MARYLAND DEPARTMENT OF THE ENVIRONMENT
AIR AND RADIATION MANAGEMENT ADMINISTRATION

PROPOSED STATE IMPLEMENTATION PLAN
PHASE I ATTAINMENT PLAN FOR THE
BALTIMORE NONATTAINMENT AREA AND CECIL COUNTY

DECEMBER 1997

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EXECUTIVE SUMMARY

This document contains Maryland's proposed revision to its State Implementation Plan (SIP) to meet the Post-1996 Rate of Progress Plan (RPP), as required under the Clean Air Act as amended in 1990 (the Act) and as a required element of Maryland's first phase of the ozone attainment demonstration SIP submittal (Phase I Plan).

The Act represents 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 and, accordingly, prescribes increasingly stringent measures that must be implemented and sets new deadlines for achieving the standard. The Act also establishes specific emissions reduction requirements to ensure that continual progress toward attainment is made.

All areas of the country classified as "Serious" or above for ozone nonattainment, must submit to the U.S. Environmental Protection Agency (EPA) a revision to the State Implementation Plan (SIP) demonstrating how emissions which contribute to the formation of ozone, will be reduced by 3% per year, net of growth, until the date the area is required to reach attainment of the ozone standard. The Baltimore Nonattainment Area (Baltimore City, and the counties of Anne Arundel, Baltimore, Carroll, Howard, and Harford) and Cecil County (Maryland's portion of the Philadelphia Area), are classified as "Severe" establishing their attainment date for the year 2005. The first effort to show these "milestone" reductions for these areas is contained in the 15% Rate-of-Progress Plan (15% Plan) submitted to the EPA. On November 1994, these areas were required to submit the Post-1996 Rate-of-Progress Plan which would show how the additional emissions reductions would be obtained. In addition, a demonstration how the areas would attain the standard using computer models was also required on November 1994. A March 2, 1995 Memorandum, entitled "Ozone Attainment Demonstrations" from EPA Administrator Mary D. Nichols to the Regional Administrators sets forth guidance for an alternative approach to submitting these requirements to provide States flexibility in their planning efforts. The memorandum established a two-phased SIP submittal approach. One of the elements of the Phase I Plan must include a set of specific control measures which obtain at least a 9 percent reduction in ozone forming emissions, to satisfy rate-of-progress requirements for the 1997-99 period. In addition, commitments by the State to implement additional emission control measures as required to attain the ozone standard is required for the Phase I Plan. This document shows how Maryland intends to achieve these requirements for the Baltimore Nonattainment Area and Cecil County. Tables 1.1 and 1.2 demonstrate the emission control measures which would obtain the reductions required. The Baltimore Nonattainment Area expects to obtain a 4.55 percent reduction in volatile organic compound emissions and a 4.45 percent reduction in oxides of nitrogen emissions (total of 9 percent). Cecil County will obtain the 9 percent reductions solely from VOC emissions.

Why is it so important to achieve the standards for ozone? High levels of ozone pose a health problem. When it is breathed into the lungs, ozone reacts with lung tissue. It can harm breathing passages, can decrease the lungs' working ability, and can cause:

- coughing and chest pains;
- eye and throat irritation;
- breathing difficulties, especially for those with respiratory problems ; and
- greater susceptibility to respiratory infection.

Ozone also poses a threat to the health of ecosystems. Scientific evidence suggests that air pollution weakens the immune systems of many types of vegetation and can cause significant crop damage. In addition, precipitation washes air pollution deposited on vegetation and architectural surfaces into the streams and rivers of the region and finally into the Chesapeake Bay.

Table 1.1 - Summary of Emission Benefits For The Baltimore Area (Tons per Day) 1990-1999

Ref. No.	**Control Measure**	**VOC**	**NOx**
Federally Mandated Measures			
6.1.1	Inspection and Maintenance	21.7	17.2
6.1.2	Tier I and EVP	6.9	16.7
6.1.3	Reformulated Gasoline	12.5	-1.3
6.1.4	Stage II and OBVR	8.1	0.0
6.1.5	NOx RACT	0.0	4.8
6.1.6	Non-Road Diesel Engines	0.0	4.7
Pending Federal Measures			
6.2.1	Small Gasoline Engines	6.1	-0.3
State and Local Measures			
6.3.1	Open Burning	3.6	0.8
Regional Measures			
6.4.1	OTC NOx Phase II	0.0	87.2
Previous Measures			
	FMVCPand RVP	52.8	44.3
	15% RPP Reductions	30.3	
Total Reductions in Progress		**142.0**	**174.1**
FMVCP/RVP and Growth			**93.7**
VOC Equivalent Reductions[1]		**55.4**	
Total VOC Reductions Obtained		**197.4**	
Total VOC Reductions Required[2]		**155.3**	
Reduction Surplus (+) or Shortfall (-)		**+42.1**	

[1]NOx emission reductions may be substituted for VOC emissions reductions at a rate of 1% of VOC inventory for 1% of NOx inventory. For 1999, this 1% for 1% rate is 1.45 tons of NOx for each ton of VOC ((467.9-35.8) tons of NOx / (343.0-44.5) tons of VOC). VOC Equivalent reductions is equal to ((174.1-93.7) / 1.45).

[2]Total VOC Reductions Required equals the projected (uncontrolled) emissions (Table 4.2) subtracted from the emissions target level (Table 5.1) ((381.7 - 226.4) tons of VOC).

Table 1.2 - Summary of Emission Benefits For Cecil County (Tons Per Day) 1990-1999

Ref. No.	Control Measure	VOC	NOx
Federally Mandated Measures			
6.1.1	Inspection and Maintenance	1.3	1.2
6.1.2	Tier I	0.2	0.7
6.1.3	Reformulated Gasoline	0.4	-0.1
6.1.4	Stage II and OBVR	0.4	0.0
6.1.5	NOx RACT	0.0	0.0
6.1.6	Non-road Diesel Engines	0.0	0.2
Pending Federal Measures			
6.2.1	Small Engine Equipment	0.2	0.0
State and Local Measures			
6.3.1	Open Burning	4.4	1.0
Regional Measures			
6.4.1	OTC NOx Phase II	0.0	0.0
Previous Measures			
	FMVCP and RVP	2.9	2.0
	15% RPP	1.5	
Total Reductions in Progress		**11.3**	**5.0**
Emission Reduction Target Levels[3]		**7.5**	
Reduction Surplus (+) or Shortfall (-)		**+3.8**	

[3] Total VOC Reductions Required equals the projected (uncontrolled) emissions (Table 4.3) minus the emissions target level (Table 5.1)

DOCUMENT SUMMARY

Chapter 2 provides a detailed background information about the Act, the region's air quality planning process, the role of the states, and the proposed plan.

Chapter 3 presents the 1990 Base Year Inventory, which serves as the baseline against which emissions reductions are measured.

Chapter 4 outlines how, utilizing EPA-approved growth factors, the 1990 base year emissions are projected for 1999, 2002, and 2005; these years are the milestone years for severe nonattainment areas, as defined in the Act. This gives us a picture of how much emissions the area would have if no control measures are adopted.

Chapter 5 presents the Department's calculations of how many tons per day of emissions must be reduced in order to meet the 3% per year requirement.

Chapter 6 describes the various strategies which will be used to control emissions by 1999. For the reader's convenience, the control strategies are divided into four sections of summary sheets.

Chapter 7 describes the conformity process.

Chapter 8 specifies' Marylands commitments to additional control measures.

Chapter 9 includes the contingency plan. The Act requires states to outline a contingency plan of alternative measures. These measures are automatically implemented if the control measures described in Chapter 6 fail to provide the required emissions reductions.

Appendices which provide documentation supporting the technical analysis for this document and EPA policy documents are included.

2.0 INTRODUCTION AND BACKGROUND

This document, the *Post-1996 Rate-of-Progress Plan (RPP*) presents the regional air quality plan for the Baltimore nonattainment area and Cecil County for meeting the requirement of the 1990 Clean Air Act Amendments (referred to hereafter as the Act) to reduce emissions of volatile organic compounds (VOCs) and/or nitrogen oxides (NOx) by 3% per year from 1990 levels by 1999. Congress required these annual emissions reductions to ensure that areas not in attainment of the National Air Ambient Quality Standards for ozone would make consistent progress in cleaning up the air. In addition, the target emission levels for 2002 and 2005 are presented in the document. This section of the document presents an overview of the Clean Air Act, the ozone issue, the 1993 State Implementation Plan (SIP) revision (i.e., the *15% Rate-of-Progress Plan),* and the requirements of this SIP revision.

2.1 CLEAN AIR ACT REQUIREMENTS

The original Air Pollution Control Act was passed in 1955 in response to public concerns raised by several air pollution episodes during which many fatalities occurred. The most famous episode was the four-day "killer fog" in London, England which claimed 4,000 lives. In 1948, a similar incident in Donora, PA, culminated in 20 fatalities and 7,000 illnesses. In response to public concerns, Congress adopted air pollution control laws.
With the passage of the original Air Pollution Control Act of 1955 and the Clean Air Act (the Act) of 1963 (amended in 1967, 1970, 1977, and 1990), Congress responded to the problem of air pollution by offering technical and financial assistance to the states. The Act of 1963 and subsequent amendments are intended to protect public health and the environment from hazards associated with airborne pollutants. The 1970 Amendments to the Act sharply increased federal authority and responsibility for addressing the air pollution problem; however Section 107(a) of the Act still provided that each state "shall have the primary responsibility for assuring air quality within the entire geographic area comprising the state". Despite the state's role in attaining and maintaining air quality standards within its borders, the challenges require an extensively cooperative state/federal partnership.

One of the most important components of the 1970 amendments to the Act was the creation of National Ambient Air Quality Standards (NAAQS) for air pollutants which endanger public health and welfare. A system of primary NAAQS was established for the protection of human health and a set of secondary standards was established for the protection of public welfare, property, crops, animals and natural ecosystems. A geographic area that meets or does better than the primary standard is called an "attainment area;" areas that do not meet the primary standard are called "nonattainment areas." The six criteria pollutants for which NAAQS have been established are: lead (Pb), carbon monoxide (CO), particulate matter (PM), sulfur dioxide (SO_2), nitrogen dioxide (NO_2), and ozone (O_3). The last three pollutants are serious respiratory irritants. They are highly reactive compounds that can oxidize or burn tissues of the mucous membranes and lungs. Prolonged exposure can cause permanent scarring of lung tissue and reduced lung capacity.

Despite the 1970 legislation, air quality in many areas of the country still did not meet the NAAQS. Congress amended the Act again in 1977, partly to address those areas that had not attained the NAAQS. SIP revisions submitted pursuant to the requirements of the 1977 amendments yielded progress in meeting the NAAQS. However, many areas remained in nonattainment of these standards.

In 1990 Congress once again enacted comprehensive amendments to the Act to address SIP requirements for nonattainment areas. The requirements of the 1990 Amendments to the Act represent an unprecedented commitment to protecting public health and the environment. Title I of the Act classified areas that exceed national air quality standards. Based on the severity of their pollution problem, the Act prescribed increasingly stringent, mandatory measures and set new deadlines for achieving the NAAQS.

One major impact the Act had on the state of Maryland was to redefine and enlarge the ozone nonattainment areas. Cecil County was added to the Philadelphia-Wilmington-Trenton nonattainment area in 1990, and so it is referred to as separate from the Baltimore nonattainment area in this document. Also, Calvert, Charles, and Frederick counties were added to the Maryland portion of the Washington, D.C. nonattainment area. Therefore, these counties will be included in a separate document. Table 2.1 show the current designations for the State of Maryland.

Table 2.1
Maryland Ozone Classifications

AREA	**CLASSIFICATION**	**ATTAINMENT DATE (NOVEMBER 15)**
BALTIMORE, MD Anne Arundel County, Baltimore City, Baltimore County, Carroll County, Harford County, Howard County	Severe Nonattainment	2005
WASHINGTON, D.C. Calvert County, Charles County, Frederick County, Montgomery County, Prince George's County	Serious Nonattainment	1999
PHILADELPHIA/WILMINGTON/TRENTON Cecil County	Severe Nonattainment	2005
KENT/QUEEN ANNE'S COUNTY Kent County Queen Anne's County	Marginal Nonattainment	1993
OTHER MARYLAND COUNTIES Allegheny, Caroline, Dorchester, Garrett, Somerset, St. Mary's, Talbot, Washington, Wicomico Worcester	Unclassifiable (Insufficient data to classify)[4]	N/A

In addition to redefining and enlarging the nonattainment areas, the Act included specific emissions

4 Areas which are unclassified are *not* nonattainment areas.

reductions requirements depending on the severity of pollution in a nonattainment area. The Act also established specific emission reduction requirements to insure that continuous progress towards attainment of the NAAQS would be made. Mandatory emissions control measures, specific emissions reduction requirements and deadlines for achieving attainment of the NAAQS vary according to the classification of the nonattainment area. Areas in a higher class of nonattainment must meet the mandates of the lower ones plus the more stringent requirements of their class, but are allowed a longer period of time to do so. The attainment date for Cecil County and the Baltimore nonattainment area is the year 2005.

