

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

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 4th 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		NOx Reductions tons/day	
		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	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)	6.19	7.17	29.67	37.63
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				
6.4.7	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 NO_x. 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 NO_x, 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 NO_x 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 NO_x 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 NO_x 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 NO_x 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 NO_x 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 (NO_x) 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

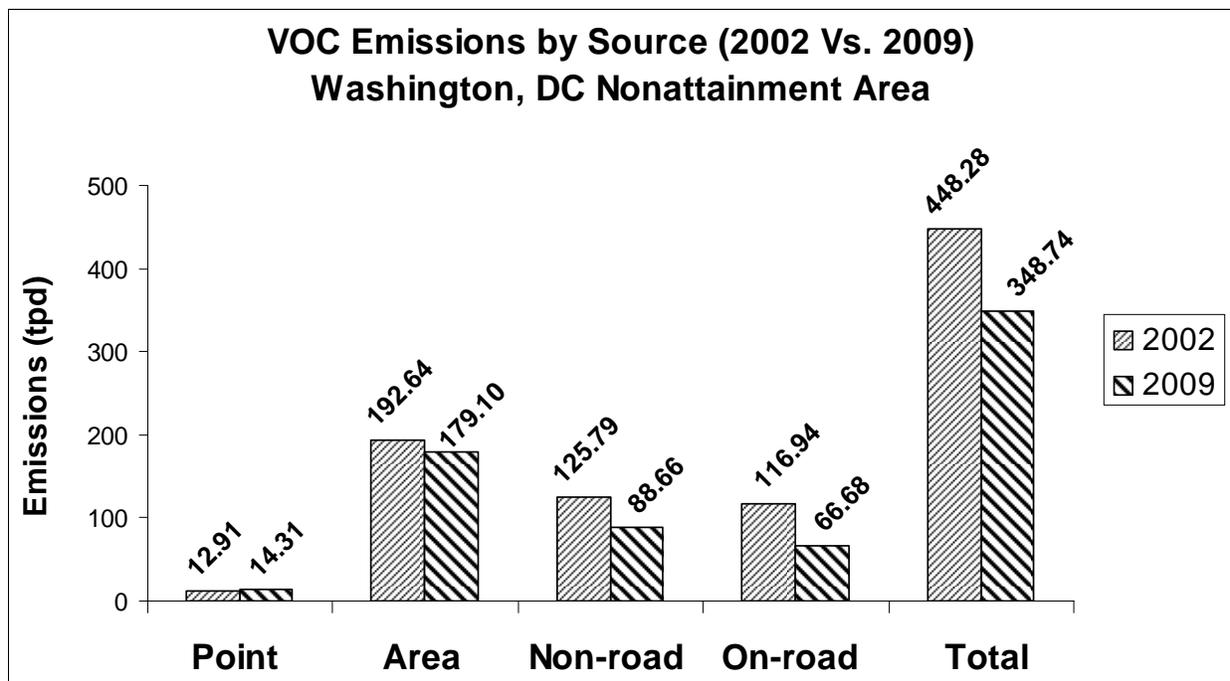
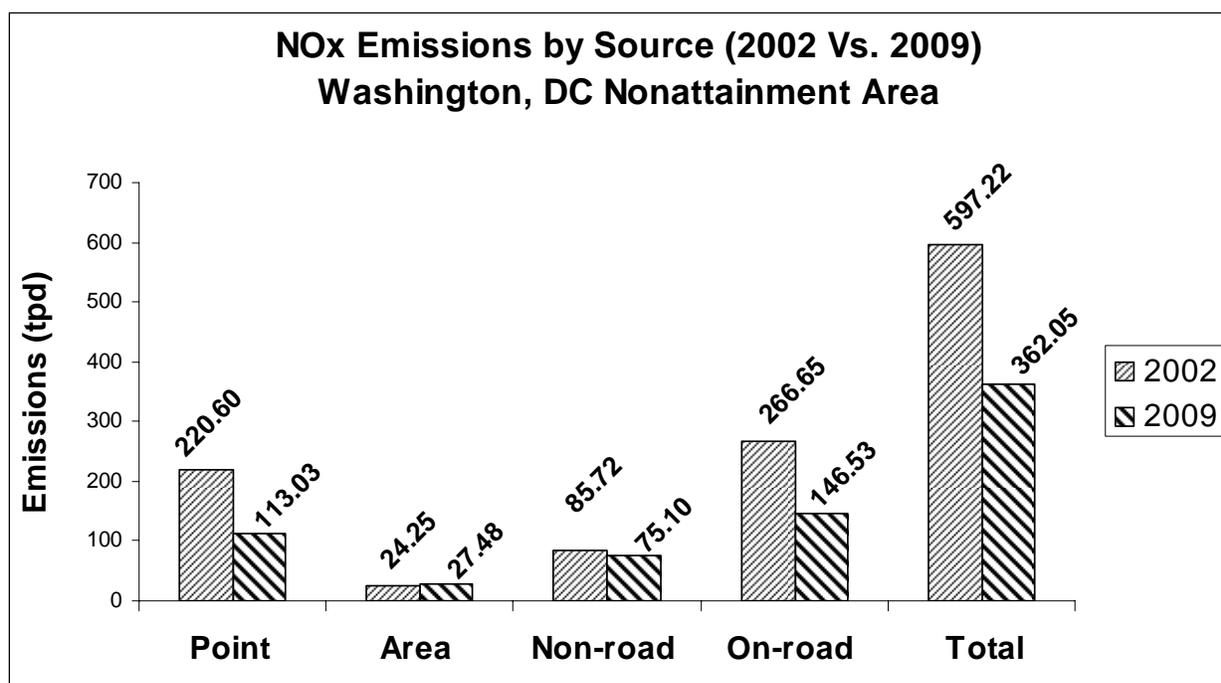


