 42 U.S.C. § 7547 (a).

**Projected Reductions**

| | Emission Reductions (tons per day) | | | |
|---|---|---|---|---|
| | District Of Columbia | Maryland | Virginia | Total |
| VOC Reductions | 0.19 | 1.07 | 0.15 | 1.42 |

**Emission Benefit Calculations**

The contingency reductions are estimated using EPA's NONROAD model for reductions occurring between 2009 and 2011.

### 11.2.8 Emissions Standards for Large Spark Ignition (SI) Engines

This EPA measure controls VOC and NOx emissions from several groups of previously unregulated nonroad engines, including large industrial SI engines.

**Control Strategy**

The 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 began.

Controls on the category of large industrial SI engines were first required in 2004. Controls on the other engine categories began in years after 2005. Large industrial SI 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, which started 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. Tier 2 standards became effective in 2007.

**Implementation**

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

**Projected Reductions**

| | Emission Reductions (tons per day) | | | |
|---|---|---|---|---|
| | District of Columbia | Maryland | Virginia | Total |
| VOC Reductions | 0.04 | 0.30 | 0.21 | 0.54 |
| NOx Reductions | 0.08 | 0.48 | 0.40 | 0.96 |

**Emission Benefit Calculations**

The contingency reductions are estimated using EPA's NONROAD model for reductions occurring between 2009 and 2011.

### 11.2.9 Portable Fuel Containers Rule: Phase I and Phase II

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, the District, and Virginia all adopted Phase I and are in the process of adopting Phase II of the OTC Model Rule for Portable Fuel Containers.

**Implementation**

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

**Projected Reductions**

| | VOC Emission Reductions (tons per day) | | | |
|---|---|---|---|---|
| | District of Columbia | Maryland | Virginia | Total |
| VOC Reductions | -0.06 | 2.98 | 1.71 | 4.62 |

**Emission Benefit Calculations**

Projected reductions are based on an emission reduction factor of 75% after full implementation after 10 years. Implementation began in 2005. In 2008, the emission reduction factor is 30%. In 2009, the emission reduction factor is 37.5%. Phase II reductions are based on an additional 4 percent reduction in emissions of VOC.

Note that the District's OTC VOC rules on all the applicable area source categories are or will be fully adopted, submitted to EPA, and federally enforceable measures. However,

the emission reductions arising from these measures in the District are not applied to the emissions inventories presented in this RFP/attainment modeling/contingency demonstration of the Washington DC-MD-VA regional SIP. The District of Columbia's measures are expected to provide additional enhancements to the air quality improvement in the region.

The contingency reductions are for reductions occurring between 2009 and 2011.

**References**

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

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).

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.

OTC 2007. *Identification and Evaluation of Candidate Control Measures: Final Technical Support Document.* Prepared by MACTEC Federal Programs, Inc., Herndon, Virginia for the Ozone Transport Commission. February 28, 2007.