In order to meet this goal, Congress established specific emission reductions requirements: between 1990 and 1996, the areas must reduce emissions of VOCs by 15 percent, and between 1997 and 2005, the areas must reduce emissions of VOCs and/or NOx by 3 percent per year. In addition, state and local air pollution agencies must show through computer modeling that emissions reduction strategies chosen for the area will ultimately result in attainment of ozone NAAQS.

Requirements for Baltimore nonattainment area and Cecil County include placing tighter controls on businesses and industries that discharge VOC and NOx emissions, developing and implementing an improved and enhanced inspection and maintenance program for automobiles, and implementing Stage II Vapor recovery controls, which require gasoline stations to install special hose-and-nozzle controls on gas pumps to capture fuel vapors. For additional information on these new requirements see the Department's *Report to the General Assembly on the Clean Air Act Amendments of 1990* (MDE, 1990).

Additionally, all Maryland counties are part of the Northeast Ozone Transport Region (OTR). The OTR is not a nonattainment classification, but does have certain requirements associated with it. The ozone problem is regional in nature since ozone travels across county and state lines. So the Act created regions such as the OTR to facilitate coordination and consensus-building between states in areas with pollution transport problems. The Northeast OTR comprises Maine, New Hampshire, Vermont, Massachusetts, Connecticut, New York, Rhode Island, New Jersey, Delaware, Maryland, Pennsylvania, Washington, DC, and Virginia. The coordinating body for the Northeast OTR is the Ozone Transport Commission (OTC). The OTC has developed a memorandum of understanding among the participating states to implement point source NOx standards for the region. All but two states have agreed to implement these standards. In addition, the OTC requested the EPA implement standards for low emission vehicles (LEV) for the region. As a result the EPA plans on implementing a 49-state car rule. These two regional control strategies are included in this *Post-1996 RPP*.

2.2 THE OZONE PROBLEM

The Act has been amended repeatedly in part because ozone pollution is a difficult problem to solve. Solving the problem has been challenging for several reasons:

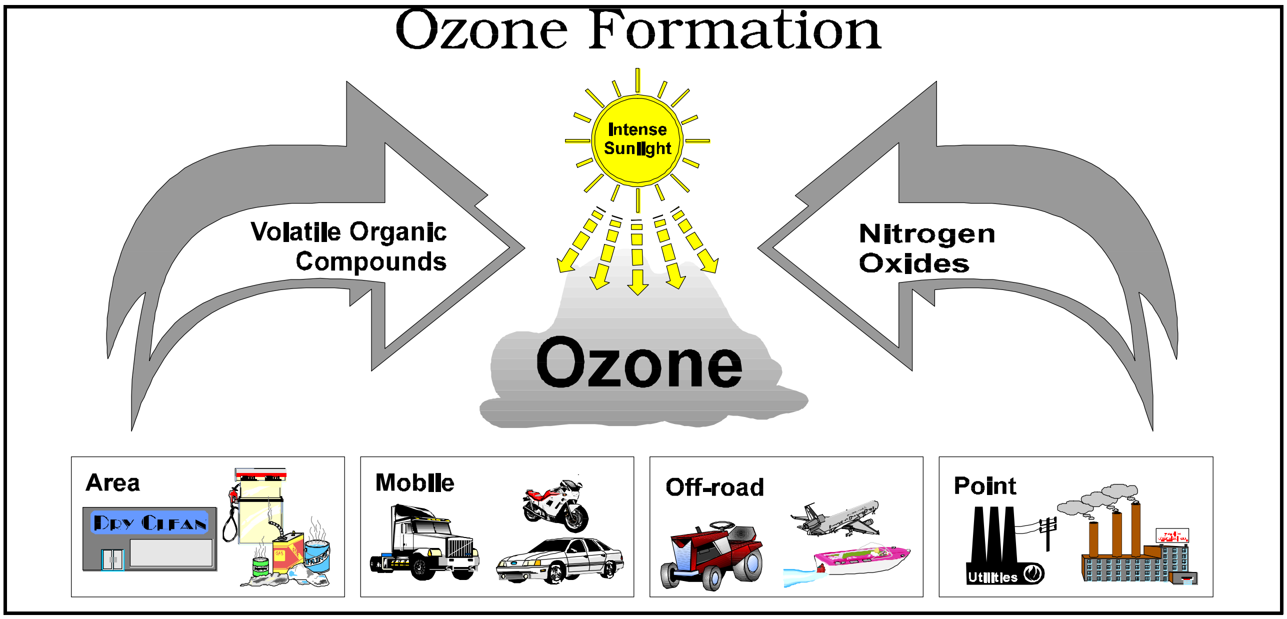
- Ozone is not discharged directly but is the result of complex reactions between a wide range of chemicals;
- the severity of the problem is highly dependent on weather conditions;
- the problem is regional -- ozone plumes can travel hundreds of miles; and

❖ there are many different sources of pollution that contribute to the problem, many of which are difficult and/or costly to control.

The following explains the ozone problem in greater detail.

First, ozone (O_3) is formed through a complex series of chemical reactions. Oxygen molecules and atoms (O_2 + O) combine when sunlight and high temperatures cause complex photochemical reactions to occur between VOC and NOx emissions. Figure 2.1 illustrates the ozone formation process. In Maryland, the problem is seasonal, with the ozone season lasting from May through September. Typically, ozone levels escalate rapidly after noontime, peak in the afternoon and taper off when the sun goes down.

Figure 2.1



Second, the ozone problem is complicated by the fact that weather conditions play a major role in the formation of ozone and in the severity of the problem. When warm air becomes trapped near the ground instead of rising and winds are calm, ozone may stay in place for days at a time, causing damage to public health and the economy. It is not always possible to predict conditions that facilitate severe ozone problems.

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

Fourth, given that ozone travels across areas, the ozone problem is regional. Therefore, solving the ozone problem requires considerable coordination and consensus building on the part of local and state governments to develop regional emission control measures. As stated previously, the Act created regions such as the Northeast OTR to facilitate coordination and consensus-building between states. As a result of the March 2, 1995 memorandum from Mary D. Nichols, the Ozone Transport Assessment Group was formed to work on quantifying and reducing the amount of ozone and its precursor emissions within the 38 participating states.

2.3 SOURCES OF OZONE POLLUTION IN THE BALTIMORE NONATTAINMENT AREA

A number of diverse sources emit VOC and NOx emissions. Most VOC emissions come from solvent evaporation from facilities or operations such as bakeries, gasoline refueling stations, printing facilities, motor vehicles, and lawnmowers. Principal sources of NOx emissions, which are produced during combustion, include: motor vehicles, fossil fuel fired power plants, and open burning. Tables 2.2 and 2.3 list the top ten sources of VOC and NOx emissions in the Baltimore nonattainment area in 1990.

Table 2.2
Top Ten Sources of Volatile Organic Compounds (VOC) Emissions in the Baltimore Nonattainment Area in 1990

#	SOURCE CATEGORY	SOURCE	VOCs tons/day
1.	On-Road Mobile	CARS	84
2.	On-Road Mobile	LIGHT TRUCKS *(less than 8500 lbs)*	32
3	Area	PAINTING & COATING *(coatings on homes, buildings, roads & industrial equipment)*	27
4	Area	COMMERCIAL & CONSUMER PRODUCTS *(pesticides, hairsprays)*	20
5.	Nonroad Mobile	LAWN & GARDEN EQUIPMENT	18
6.	Stationary	GENERAL MANUFACTURING *(steel, yeast, paper, asphalt, cement)*	18
7.	Area	GASOLINE STATION REFUELING	13
8.	Stationary	COATINGS ON MANUFACTURED PRODUCTS *(beverage can painting, paper coating)*	13
9.	Area	COLD CLEANING DEGREASING *(removal of oil from automotive parts, machined products)*	10
10.	Area	AUTO REFINISHING *(primers, surfaces, sealers, topcoats and specialty coatings)*	10

The emissions estimates above are rounded to the nearest whole number. The total emissions of VOCs in the Baltimore nonattainment area was 343 tons per day in 1990. These categories account for 245 tons per day or 71% of the total.

Table 2.3
Top Ten Sources of Nitrogen Oxides (NOx) in the Baltimore Nonattainment Area in 1990

#	**SOURCE CATEGORY**	**SOURCE**	**NOx** tons/day
1.	Stationary	UTILITIES	162
2.	On-Road Mobile	CARS	70
3.	On-Road Mobile	HEAVY DUTY DIESEL TRUCKS *(over 8500 lbs)*	55
4.	Stationary	GENERAL MANUFACTURING *(steel, yeast, paper, asphalt, cement)*	44
5.	Nonroad Mobile	CONSTRUCTION EQUIPMENT *(bulldozers, cranes)*	37
6.	On-Road Mobile	LIGHT TRUCKS *(less than 8500 lb)*	24
7.	On-Road Mobile	HEAVY DUTY GAS TRUCKS *(over 8500 lbs)*	11
8.	Nonroad Mobile	RAILROADS *(just locomotives)*	11
9.	Nonroad Mobile	FARM EQUIPMENT *(tractors, harvesters)*	8
10.	Nonroad Mobile	AIRCRAFT SUPPORT *(luggage carriers, other vehicles)*	5

The emissions estimates above are rounded to the nearest whole number. The total emissions of NOx in the Baltimore nonattainment area was 468 tons per day in 1990. These categories account for 427 tons per day or 91% of the total.

2.4 COSTS OF OZONE

All of the million residents of the Baltimore metropolitan area are likely to feel some of the adverse effects of ozone at one time or another, when working outdoors or exercising on a day when ozone levels are high. However, certain people will feel symptoms at lower levels of exposure (even levels below the NAAQS), or experience more adverse effects at high levels. These people are therefore running greater than normal health risks due to poor air quality. According to the American Lung Association, populations at increased risk in the state of Maryland include:

❖ 152,619 adult asthmatics and 75,534 child asthmatics;

❖ 274,896 residents with chronic bronchitis or emphysema.

Ozone precursors also pose a threat to the health of natural ecosystems. NOx emissions in particular can combine with precipitation to form nitric acid, a major component in acid rain, which has damaged lakes, streams, and vegetation throughout the eastern and Midwestern U.S.[5]

These costs translate into a significant drain on Maryland's economy. For instance, it is estimated that between 1981 and 1991 crop losses from ozone pollution totaled an average of $40 million annually.[6] Air pollution accounts for $40-50 billion in health care costs annually.[7]

In addition, rain washes ozone precursors deposited on vegetation and architectural surfaces into the streams and rivers of the state and finally into the Chesapeake Bay. Air pollution decreases our standard of living, threatens our health, and further stresses the natural environment.

2.5 FREQUENCY OF VIOLATIONS OF THE FEDERAL HEALTH STANDARD FOR OZONE

The Baltimore nonattainment area has exceeded the ozone NAAQS every summer for the past 20 years. The number of violations per summer ranged from a low of 4 to a high of 44. Federal law allows only one violation of the NAAQS a year (averaged over 3 years) at any one monitoring stations in the region. The NAAQS for ozone concentration is 120 parts per billion (0.12 parts per million) of ozone averaged over one hour. Figure 2.2 shows the number of days the Baltimore nonattainment area has violated the ozone standard since 1979, and figure 2.3 shows the location of the various air quality monitoring sites in Maryland.

2.6 THE STATE IMPLEMENTATION PLAN (SIP) PROCESS

The Act requires states to develop and implement ozone reduction strategies in the form of a State Implementation Plan (SIP). The SIP is the state's "master plan" for attaining and maintaining the NAAQS. The SIP is basically a "work in progress" in need of periodic revisions. The *Post-1996 RPP* has been written for this purpose according to a timeline and requirements established by the Act.

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, 1992). The four fundamental principles are:

❖ that emissions reductions ascribed to control measures must be quantifiable and measurable (*quantifiable*);

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[5] Bill K. Stevens, "Study of Acid Rain Uncovers a Threat to a Far Wider Area", *New York Times*, December 16, 1990.

[6] Mulchi, Charles, *Estimating the Economic Impact of Air Pollution on Maryland Agriculture*, Maryland Institute for Agriculture and Natural Resources, College Park, MD 1993

[7] Ibid.

- that 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 (*enforceable*);

- that measures are replicable (*real*); and

- that the control strategies 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 (*permanent*).

Once a SIP revision is approved by the Administrator of the EPA, it is enforceable as a state law and as federal law under Section 113 of the Act. If the SIP is found to be inadequate in the EPA's judgement, and if the state fails to make amendments to rectify the problem, under §110(c)(1), the EPA Administrator issues binding amendments to the SIP. These amendments are referred to as the federal implementation plan (FIP).

EPA must impose sanctions if a state:

- Does not submit a SIP revision; or

- submits a SIP revision that the EPA does not approve; or

- fails to implement the SIP revision.

Possible sanctions include:

- Requiring new large industries, or those that want to expand, to offset emissions by 2:1, which could deter economic growth;

- withholding federal highway funds;

- withholding air quality planning grants;

- imposing a FIP.

The Act allows the EPA to exercise discretion in imposing sanctions for 18 months after a deadline which states are actively trying to comply. The EPA promulgated a rule so that after 18 months mandatory sanctions would be imposed with 2:1 offsets (See above) for the first six months before transportation funds are affected. Failure to submit or implement a SIP will have significant consequences for compliance with transportation conformity requirements[8].