Figure 1-2.

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

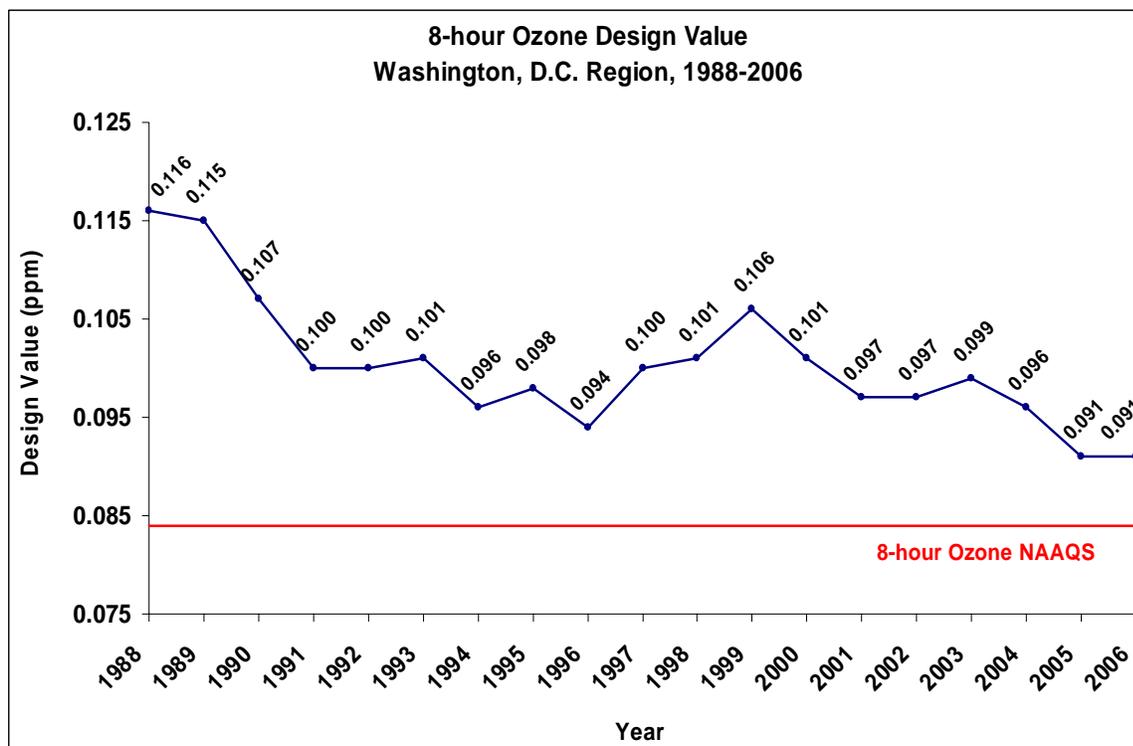
1.8 Attainment Demonstration

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°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 NO_x 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 NO_x, 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.