[8] The transportation conformity rule (40 CFR Part 51) establishes criteria used to ensure that state transportation plans and programs conform to the purposes of the SIP.

2.7 THE 15% RATE-OF-PROGRESS PLAN SIP REVISION

The 15% RPP estimates have been updated in this Phase I Attainment Plan. The revisions reflect more recent and accurate growth estimates and changes in EPA guidance since the plan was submitted. Tables 2.4 and 2.5 contain these revisions.

Emission reduction credits for the various control measures have been revised to reflect more accurate growth estimates as well as changes in EPA guidance on calculating emission reductions. EPA revised guidance on emission reduction credits for the following control measures:

- Emissions reduced by the architectural/industrial mainteance coating regulations have been revised to reflect a 20% overall reduction.
- Reformulated consumer products reflect a 20% emission reduction from a regulated subset of consumer products.

Addtional documentation on revisions to the 15% RPP are included in Appendix H.

Table 2.4
Control Measures and Target to Meet the 15% Plan for the Baltimore Nonattainment Area

	Tons per Day in 15% Plan	Tons per Day Revised
1990 Base Year	346.8	343.3
Adjustment for Federal Motor Vehicle Emissions Control Program and Gasoline Volatility Regulation (1990-1996)	-39.7	-39.7
1990 Adjusted Base Year Inventory	=307.1	=303.6
15% Reduction Requirement from Adjusted Base Year Inventory	46.1	45.5
Expected Emissions Growth (1990-1996)	+27.2	+18.4
Emissions Reduction Required	**73.3**	**63.9**
Total Reductions From Rate-of-Progress Plan	**76.8**	**72.8**
Surplus (+) or Shortfall (-) = (Reductions in Rate-of-Progress Plan) - (Reductions Required)	**+3.5**	**+8.9**
Federally Mandated Measures	**40.6**	**40.6**
Mobile Source Measures	(39.2)	(39.2)
Enhanced Inspection and Maintenance	16.8	16.8
Stage II + On Board	7.4	7.1
Tier I	1.2	1.2
Reformulated Gasoline	13.8	13.8
RACT - Reasonably Available Control Technology	(1.4)	(1.7)
Expandable Polystyrene Products	0.1	0.1
Yeast Production	0.5	0.5
Bakeries	0.3	0.6
Screen Printing	0.5	0.5
Pending Federal Programs	**18.2**	**14.9**
Surface Coating	8.2	6.6
Consumer Products	1.7	2.6
Autobody Refinishing	5.0	5.3
Pesticide Reformulation	2.9	0.0
Federal Air Toxics	0.4	0.4
State and Local Initiatives	**18.0**	**17.3**
Surface Cleaning/Degreasing/Pollution Prevention	5.5	7.6
Graphic Arts	0.5	0.5
Landfills Controls	1.2	0.2
Enhanced Rule Compliance	6.3	4.5
State Air Toxics	0.9	0.9
Seasonal Open Burning Ban	3.6	3.6
Total Reductions From Rate of Progress Plan	**76.8**	**72.8**

Table 2.5
Control Measures and Target to Meet the 15% Plan for Cecil County

	Tons per Day in 15% Plan	Tons per Day Revised
1990 Base Year	18.9	18.5
Adjustment for Federal Motor Vehicle Emissions Control Program and Gasoline Volatility Regulation (1990-1996)	-2.4	-2.4
1990 Adjusted Base Year Inventory	=16.5	=16.1
15% Reduction Requirement from Adjusted Base Year Inventory	2.5	2.4
Expected Emissions Growth (1990-1996)	+0.7	+0.4
Emissions Reduction Required	**3.0** *	**2.8**
Total Reductions From Rate-of-Progress Plan	**7.7**	**7.8**
Surplus (+) or Shortfall (-) = (Reductions in Rate-of-Progress Plan) - (Reductions Required)	**+4.7**	**+5.0**
Federally Mandated Measures	**2.6**	**2.7**
Mobile Source Measures	2.6	2.7
Enhanced Inspection and Maintenance	1.8	1.8
Stage II + On Board	0.1	0.3
Tier I	0.1	0.0
Reformulated Gasoline	0.6	0.6
Pending Federal Programs	**0.5**	**0.5**
Surface Coating	0.2	0.2
Consumer Products	0.1	0.1
Autobody Refinishing	0.2	0.2
State and Local Initiatives	**4.6**	**4.6**
Surface Cleaning/Degreasing/Pollution Prevention	0.2	0.2
Seasonal Open Burning Ban	4.4	4.4
Total Reductions From Rate of Progress Plan	**7.7**	**7.8**

2.8 THE PHASE I OZONE ATTAINMENT DEMONSTRATION PLAN

A March 2, 1995 Memorandum, entitled "Ozone Attainment Demonstrations" from EPA Administrator Mary D. Nichols to the Regional Administrators sets forth guidance for an alternative approach to submitting these to provide States flexibility in their planning efforts. The memorandum established a two-phased SIP submittal approach. One of the elements of the Phase I Attainment Demonstration must include a set of specific control measures which obtain at least a 9 percent reduction to satisfy rate-of-progress requirements for the 1996-99 period. The *Post-1996 RPP* shows how Maryland intends to achieve this requirement for the Baltimore Area (Baltimore City, and the counties of Anne Arundel, Baltimore, Carroll, Howard, and Harford) and Cecil County (Maryland's portion of the Philadelphia Area).

Unlike the emissions reductions required in the *15 Percent RPP*, Section 182 (c)(2) of the Act allows states to substitute NOx emission reductions to meet the 9 percent rate-of-progress requirement. NOx emissions reductions can be used provided they meet the criteria outlined in "EPA's NOx Substitution Guidance". The condition for meeting the rate-of-progress requirement is that the sum of all creditable VOC and NOx emission reductions equal 3 percent per year averaged over each three year period.

In addition, Phase I requires a nonattainment areas to submit several enforceable commitments. The states are required to submit enforceable commitments:

- to adopt the remainder of the rules needed to meet the Post-1996 rate-of-progress requirements (for reductions between 1999-2005), pending the results of the Ozone Transport Assessment Group, for the Baltimore nonattainment area and Cecil County;

- to adopt additional measures needed for attainment for Cecil County and the Baltimore and Washington nonattainment areas;

- to eliminate the area's contribution to downwind problems; and

- to adopt Phase II of the OTC NOx Memorandum of Understanding.

These commitments are contained in Chapter 8 of this document.

3.0 1990 BASE YEAR INVENTORY

3.1 BACKGROUND AND REQUIREMENTS

The Act requires states to compile an emissions inventory to use as the foundation for planning strategies necessary to attain the NAAQS. The Act requires this base year inventory for all classes of nonattainment areas (42 U.S.C.A. Section 7511(a)(1)), and EPA requires a state-wide inventory for those states that are part of the Northeast OTR. The base year inventory is also the foundation for other required inventories that this chapter explains in greater detail:

- The adjusted base year inventory;
- the periodic inventory;
- the Reasonable Further Progress (RFP) inventory; and
- the projection inventory.

The 1990 base year inventory was required as part of the November 15, 1992 SIP submittals. The Department submitted a working draft of the inventory to the EPA on November 14, 1992. As part of the SIP submittal the EPA decided that the inventory must be subject to the public hearing process, and that the deadline for the public hearing would be November 15, 1993 concurrent with the *15% RPP* hearing. The complete inventory documentation is available for review and is entitled *1990 Base Year Inventory for Precursors of Ozone, Volatile Organic Compounds (VOC), Carbon Monoxide (CO), Nitrogen Oxides (NO_x) for the State of Maryland, Volumes 1-6, September 30, 1993* (MDE, 1993a).

The base year inventory is an inventory of actual emissions for the calendar year 1990. It includes the ozone precursor pollutants: Volatile organic compounds (VOC) and oxides of nitrogen (NO_x). The Department calculated emissions for a typical peak ozone season weekday. A typical peak ozone season weekday is a day in June, July, or August, since these months comprise the peak of Maryland's April 1- October 1 ozone season.

3.2 SOURCE TYPES

There are five emission source types:

- Point sources: Industrial and commercial sources with emissions great enough for the Department to quantify on an individual basis.
- Area sources: Smaller industrial, commercial, and business sources that collectively contribute a significant amount of emissions, but whose emissions are too low to quantify individually.
- Onroad mobile sources: Traditional highway vehicles, such as cars and trucks.
- Nonroad mobile sources: Sources powered by internal combustion engines that are not traditionally used for highway transportation, such as lawn mowers, airplanes, boats and construction equipment.

- ❖ Biogenic sources: Natural emissions sources of VOCs, such as trees, grasses, and crops.

The remainder of this chapter summarizes the approach used to develop the inventory for ozone precursors during the ozone season, and presents inventory results for each pollutant.

Table 3.1 presents the inventory by source type. Figures 3.1 and 3.2 display the information for VOC and NOx emissions in the Baltimore nonattainment area and Cecil County in graphs.

TABLE 3.1: 1990 Base Year Ozone Precursor Emissions Inventory Emissions Summary By Source Type

Nonattainment Area	Tons Per Day	
Source Type	**VOC**	**NOx**
Baltimore Nonattainment Area		
Point Sources	42.0	223.2
Area Sources	122.4	13.7
Nonroad Sources	44.7	71.5
Mobile Sources	134.2	159.5
Subtotal:	343.3	467.9
Washington Nonattainment Area		
Point Sources	14.6	334.8
Area Sources	191.2	47.3
Nonroad Sources	70.4	85.0
Mobile Sources	251.2	261.7
Subtotal:	527.2	728.8
Washington NAA - MD Portion		
Point Sources	5.5	267.4
Area Sources	94.2	15.8
Nonroad Sources	32.1	43.5
Mobile Sources	108.5	129.1
Subtotal:	240.3	455.8
Cecil County - Phil-Wil-Tren NAA		
Point Sources	0.6	0.0
Area Sources	8.7	1.8
Nonroad Sources	2.0	2.6
Mobile Sources	7.2	9.3
Subtotal:	18.5	13.7
Kent/Queen Anne's Nonattainment Area		
Point Sources	0.3	0.0
Area Sources	9.4	0.7
Nonroad Sources	3.4	1.8
Mobile Sources	6.6	7.3
Subtotal:	19.7	9.8
Maryland Unclassified Counties		
Point Sources	12.3	40.6
Area Sources	52.4	29.5
Nonroad Sources	25.3	23.7
Mobile Sources	47.3	50.9
Subtotal:	137.3	144.7
State		
Point Sources	60.7	531.2
Area Sources	287.1	61.5
Nonroad Sources	107.5	143.1
Mobile Sources	303.7	356.1
Total:	759.0	1091.9

Figure 3.1: 1990 Base Year Ozone Precursor Emissions Inventory
VOC Emissions in Tons per Day

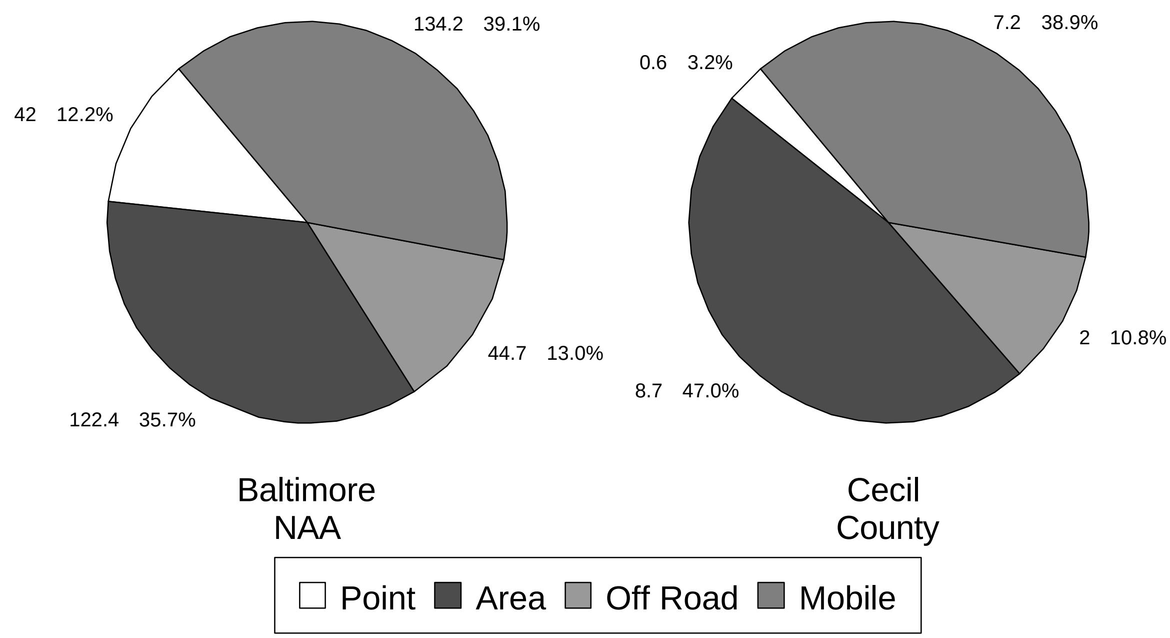
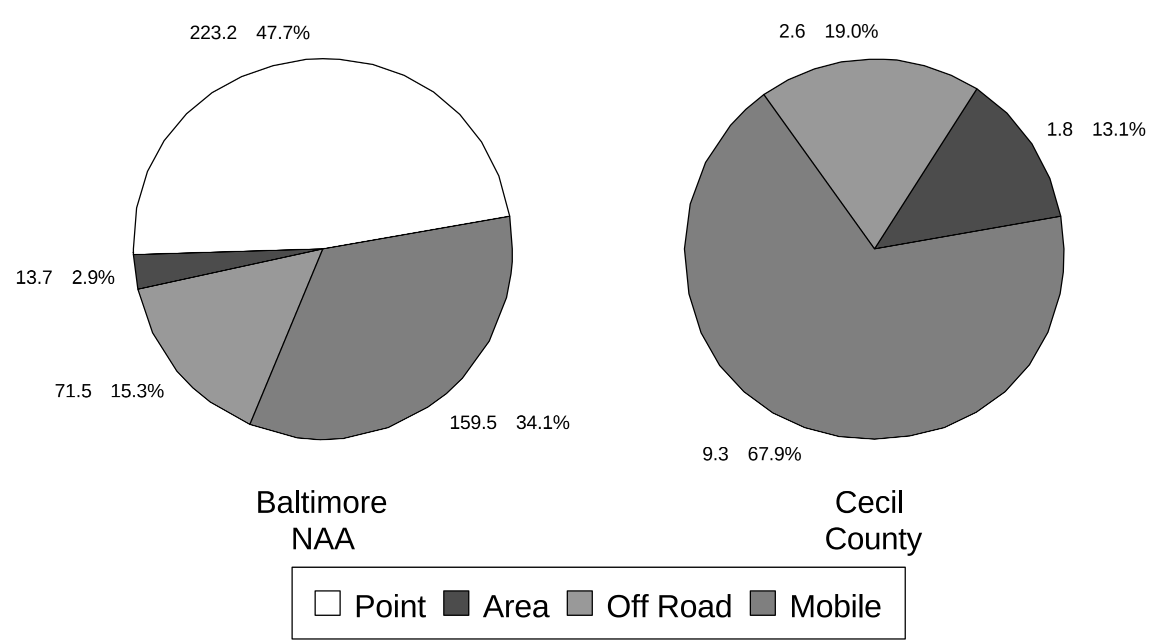


Figure 3.2: 1990 Base Year Ozone Precursor Emissions Inventory
NOx Emissions in Tons per Day



3.2.1 POINT SOURCES

A point source in the base year inventory is defined as a stationary source of emissions (i.e., smokestacks) in any Maryland county that emits annually at least 10 tons of VOCs, 100 tons of CO or 25 tons of NOx. There is a 25 ton per year threshold for NO_x emissions for a structure to be deemed a point source in the Baltimore ozone nonattainment area and Cecil County .

The Department's technical staff calculated emissions using the following types of methodologies :

- EPA-supplied emission factors;
- material balance emissions calculations;
- source-based test data calculations; or
- agency- or company-generated emission factors

EPA guidance requires that the Department adjust the inventory to take into consideration equipment failures and the inability of control programs to achieve 100% effectiveness at all times. This analysis, referred to as rule effectiveness (RE), means that when Department staff conduct RE studies, they take into account various factors including non-compliance with existing rules, control equipment downtime, operating and maintenance problems, and process upsets due to human or other errors. RE may also indicate errors in the projection of emissions estimates as well as the actual emissions themselves. RE adjusts emissions to correct for these failures and uncertainties to provide a more reliable estimate for planning and modeling.

The Department used the 80% default factor in several RE applications, and concentrated on RE improvements for key sources. Although the Department recognizes that the EPA default RE factor of 80% inadequately represents the variation that exists in the effectiveness of different industry process unit/control device combinations, staff limitations have precluded the Department's extensive use of surveys or Stationary Source Compliance Division (SSCD) studies to develop alternatives.

The Department did not apply RE to several source categories. RE was not applied to uncontrolled sources, to sources which have undergone an irreversible process change nor to sources whose emissions were calculated using direct determinations (material balance), unless a control device was employed. Additionally, the Department did not apply RE to sources where the operation of process equipment without an operational control device is mechanically or electronically prevented. This included some solvent vapor recovery processes and web printing equipment. Although the Department concedes that these electronic lock-outs can fail or be disabled, the former is rare and the latter is a criminal offense.

The Department has not collected extensive data on the temporal distribution of emissions. Typically, companies are required to quantify annual emissions by quarter. For purposes of modeling, however, the Department obtained daily NO_x emissions for specific ozone episodes. More specific information will be collected under the Certified Emissions Statement regulation, Code of Maryland Regulations 26.11.01.05-1 (COMAR, 1993).

The Department calculated peak ozone season emissions by the following method:

1) The Department converted annual emissions in pounds per year into pounds per day emissions by dividing annual emissions by operating days.

2) The pounds per day emissions were then multiplied by a seasonality factor. The seasonality factor was based on the quarterly percentage of operations (estimated by the company) for June, July, and August. The factor was calculated by multiplying the second quarter percentage by one third and the third quarter percentage by two thirds. The sum of the two results was divided by 25.

3) The ratio obtained was multiplied by the pounds per day emissions to get the seasonally adjusted emissions.

This methodology conforms with EPA-accepted practices. For a more detailed discussion of the methodology refer to *Volume 1, Section 2: Point Sources and Volumes 3-5: Documentation for Individual Point Sources* of the complete inventory documentation (MDE, 1993a). Table 3.2 displays the VOC emissions for the Baltimore nonattainment area, a highly industrialized area of Maryland. Cecil County emissions, displayed in Table 3.3, reflect the rural nature of the county and its lack of heavy industry. Figures 3.3 and 3.4 illustrate, in the form of bar graphs, the comparative emissions levels from the various point sources present in the Baltimore ozone nonattainment area.

Table 3.2: 1990 Base Year Ozone Precursor Emissions Inventory
Point Source Emissions Totals By Category In The Baltimore Nonattainment Area

Baltimore Area	**VOC** tons/day	**NOx** tons/day
Petroleum Product Handling	8.2	0.0
Industrial Processes	18.5	43.8
Industrial Surface Coating	12.7	0.7
Other Solvent Use	0.9	0.0
External Combustion Sources	1.0	166.5
Stationary Internal Combustion	0.3	7.0
Waste Disposal	0.4	5.2
Total	42.0	223.2

Table 3.3: 1990 Base Year Ozone Precursor Emissions Inventory
Point Source Emissions Totals By Category In Cecil County

Cecil County (Phil-Wilm.-Trenton Nonattainment area)	**VOC** tons/day	**NOx** tons/day
Petroleum Product Handling	0	0
Industrial Processes	0.6	0
Industrial Surface Coating	0	0
Other Solvent Use	0	0
External Combustion Sources	0	0
Stationary Internal Combustion	0	0
Waste Disposal	0	0
Total	0.6	0

Figure 3.3: 1990 Base Year Ozone Precursor Emissions Inventory
Baltimore Nonattainment Area
VOC Point Source Emission Distribution By Category

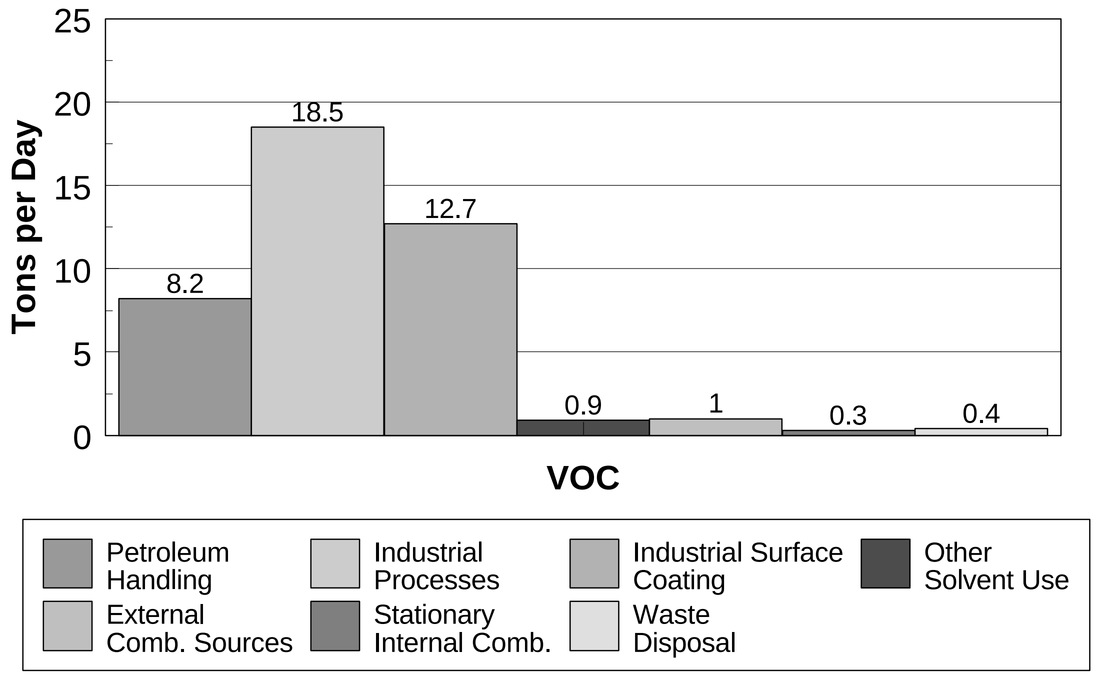
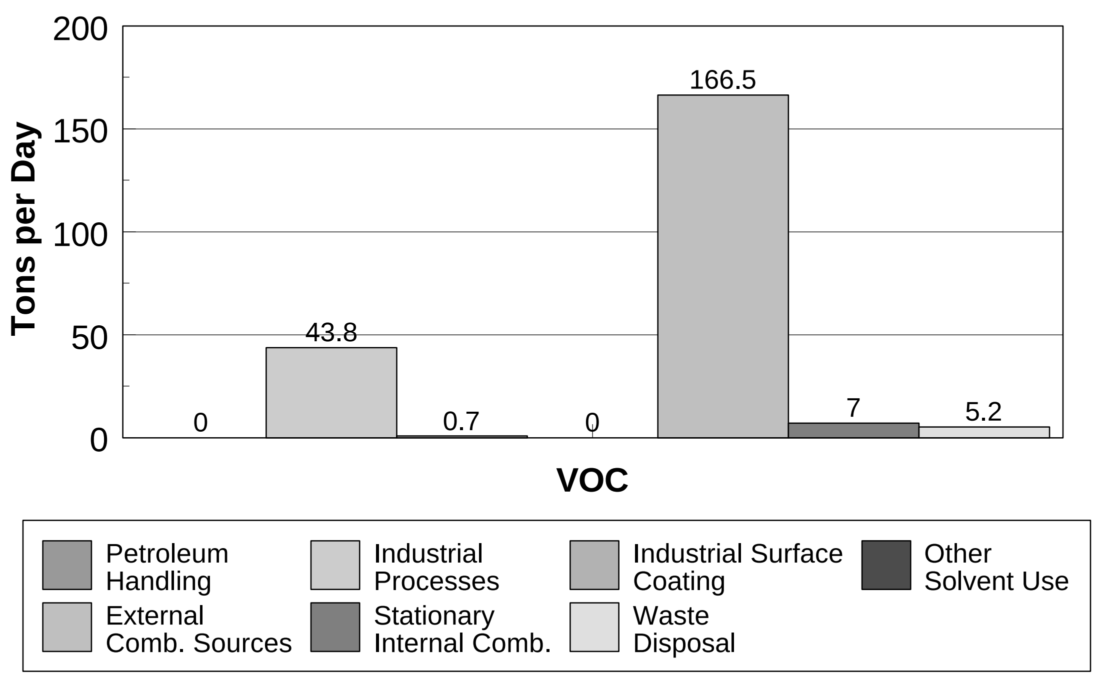


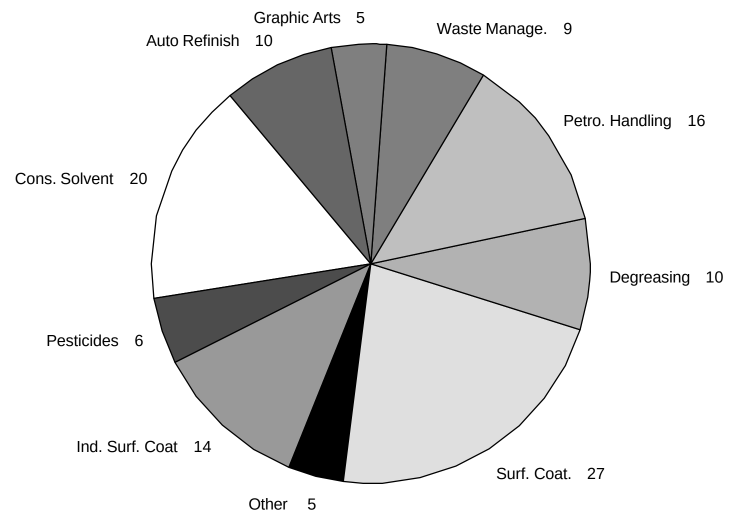
Figure 3.4: 1990 Base Year Ozone Precursor Emissions Inventory
Baltimore Nonattainment Area
NOx Point Source Source Emission Distribution By Category



3.2.2 AREA SOURCES

The area source component of the emissions inventory is an estimate of the emissions of sources too numerous to quantify them on an individual basis. The amount of emissions from each individual source is small, but collectively emissions from these sources represent a sizable portion of the inventory. In some cases, an area source category may represent the emissions from a specific activity associated with source. For example, gasoline distribution is broken into tank breathing and refueling emissions. Both categories represent emissions from service stations. Gasoline distribution also includes emissions from tank trucks in transit, another area source category, and bulk terminals, which are included in the point source inventory. Figure 3.5 displays the VOC emissions for the Baltimore nonattainment area. Figure 3.6 (below) displays the VOC emissions for Cecil County.

Figure 3.5: 1990 Base Year Ozone Precursor Emissions Inventory
Baltimore Nonattainment Area
Area Source Emissions Distribution by Category (Tons per Day)



The Department developed area source emissions estimates by multiplying an EPA-published emission factor by the activity indicator for each source category. Since source activity can vary throughout the year (for example, pesticides are applied more during the summer) seasonal adjustment factors developed by the EPA are also used to compile the inventory. In addition, as per EPA guidance, a rule effectiveness factor of 80% is assumed where applicable.

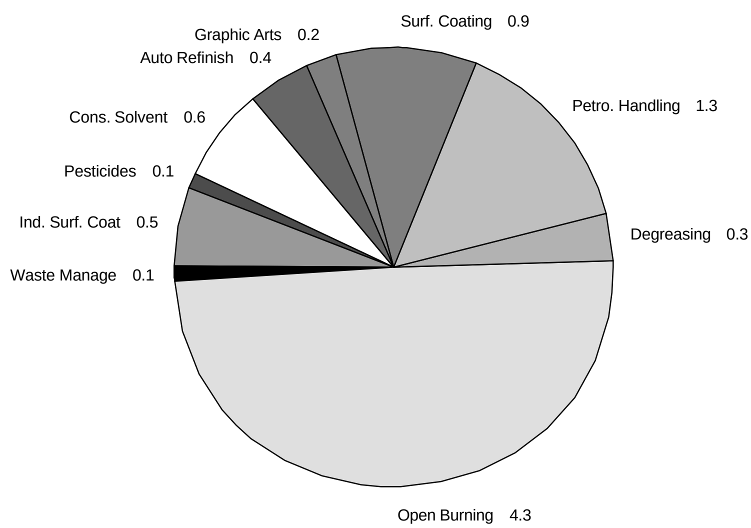
Another important consideration in developing an area source inventory is variations in the level of activity throughout the week. For example, automobile refinishing establishments may typically operate only five days per week while vehicles are refueled seven days per week.

The Department used one of four emission factor-based estimation approaches to calculate area source emissions:

- Per-capita emission factors;
- commodity consumption-related emission factors;
- level-of-activity-based emission factors; and
- employment-related emission factors.

Most of the emission estimates are calculated using procedures described in the EPA guidance document entitled *Procedures for the Preparation of Emission Inventories for Carbon Monoxide and Precursors of Ozone, Volume I: General Guidance for Stationary Sources*, referred to as (EPA, 1991g).

Figure 3.6: 1990 Base Year Ozone Precursor Emissions Inventory
Cecil County
Area Source Emissions Distribution by Category (Tons per Day)



The Department obtained activity and commodity level data from publications containing census and economic data, and from letter communications with individual companies and government agencies. Emission factors are from *Procedures, May 1991 and Compilation of Air Pollutant Emission Factors, Fourth Edition, Volume I: Stationary Point and Area Sources, AP-42* (EPA, 1985).

For certain categories, the Department subtracted ozone precursor emissions included in the point source inventory from the area source totals to avoid double counting. These categories include auto refinishing, industrial coating operations, and printing.

For a further discussion of the methodology used to calculate the area source emission inventory refer to *Volume 1, Section 3: Area Sources, and Volume 6: Area Source Supporting Documentation* of the complete inventory documentation (MDE, 1993a).

3.2.3 ONROAD MOBILE SOURCES

The highway mobile source component of the base year inventory is an estimate of VOC, NO_x, and CO tailpipe emissions and VOC evaporative emissions from vehicles operating on public roadways. Emissions are estimated for eight types of vehicles, including light-duty vehicles, light-duty trucks, heavy-duty trucks (both gasoline and diesel), and motorcycles, operating on thirteen categories of rural and urban public roadways.

The official 1990 ozone precursor inventory for highway vehicles in the Baltimore Nonattainment Area is the hourly, transportation model link-based inventory documented in Section 4.5 of *Volume 2*. The Mobile Sources Control Program at the Department considers the inventory produced using this methodology to be the most rigorous locality-specific inventory possible given current data resources.

Methodology for the Baltimore Nonattainment Area

In accordance with the standard methodology developing highway vehicle emissions inventories, the Department based all emissions estimates on emissions factors developed using the EPA's MOBILE 5 emissions factor model (December 4, 1992 release). Activity levels were developed using both Highway Performance Measuring System (HPMS) Vehicle Miles Traveled (VMT) data and locality-specific transportation model data as developed by the Baltimore Metropolitan Council (BMC).

In general, the better resolution of a link-based inventory makes it more accurate than a lower resolution inventory such as an HPMS-based inventory. Whereas, in an HPMS inventory, all travel along a particular roadway classification (e.g., urban interstate highways) is aggregated into a single county-level value, link-based inventories break the same travel into a series of discrete segments (i.e., links), each of which represents a discrete portion of the particular roadway classification over which traffic flow can be uniformly defined. Travel speed associated with a link-based inventory can vary within a roadway classification in accordance with actual traffic variations. Conversely, variations in speed within an individual roadway classification in an HPMS inventory are not considered travel aggregation process. As a direct result of the nonlinear relationship between vehicle speed and emissions, vehicle emissions are underestimated.

Since the Baltimore nonattainment area is classified as severe, the Mobile Source Control Program opted, in an effort to quantify emissions as accurately as possible, to develop an inventory of the area using hourly, link level data . While this type of inventory involves substantially more detailed input data than a daily inventory, the increased rigor is warranted given the scope of the controls likely to be considered for the Baltimore nonattainment area over the next decade. In addition, the inventory framework developed to support an hourly, link-based inventory can readily be used for promoting increased accuracy in the transportation conformity process for the Baltimore area.[9]

Just as a link-based inventory provides better speed resolution, it also allows for better spatial and temporal resolution of emissions. HPMS travel data is available at a county level-of-detail and therefore requires additional disaggregation algorithms to further resolve data. Typically these disaggregation algorithms are difficult to develop and subject to error far in excess of that associated with a properly designed and validated transportation model which allocates travel to discrete sections of roadway within a modeling network.

Methodology for Cecil, Kent, and Queen Anne's Counties

The official inventories for the Maryland portion of the Philadelphia-Wilmington-Trenton Nonattainment Area, which consists of Cecil County, and for the Kent/Queen Anne's Marginal Nonattainment Area are the daily HPMS-based inventories (methodology 1) documented in Section 4.5 of *Volume 2*. The Mobile Sources Control Program considers the HPMS methodology to be acceptable and accurate for these areas given the unavailability of transportation model data with which to increase modeling resolution. Also, given the fact that the quantity of ozone precursor emissions from these areas is relatively small, the likelihood of significant emissions under prediction associated with the use of a simpler inventory methodology is reduced.

[9] The transportation conformity process is defined in the consultation procedures and the memoranda of understanding developed between the Departments of Transportation and the Environment and metropolitan planning organizations in Washington, DC, Baltimore, and Delaware.

The 1990 mobile source emissions are summarized by nonattainment area in Table 3.1 above.

3.2.4 NONROAD MOBILE SOURCES

Nonroad mobile sources include those vehicles and equipment which are powered by internal combustion engines, but which are not normally operated on public highways. This includes mobile construction and industrial machinery and farm equipment, lawn and garden equipment and recreational boats. Emissions from aircraft and airports, railroads, and sea vessels are also included in this portion of the inventory.

Section 213(a) of the Act mandates that the EPA conduct a study of emissions from nonroad engines and vehicles in order to determine if these emissions cause or significantly contribute to air pollution. The EPA contracted with Energy and Environmental Analysts, Inc. (EEA) to conduct an emissions inventory for 33 severe and serious ozone nonattainment areas. The study covered nine nonroad equipment categories:

- lawn and garden equipment;
- agricultural or farm equipment;
- logging equipment;
- industrial equipment;
- construction equipment;
- light commercial equipment;
- airport service equipment;
- recreational land vehicles or equipment; and
- recreational marine equipment.

Data from the study entitled *Nonroad Engine and Vehicle Emission Study*, was provided to the nonattainment areas under study for use in developing the 1990 base year inventory.

The EEA inventory weighted use equally throughout the week. A Baltimore survey of boat owners found that use of personal boats was split 40/60 weekday to weekend use. Maryland adjusted the EEA inventory to account for this and for a 50/50 split of weekday/weekend use of lawnmowers.

The remaining six nonroad categories not covered in the EEA study are railroads, commercial aviation, air taxis, general aviation, military aviation and vessels. Calculations for these categories were performed by the Department using methodologies in *Procedures for Emission Inventory Preparation, Volume IV: Mobile Sources, Revised* (EPA, 1992f).

Aircraft, marine vessel and railroad activities were considered constant throughout the year. The data necessary to estimate a seasonal variation in their emissions was not readily available, and their emissions represent a small fraction of both the total inventory and the nonroad inventory.

Table 3.6: Nonroad Source Emissions In Baltimore

Nonroad Source Category	Emissions (tons per day)
Lawn & Garden Equipment	17.7
Aircraft Services	0.9
Off-Road Vehicles	0.9
Recreational Boating	7.7
Construction	5.5
Industrial	1.8
Agricultural	1.7
Light Commercial	3.8
Logging	0.3
Other	4.4
Total	44.7

Table 3.7: Nonroad Source Emissions In Cecil County

Nonroad Source Category	Emissions (tons per day)
Lawn & Garden Equipment	0.68
Aircraft Services	0.00
Off-Road Vehicles	0.24
Recreational Boating	0.55
Construction	0.12
Industrial	0.05
Agricultural	0.24
Light Commercial	0.12
Logging	0.02
Other	0.02
Total	2.02

Figure 3.7: 1990 Base Year Ozone Precursor Emissions Inventory
Baltimore Nonattainment Area
Nonroad Source Emission Distribution By Category

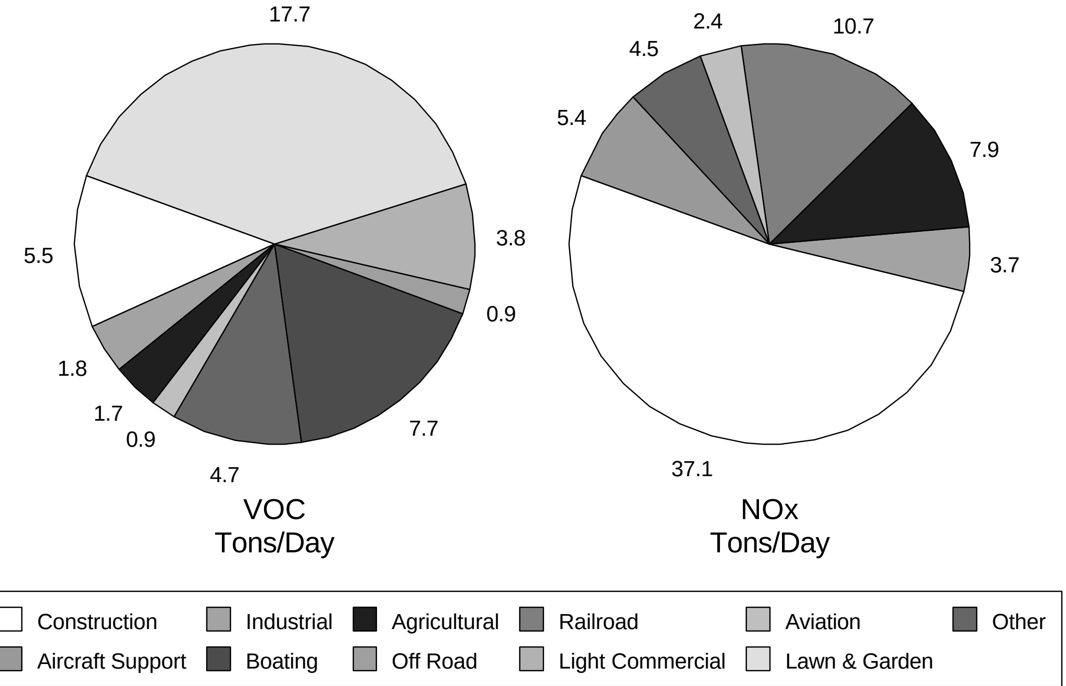
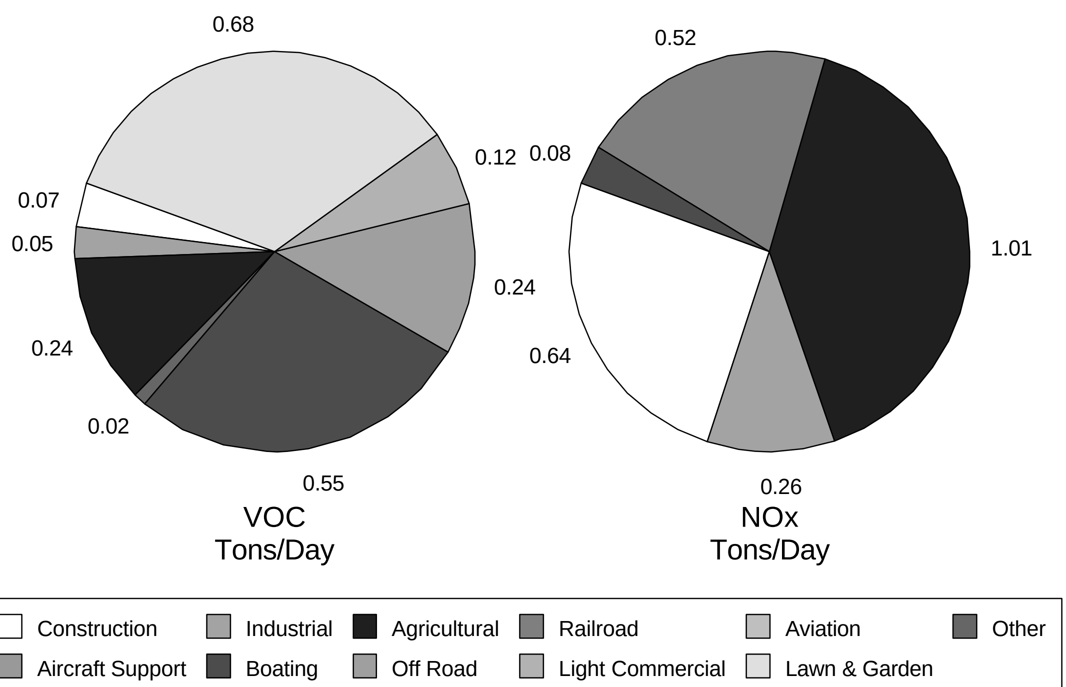


Figure 3.8: 1990 Base Year Ozone Precursor Emissions Inventory
Cecil County Area
Nonroad Source Emission Distribution By Category



3.2.5 BIOGENIC EMISSIONS

VOCs are emitted from biogenic sources (vegetation). The Department used the EPA *Personal Computer Version of the Biogenic Emissions Inventory System* (PC-BEIS) (EPA, 1991f), to calculate emissions from biogenic sources. PC-BEIS calculates VOC emissions in tons per day based on land use, leaf biomass factors (mass of dry leaf related to forest area), emission factors for different chemical species, and meteorological data.

The hourly meteorological data (wind speed, temperature, sky cover and relative humidity) were obtained from the National Weather Service at Baltimore Washington International Airport for July 6, 1988. The Introduction to *User's Guide to the Personal Computer Version of the Biogenic Emissions Inventory System* (PC-BEIS) (EPA, 1991f), recommends for a base year inventory to select a day based on the following steps:

- ❖ select top ten days with highest hourly ozone readings over most recent three years of monitoring
- ❖ obtain National Weather Service data for daily maximum temperature on each of the ten days
- ❖ rank temperature maxima from highest to lowest
- ❖ select fourth highest based upon maximum daily temperature
- ❖ use hourly meteorological data as above for this day as input to PC-BEIS

Using this criteria the Department selected July 6, 1988.

Land use data are from the Oak Ridge National Laboratory's GEOECOLOGY data base. It is aggregated into 25 land use types. The forest types are designated as primarily oak, other deciduous and mostly coniferous to match published emission factors in Lamb et al. (Lamb, 1987).

Table 3.6 summarizes the biogenic emissions for the state by county. Subtotals for the nonattainment areas are included. Cecil County is the only county in Maryland included in the Philadelphia-Wilmington-Trenton nonattainment area, and as such, was not listed individually as a regional subtotal.

TABLE 3.8: EMISSIONS FROM BIOGENIC SOURCES BY COUNTY

County	VOC (tpd)
Allegany	47.77
Anne Arundel	29.27
Baltimore	43.35
Calvert	22.01
Caroline	29.47
Carroll	38.91
Cecil	32.96
Charles	44.37
Dorchester	50.43
Frederick	57.95
Garrett	64.01
Harford	43.94
Howard	21.25
Kent	33.83
Montgomery	38.35
Prince George's	43.15
Queen Anne's	36.88
Saint Mary's	35.69
Somerset	23.83
Talbot	16.54
Washington	43.16
Wicomico	36.25
Worcester	43.94
Baltimore City	3.37
Baltimore Area	180.09
Washington Area (MD)	205.83
Kent/Queen Anne's	70.71
Unclassified Counties	391.09

[2] Lamb, B., A. Guenther, D. Gay, and H. Westburg (1987): A national inventory of biogenic hydrocarbon emissions. *Atmospheric Environment*, **21**, pp. 1695-1705.

3.3 ADJUSTMENTS TO THE 1990 BASE YEAR INVENTORY

The 1990 base year inventory presented in this *Post-1996 RPP* has been modified from the 1990 base year inventory presented in the 1990 Base Year Ozone Precursor Inventory. These changes are due to several factors such as higher emissions reported from stack tests as compared to emissions developed with the EPA's AP-42 emission factors and point sources which were excluded in the inventory. Modifications to the 1990 base year inventory are very important due to their direct relationship in the emission target level and reduction calculations. Additional documentation concerning the modifications to the 1990 Base Year Ozone Precursor Inventory can be found in Appendix B.

The modifications to the inventories are summarized in the tables below.

Table 3.9: Modifications to the Baltimore Nonattainment Area VOC Inventory

Source	Original	Modified	Change
Point	40.3	42.0	+1.7
Area	127.1	122.4	-4.7
Mobile	134.2	134.2	0
Nonroad	45.2	44.7	-0.5
Total	346.8	343.3	+3.5

Table 3.10: Modifications to the Baltimore Nonattainment Area NOx Inventory

Source	Original	Modified	Change
Point	231.4	223.2	-8.2
Area	10.6	13.7	+3.1
Mobile	159.5	159.5	0
Nonroad	71.7	71.5	-0.2
Total	473.2	467.9	-5.3

Table 3.11: Modifications To The Cecil County VOC Inventory

Source	Original	Modified	Change
Point	0.6	0.6	0
Area	8.9	8.7	-0.2
Mobile	7.2	7.2	0
Nonroad	2.0	2.0	0
Total	18.7	18.5	-0.2

Table 3.12: Modifications To The Cecil County NOx Inventory

Source	**Original**	**Modified**	**Change**
Point	0	0	0
Area	1.7	1.8	+0.1
Mobile	9.3	9.3	0
Nonroad	2.0	2.6	+0.6
Total	13.0	13.7	+0.7

4.0 THE PROJECTED EMISSIONS INVENTORIES

The Act requires all ozone nonattainment areas classified as moderate and above to achieve a 15 percent reduction in actual VOC emissions by 1996. Also, the Act requires that emissions be reduced by 3 percent every year until 2005. The reduction must be calculated from the anthropogenic VOC and NOx emission levels reported in the state's 1990 base year inventory after those levels have been adjusted for pre-1990 controls. The 1990 base year inventory is reported in Section 3. This section presents the projection year inventories, the state's estimation of the level of VOC and NOx emissions to be expected if no further action is taken to control VOC or NOx emissions.

The VOC and NOx projected year emissions inventories were derived by applying the appropriate growth factors to the 1990 base year emissions inventories. The EPA guidance describes four typical indicators of growth (EPA, 1991d). In order of priority, these are:

- product output;
- value added;
- earnings and;
- employment

For the *Post-1996 RPP*, population, households, and employment factors were based on Round 5 forecasts. For point and area, the Bureau of Economic Analysis (BEA) factors were used to project growth except for utilities and nonroad mobile sources. For these categories, the Economic Growth Analysis System (EGAS) was used as recommended by the EPA.

The results from using earnings data to project the point, area and nonroad sources using BEA and EGAS factors are presented. Mobile source growth is based on vehicle miles traveled (VMT) trends from 1986 to 1991 for Cecil County and on the computer modeling of 1996 mobile source patterns for the Baltimore nonattainment area. A brief discussion of the indicators and a detailed description of the BEA and EGAS methodology is provided in this section.

4.1 GROWTH FACTOR METHODOLOGY - BEA EARNINGS METHODOLOGY

4.1.1 DESCRIPTION OF DATA SOURCE

Growth rates for most point and area source categories in this study are derived from projection of industrial earnings made by the U.S. Department of Commerce, Bureau of Economic analysis (BEA, 1990). Using BEA industrial earnings to project emissions is consistent with EPA guidance on preparing emission projections (EPA, 1991d). BEA projects State-specific industrial earnings for 57 industrial groups for the following years: 1995, 2000, 2005, 2010, and 2040. These 57 industrial groups can, for the most part, be matched with 2-digit Standard Industrial Classification (SIC) codes. Some new pseudo-SIC codes were assigned in the (99x) range for composite categories or categories not covered in the SIC system, such as population and VMT.

4.1.2 GROWTH PROJECTION METHODOLOGY

Growth rates for area source and VOC point sources came from the BEA earnings data. The methodology for developing NOx point source, and nonroad mobile source growth is presented separately in this section, along with justification for the distinct methodologies used. The methodology for calculating VMT growth rates is also presented separately, later in this section. BEA supplies historical data for 1973, 1979, 1983, and 1988 for each category for which it makes projections.

The first step in developing growth rates based on BEA factors is to estimate earnings in the base year (1990) and the projection years for which earnings data do not exist (1996, 1999, 2007). This is done by assuming straight-line growth between the two closest years for which data exists. For example, 1990 earnings were estimated using the following formula:

$$EARN_{90}=EARN_{88}+[2/7*(EARN_{95}-EARN_{88})]$$

where:

$EARN_{xx}$ = BEA earnings estimate in year xx

After using this process to estimate data for the base year and all projection years, average annual growth rates were calculated between the base year and each projection year:

$$AAGR_{BYPY}=\left[\left(\frac{EARN_{PY}}{EARN_{BY}}\right)^{\frac{1}{PY-BY}}-1\right]*100$$

where:

$AAGR_{BYPY}$ = average annual growth rate from the base year to the projection year (percent)
$EARN_{PY}$ = earnings in the projection year
$EARN_{BY}$ = earnings in the base year

4.1.3 OFFSET PROVISIONS

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 in severe ozone nonattainment areas such as the Baltimore nonattainment area, major stationary sources include all stationary sources exceeding 25 tons per year of VOC and NOx emissions, and 100 tons per year of CO emissions.

For extreme and severe areas, the Act also requires that mobile emission increases that result from increases in VMT be offset by transportation control measures. It is difficult at this time to determine if any offsets will be necessary under this provision because total reductions necessary for attainment and the reduction measures required to bring about these reductions have not been determined.

4.2 GROWTH FACTOR METHODOLOGY- EGAS GROWTH FACTORS

EGAS is composed of three tiers: a national economic tier, a regional economic tier, and a growth factor tier. Each of these tiers will be discussed briefly.

Tier 1: The National Economic Tier

The national economic tier includes a Regional Economic Modeling Institute (REMI) model of the United States which includes a baseline forecast calibrated to the one released by the Bureau of Labor Statistics (BLS). Although the BLS forecast is updated every two years, REMI updates the forecast using data released annually by BEA. In addition, the EGAS national economic tier contains the option to use economic forecasts from Wharton Economic Forecasting Association (WEFA). WEFA forecasts national economic activity under low growth, base case high growth, and cyclical growth scenarios.

The function of the national tier in EGAS is two-fold. First, the inclusion of a national forecasting capability allows EPA to forecast urban and regional economic growth using a common assumption about national economic growth. Second, it provides users with the ability to use the most current national economic forecasts and to simulate the effects of different levels of national growth on emission-producing activity in nonattainment areas.

Tier 2: The Regional Economic Tier

The regional economic tier includes separate economic models for each of the nonattainment areas and attainment portions of the States. The largest geographic area covered by an economic model is a State.

The regional economic models included in EGAS were built by REMI. The models simulate interaction between the 14 major sectors of an economy and produce estimates of employment and value added for 210 sectors. The 210-sector outputs are identified by BLS industrial codes. The BLS codes are closely related to three-digit SIC codes. Outputs from the regional models are used as input data for the growth factor tier.

The REMI models are designed to forecast future activity in an area and to simulate the effects of a policy change in an area. The models come with a capability for the user to simulate the effects of changes in almost 400 economic policy variables and over 70 demographic variables. The list of policy variables included with EGAS was reduced to 84 variables. Two criteria were used for choosing which policy would be included in the system: whether the policy variable relates to the implementation of the Act and whether the variable is one which local personnel using EGAS would be knowledgeable of , particularly changes of proposed changes. For example, industrial capital costs were included as a variable because that variable satisfies the first criterion. This variable will allow users to simulate the effects of control costs associated with the Act. Policy variables that satisfy the second criterion include local tax rates and State and local government spending. Policy variables which do not satisfy either criterion, and therefore are not in EGAS, include demographic variables such as birth and survival rates, and economic variables such as demand for goods not affected by the Act.

The REMI models and outputs contribute to the development of credible growth factors for future-year inventories in the following ways:

- Forecasts of activity from emission-producing sources were to be developed for both the attainment and nonattainment portions of States, allowing growth rates to differ between rural and urban portions of a State.

- Outputs form the models are used to produce area-level estimates of fuel consumption and and physical output.

- The effects of a nonattainment area policy on the surrounding areas can be assessed.

- Information on local policies can be entered directly into the REMI models. This ability allows users to include the effects of local policies when developing forecasts.

REMI outputs and the growth factor tier are linked in the following specific ways:

- REMI models provide income forecasts for estimating residential fuel consumption.

- REMI models provide population and personal income forecasts for estimating commercial energy consumption.

- REMI models provide the forecasts of the relative costs of capital, labor, and materials for estimating industrial fuel consumption.

- REMI models provide industry-specific employment and value added forecasts for estimating physical output.

Tier 3: The Growth Factor Tier

The third tier of EGAS is the largest portion of the system. Housed within the third tier are commercial, residential, industrial, and utility energy models; a physical output module; and a Crosswalk. Each of these modules will be discussed.

Utility Energy Models

The energy models in the system were developed by Argonne National Laboratories (ANL) and are currently being used for the National Acid Precipitation Assessment Program (NAPAP). The residential energy model, the Household Model of Energy (HOMES), was modified for use in the NAPAP model set in the mid-1980s. In 1989-1990, ANL updated HOMES to include the capability to model residential fuel consumption at the State, rather than Census, level. For use in EGAS, two changes were made to HOMES. First, the base year of the model projections was updated to 1990 using data from the State Energy Data Report (SEDS). Additionally, the capability to estimate growth in residential fuel consumption at the sub-State level was developed. REMI forecasts of population data for nonattainment areas and attainment portions of States are input with State-level fuel price forecasts to develop estimates for residential fuel consumption growth for seven fuels for each of the nonattainment areas and attainment portions of States in EGAS.

Commercial Energy Model

The Commercial Sector Energy Model (CSEMS), was also developed for use in the NAPAP model set in the mid-1980s and updated in 1989-1990 to estimate commercial fuel consumption at the State level. Like HOMES, the model was modified for use in EGAS to estimate commercial energy consumption growth for six fuels for nonattainment areas and surrounding attainment portions of States. The base year for the model projections was updated to 1990 using data form SEDS. Inputs to CSEMS include State-level fuel price forecasts and REMI forecasts of population and personal income at the sub-State level.

Industrial Energy Model

The Industrial Regional Activity and Energy Demand Model (INRAD), was developed to predict how energy use will be influenced by energy prices and the general level of economic activity. INRAD was developed to model energy consumption of fossil fuels and electricity for seven energy-intensive industries and an eighth "other" category with aggregates the non-energy-intensive industries. Two modifications to INRAD were made for use in EGAS. first, additional industrial categories were modeled. Second, INRAD was modified to estimate fossil fuel consumption by fuel type. With the modifications, INRAD can estimate coal, oil, gas, and electricity consumption for the following sectors: food, textiles, upstream paper products, down stream paper products, upstream chemicals, downstream chemicals, glass, glass products, and metals. Inputs to INRAD include State-level forecasts of fuel prices and REMI forecasts of the relative costs of capital, labor, and materials at the sub-State level.

Physical Output Module

The physical output module estimates physical output form value added data generated by the REMI models. Industrial VOC sources were ranked by their contributions to industrial VOC emissions and equations were developed for the largest VOC sources. These equations relate changes in physical output by three-digit SIC categories (as identified by BLS code) with changes in value added and a time trend to capture technological change. These equations provide better estimates of VOC-producing activity than value added alone because they estimate change in actual material output, which is related to the use of VOC producing materials, such as surface coatings and degreasers. For industrial VOC categories for which equations were not developed, activity levels are forecast using value added forecasts form the REMI models.

Electricity Generation Model

Electricity generation by electric utilities is forecast by the Neural Network Electric Utility Model (NUMOD). NUMOD is a behavioral model which uses three embedded neural networks to calculate annual generation activity indices and annual generation resulting from combustion of coal, oil, and natural gas in each of the 48 contiguous states. although NUMOD forecasts state aggregate generation, it assumes that states are grouped into power pools. It also assumes that generation needed to meet demand in any state may be partially located in other states in the power pool. In contrast to traditional electric utility models, NUMOD used artificial intelligence to learn to relate the amount of electricity generated from data describing generation capacity, climate, peak loads, fuel prices, and power pool effects. The model operates by reading input records, each of which describes one state for one year. Each record is independent of every other record, allowing NUMOD to run any number of scenarios during a single model run.

The Crosswalk

The Crosswalk is the final component of the EGAS system. The Crosswalk translated growth factors from the energy and physical output modules into growth by SCC. The growth factors from the industrial energy and physical output modules are desegregated to the two-, three-, and sometimes four-digit SIC level, while growth factors from the electric utility model can be desegregated to the plant or county level by type of fuel consumption. The commercial and residential sector energy models desegregates consumption by fuel type only. The Crosswalk was developed by individually matching each of the approximately 7000 SCCs with the appropriate growth factor from the modules. This allows different growth factors to be applied to different emission sources form the same industrial category. For example, forecasts of fuel consumption in upstream chemical manufacturing are developed by INRAD, while forecasts of physical output of upstream chemical products are developed in the physical output module. This methodology takes into account that future emissions associated with an SIC code will vary by type of emission. This is consistent with the SCC system of clarification which differentiates according to not only industrial category, but also to processes within that category.

4.2.1 NOx POINT SOURCE GROWTH

EGAS will be used to project the AIRS point source inventories which are housed in the AIRS Facility Subsystem (AIRS/FS). These projected inventories will be used in photochemical grid modeling and RFP inventories. Because the AIRS/FS inventories will be projected on a source-specific basis, the user will be able to choose each growth factor. For example, if a user has information from permits or plant surveys about the expected growth of a point source, the user may use that information to predict future growth of that source within EGAS. The ability of the user to override default growth factors may be most important for electric utilities, which are permitted sources and are major emitters of oxides of nitrogen. EGAS produces default growth factors for commercial and industrial energy consumption, fuel consumption by electric utilities, and physical output by Bureau of Labor Statistics code, which represent groups of three- and four-digit SICs. These growth factors are then translated, via the EGAS CROSSWALK, into default growth factors by SCC. Because there is no direct linkage between EGAS and AIRS, users may alter the EGAS growth factor based on information that they have on specific emission sources.

EGAS uses the following information for projecting point source growth:

- ❖ Value added estimates for 210 non-farm industrial categories;
- ❖ Physical output estimates for 210 some major VOC-emitting sources; and
- ❖ Estimates of fuel consumption by type of fuel for the commercial, industrial, and electric utility sectors.

4.2.2 NONROAD GROWTH

Until the EPA develops it computer model for determining nonroad emissions, EGAS growth factors will also be used to determine future emissions from these sources.

The full text of the EPA guidance on projection of emissions from nonroad sources may be found in an EPA memo entitled "Guidance on Projection of Nonroad Inventories to Future Years", dated February 4, 1994. This guidance builds on a previously released report and subsequent development of nonroad inventories for use in 33 ozone and/or carbon monoxide nonattainment areas. These inventories were estimated as a product of equipment population, activity rates and emission factors.

EPA guidance recommends that states use one of the following five alternative methodologies to project nonroad inventories:

1. Project the original or state-modified (A+B)/2 inventory for 1990 to future years by projecting the indicator variables used to estimate the population and activity level of each engine-equipment type within the current A inventory.

2. Develop surrogates for the indicator variable(s) used to develop equipment populations estimates for inventory A and use projections of the surrogate variables to project the indicator variables required under the first approach.

3. Project the 1990 inventory by multiplying 1990 emissions by the ratio of future to 1990 human population within the same nonattainment area.

4. Projecting emissions by multiplying 1990 emissions by the growth factors developed for EGAS

5. Project the 1990 inventory by using other projected data on equipment populations and activity levels specific to the nonattainment area in question in conjunction with EPA-provided in-use emission factors.

The Department has chosen option number four to project growth in emissions from nonroad sources.

Within EGAS, the surrogate indicators for nonroad sources are value added or population as identified in the table below.

Table 4.1: EGAS Surrogate Indicators for Projecting Growth in Nonroad Sources

Source Category	**Relevant EGAS Growth Factors**
Agricultural Equipment	Value Added: Farm
Aircraft	Value Added: Air Transportation
Airport Service Equipment	Value Added: Air Transportation
Commercial Marine	Value Added: Water Transportation
Construction Equipment	Value Added: Construction
Industrial Equipment	Value Added: Durable & Nondurable Mfg.
Lawn & Garden Equipment	Population
Light Commercial Equipment	Value Added: Retail, Wholesale, Services
Logging Equipment	Value Added: Logging
Military Vessels	Total Government
Railroads	Value Added: Railroad Transportation
Recreational Equipment	Population
Recreational Equipment	Population
Recreational Marine	Population

While these indicators appear to be the most appropriate considering the general application of EGAS, other area-specific factors may influence growth in these nonroad categories. For example, water surface area constraints may affect growth in marine vessel use, and population density and climatic conditions may affect emissions from lawn and garden equipment.

4.3 GROWTH FACTOR METHODOLOGY- MOBILE SOURCE GROWTH

As stated in Chapter 3, different methodologies were used to calculate the mobile source inventories for the Baltimore nonattainment area and Cecil County. In keeping with the same philosophy of utilizing the most definitive method allowed by available data, growth is projected in a slightly different manner for each area.

For the Baltimore nonattainment area, available data allow the onroad mobile source 1990 base year inventory to be projected to the attainment year of 2005 by transportation modeling techniques. The transportation model is run using the 1990 vehicle fleet on the 2005 planned highway network. Appropriate population, household and employment growth are input through the Round 5.0 Cooperative Forecasting techniques. After projection of the emissions without controls, emission factors for 1999 conditions are used in subsequent MOBILE5a runs to estimate sequentially the effect of each control measure on future emissions. Column number two of the spreadsheet entitled "Baltimore Area Highway Vehicle Phase I ROP Inventories" is the 1990 adjusted baseline inventory in 1999. The emissions benefits associated with this scenario are due to the Federal Motor Vehicle Control Program (FMVCP) and federal Reid Vapor Pressure (RVP) requirements and are non-creditable emission benefits. At this point the emissions represent the 1999 projected mobile source inventory.

The 1990 base year inventory for Cecil County was based on Highway Performance Monitoring System (HPMS) data because the County is not part of an urban transportation network. Therefore, in Cecil County, VMT growth was based on historical data from 1986 to 1991 for the county using linear regression techniques, as stipulated in EPA guidance. The growth rate was applied to the HPMS VMT data used for the base year inventory. Emission factors for 1999 conditions from MOBILE 5a were applied to the projected VMT. This growth was adjusted to eliminate emissions that would be reduced due to pre-1990 FMVCP standards and federally mandated Reid Vapor Pressure restrictions on gasoline. The onroad emissions from Cecil County are so small that the projected growth is lost when emissions are rounded to the nearest tenth.

4.4 ASSUMPTIONS MADE IN CALCULATING GROWTH

The following section will summarize the basic assumptions applied in the construction of the projected emissions inventory. The issues involved include the use of actual versus allowable emissions in deriving the milestone emissions for each source category, and rule effectiveness and rule penetration assumptions.

4.4.1 USE OF BEA METHODOLOGY VS. USE OF EGAS METHODOLOGY

In projecting emission estimates for the Post-1996 RPP, the Department used the two methodologies described above, BEA and EGAS growth factors. The selection between these two methodologies was done based upon guidance from the EPA and through the analysis of both factors to each source category.

The EPA recommends the use of EGAS growth factors for the projection of nonroad emissions and NOx emissions from point sources. In addition, the Department analyzed these methodologies for NOx point sources., an analysis was developed for the projected estimates between EGAS and BEA growth factors. For example, EGAS uses a fossil fuel model which the Department feels projects realistically the use of fossil fuels for the Baltimore nonattainment area. This is important since fossil fuel use by sources such as utilities are the major component of the point source emissions for NOx.

As recommended by the EPA, BEA growth factors were used for area sources and point source emissions of VOC. An analysis was also developed for these source categories using both methodologies. For the area source category, commercial and consumer products and new motor vehicle refinishing were projected by EGAS to decrease over the next ten years due to a population decrease in the Baltimore nonattainment area. This contradicts industry projections and the expectations of the Department.

In using the EGAS system, specific settings were chosen to run the model. The first setting was in the national tier, where the Department chose the BLS model over the WEFA model. Time constraints did not allow for a through comparison of the two models. In the regional tier, no policy changes were enacted, and the default settings for the Maryland Region were used. This was again due to time constraints and may be studied in the future.

4.4.2 ACTUAL VS. ALLOWABLE EMISSIONS IN THE CONSTRUCTION OF THE PROJECTED EMISSIONS INVENTORY

For the purposes of calculating projection emissions inventories, EPA guidance specifically outlines the circumstances under which emissions projections are to be based on actual or allowable emissions. For sources or source categories that are currently subject to a 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 used to project for sources or source categories that are currently unregulated. For sources that are expected to be subject to additional 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. At this time, the Department does not have data to calculate allowable emissions for all sources that will be controlled in the future. Therefore, all base year and all projection year emissions estimates are based on actual emissions.

Formally, the distinction between "actual emissions" and "allowable emissions" is drawn under Title 26.11.01.01 of Maryland air quality regulations (COMAR, 1993). The term "actual emissions" means the average rate, in tons per year, at which a source discharged a pollutant during a 2-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 burned 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 Maryland 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".

4.4.3 EFFECT OF RULE EFFECTIVENESS

For the purposes of constructing the 1990 base year inventory, rule effectiveness was calculated using the EPA 80% default factor except for gasoline marketing where a Stationary Source Compliance Division study was done. Rule effectiveness was applied to the projected emissions reductions where appropriate using the 80% default factor. It was not applied in the case of product reformulations or total activity bans.

4.5 PROJECTION INVENTORY RESULTS

The VOC and NOx projection year emission inventory results with no control measures applied are summarized by component of the inventory in Table 4.2 for the Baltimore nonattainment area. Table 4.3 summarizes the results of the VOC and NOx projection year emission inventories with no control measures applied for Cecil County.

Table 4.2: Projection Year Emission Inventory Results for the Baltimore Nonattainment Area

VOC Emissions (tpd)						NOx Emissions (tpd)				
Source	**1990**	**1996**	**1999**	**2002**	**2005**	**1990**	**1996**	**1999**	**2002**	**2005**
Mobile	134.2	146.0	154.0	168.1	164.3	159.5	178.8	188.4	203.0	200.1
Point	42.0	44.6	48.1	51.4	54.2	223.2	230.5	240.6	247.5	251.9
Area	122.4	126.6	128.7	130.5	132.2	13.7	14.5	14.8	15.1	15.4
Non-road	44.7	48.5	50.9	53.4	54.4	71.5	79.5	82.0	86.6	91.8
Total	**343.3**	**365.7**	**381.7**	**403.4**	**405.1**	**467.9**	**503.3**	**525.8**	**552.2**	**559.2**

Table 4.3: Projection Year Emission Inventory Results for Cecil County Area

VOC Emissions (tpd)						NOx Emissions (tpd)				
Source	**1990**	**1996**	**1999**	**2002**	**2005**	**1990**	**1996**	**1999**	**2002**	**2005**
Mobile	7.20	7.30	7.40	7.50	7.60	9.30	9.50	9.70	9.80	10.00
Point	0.56	0.57	0.59	0.61	0.62	0.00	0.00	0.00	0.00	0.00
Area	8.73	8.91	9.00	9.09	9.17	1.78	1.83	1.91	2.02	2.16
Non-road	2.04	2.20	2.30	2.39	2.47	2.64	2.76	2.84	2.93	3.02
Total	**18.53**	**18.98**	**19.29**	**19.59**	**19.86**	**13.72**	**14.09**	**14.45**	**14.75**	**15.18**

5.0 CALCULATING THE VOC EMISSION TARGET LEVELS FOR THE POST-1996 MILESTONE YEARS

To determine the amount of emissions reductions required after the year 1996, the Department must calculate the target level for VOC emissions at each milestone year for the Baltimore nonattainment area and Cecil County. The target level is the maximum amount of VOC emissions that can be emitted to comply with the Act's requirements. Table 5.1 demonstrates the target level of VOC emissions at each milestone year for the Baltimore nonattainment area and Cecil County. A discussion on how the target level is calculated is discussed in Section 5.2.

Table 5.1: VOC Emission Target Levels for Post-1996 Milestone Years

Milestone	Baltimore Nonattainment Area	Cecil County
1999	226.4	11.8
2002	196.3	10.2
2005	168.6	8.7

5.1 NOx SUBSTITUTION

If a nonattainment area cannot meet the VOC emission target level, Section 182(c)(2)(C) of the Act allows for the substitution of actual NOx emission reductions which occur after 1990 to meet the VOC emission target level. This may be done provided that such reductions meet the criteria outlined in the EPA's December 15, 1993 NOx Substitution Guidance (Appendix G).

One of the conditions for meeting the VOC emission target level using NOx substitution is that the sum of all creditable VOC and NOx emission reductions must equal 3 percent per year averaged over each applicable milestone period. In other words, any combination of VOC and NOx emission reductions which totals 3% per year.

The following equation generally describes the method to calculate the total 3% per year emission reductions:

$$R_V/VOC(Adj.) + R_N/NOx(Adj.) >= 0.03$$

where; RV = typical summer day VOC reductions
RN = typical summer day NOx reductions
VOC(Adj.) = human-made 1990 adjusted VOC emissions inventory, and
NOx(Adj.) = human-made 1990 adjusted NOx emissions inventory.

The values of R_V and R_N include only the creditable emission reductions from the nonattainment area of concern. For instance, VOC and NOx reductions from automobile tailpipe and gasoline volatility standards adopted prior to the Act's amendments of 1990 are excluded from these values. The Act specifically excludes these as programs which may be not credited toward the *15%* and *Post-1996 RPPs*.

The values of VOC(Adj.) and NOx(Adj.) include the 1990 adjusted emissions inventories. These values are equal to the 1990 man-made base year inventory minus reductions from the pre-enactment automobile tailpipe and gasoline volatility standards.

The second condition for using NOx substitution requires the amount of NOx emission reductions used to meet the *Post-1996 RPP* be consistent with the amount of NOx emission reductions mandated by the urban airshed model. The amount of emission reductions required to bring a nonattainment area into attainment with the ozone standard are determined by the urban airshed model. Therefore, the reductions required by the model must be met in addition to those required by the RPPs. However, do to the chemical reactions the maximum amount of NOx reductions required is that dictated by the model. NOx reductions have the potential of increasing ozone. In conclusion, when using NOx substitution to meet the RPP requirements the amount of NOx reductions is capped to the amount required by the model.

In order to use NOx substitution NOx emission reductions have to be factored in. The EPA developed an approach where a target level for VOC and NOx emissions is determined. Detailed calculations of the VOC target levels following the EPA's guidance is included in Appendix C. For simplicity, the Department has developed a process with the same results as the EPA method. The Department's approach involves converting NOx reductions into equivalent VOC reductions through a ratio of VOC to NOx adjusted emissions. See Appendix H for details.

5.2 CALCULATION OF THE VOC EMISSION TARGET LEVELS FOR THE POST-1996 TARGET LEVELS

This section will present the variables and methodology used to calculate the VOC emission target levels for the Post-1996 milestone years. In addition, a sample calculation for the 1999 milestone year is included.

5.2.1 VARIABLES USED TO CALCULATE THE TARGET LEVELS

The following are the variables used to determine the target levels for the Baltimore nonattainment area and Cecil County for the Post-1996 milestone years.

(1) 1990 Rate-of-Progress Base Year Inventory -- A 1990 Rate-of-Progress Base Year Inventory was created by removing biogenic emissions from the 1990 Base Year Emissions Inventory.

(2) 1990 Adjusted Base Year Inventory -- The 1990 Rate-of-Progress Base Year Emissions Inventory was adjusted, at each milestone, to exclude the effect of the Federal automobile tailpipe standards and gasoline volatility standards which were promulgated prior to the 1990 Amendments to the Act.

(3) Emission Reduction Required -- The Adjusted Base Year Inventory at each milestone was multiplied by 9 percent. The result was the amount of emissions reductions required for VOC at each milestone.

(4) Fleet Turnover Correction Term -- The Fleet Turnover Correction Term was developed by subtracting the total emission reductions obtained from the pre-enactment Federal tailpipe and gasoline volatility standards in the previous milestone year from the current milestone year. In

other words, this would be equivalent to emission reductions from Federal tailpipe and gasoline volatility standards between milestone years.

5.2.2 METHODOLOGY USED TO CALCULATE THE TARGET LEVELS

There are six major steps in calculating a Post-1996 target level of emissions. The first four steps are needed to calculate the *Post-1996 RPP* emission reductions. Steps 1 and 2, developing the 1990 base year inventory and the rate-of-progress inventory, were required to have been submitted by States in the 15 percent RPP. The specific steps needed to calculate the target levels are discussed below.

5.2.2.1 STEP 1 - DEVELOPMENT OF THE 1990 BASE YEAR INVENTORY

The total 1990 base year emissions from the five emission source types (point, area, mobile, nonroad, and biogenic) are compiled. For a discussion of the 1990 Base Year Inventory see Chapter 3.

5.2.2.2 STEP 2 - DEVELOPMENT OF THE 1990 RATE-OF-PROGRESS BASE YEAR INVENTORY

As required by EPA guidance, the 1990 base year rate-of-progress VOC emissions inventory excludes the following items:

1) Biogenic (vegetative) emissions; and
2) Emissions from anthropogenic sources located outside the nonattainment areas;

5.2.2.2.1 EXCLUSION OF BIOGENIC EMISSIONS

Section 182 of the Act specifically calls for the exclusion of biogenic sources and sources of ozone precursor emissions outside the nonattainment area from the base year inventory before calculating the emission reduction requirements. The result of excluding biogenic emissions and emissions attributable to sources from outside the geographical borders of the nonattainment area from the base year inventory is that emissions from these sources are not subject to the state's abatement measures and are therefore uncontrollable even though their emissions may impact the nonattainment area. Only anthropogenic (human made) emissions are regulated by the Act.

As required by the Act, the Rate-of-Progress Base Year Inventory was derived by subtracting biogenic emissions (vegetative emissions) and emissions from outside the nonattainment area from the 1990 Final Base Year Inventory. Total biogenic emissions for the Baltimore nonattainment area were 180 tons per day and 33 in Cecil County in 1990.

5.2.2.3 STEP 3 - CALCULATE THE 1990 ADJUSTED BASE YEAR INVENTORY

Section 182(b)(1)(B) of the Act defines baseline emissions (for purposes of calculating each milestone emission reduction) as the "total amount of actual VOC or NOx emissions from all anthropogenic sources in the area during the calendar year of the enactment". This section excludes from the rate-of-progress inventory the emissions that would be eliminated by Federal tailpipe standards promulgated by January 1, 1990, and gasoline volatility standards promulgated by the time of enactment.

The 1990 adjusted base year inventory must be recalculated relative to each milestone and attainment year because the emission reductions associated with the Federal tailpipe standards increase each year due to automobile fleet turnover. Therefore, for the Baltimore nonattainment area and Cecil County it is necessary to calculate the 1990 adjusted base year inventory relative to 1999, 2002, and 2005. The only adjustment that must be made to the inventory in each case is to recalculate the mobile source emissions, including emissions from vehicle refueling, using the EPA's MOBILE 5A computer model.

5.2.2.3.1. EXCLUSION OF EMISSIONS REDUCTIONS ATTRIBUTABLE TO THE FEDERAL TAILPIPE STANDARDS

The first step in deriving the Adjusted Base year inventory was recalculating the mobile portion of the inventory to eliminate fleet turnover and reductions from gasoline volatility standards. Emissions factors developed for the various milestone fleet were applied to the 1990 transportation network or HPMS VMT data. The difference is the emissions that would be eliminated by pre-1990 Federal tailpipe standards.

5.2.2.3.2 EXCLUSION OF EMISSIONS REDUCTION ATTRIBUTABLE TO GASOLINE VOLATILITY STANDARDS

A second adjustment to the mobile source portion of 1990 rate-of-progress inventory involved eliminating expected emissions reductions attributable to the new Phase II gasoline volatility standards that were promulgated in 1990 (55 FR 23666 June 11, 1990). Phase II standards specify gasoline being sold in the Baltimore nonatttainment area in 1992 have a maximum volatility of 7.8 pounds per square inch. The net effect of the volatility adjustment to the mobile portion of the base year inventory is to exclude emission reductions that will result from the usage of lower volatility gasoline in 1996. This step was accomplished by changing the "pressure" input from 8.2 in the base year MOBILE 5a runstream to 7.8. The expected emission reduction due to phase II volatility standard then is the difference in the 1990 emissions calculated using the average actual 1990 "pressure" value and the maximum "pressure" value under the new Phase II volatility standard.

More specifically, the emissions reductions due to these Federal programs were calculated using emissions factors derived from using EPA's mobile source emissions inventory model, MOBILE5a.

Actual emissions were calculated using actual 1990 vehicle miles traveled (VMT) times an emissions factor that was derived from MOBILE5a using an average actual "pressure" value of 8.2 for the state of Maryland.

Actual emissions are given by:

E_{act} = (1990 VMT)*(MOBILE5a EMISSIONS FACTORS FROM THE 1990 Base year inventory)

Adjusted emissions are given by:

E_{adj} = (1990 VMT)*(MOBILE5a EMISSIONS FACTORS FROM THE PROJECTED YEAR INVENTORY)

In calculating the 1990 adjusted emissions, MOBILE 5a was run under the same assumptions as in calculating actual 1990 emission factors except that each milestone was used as the evaluation year and "pressure" value is set to 7.8 which is the maximum value allowed in the Baltimore nonattainment area under Phase II volatility standards.

5.2.2.4. STEP 4 - CALCULATE 3 PERCENT PER YEAR EMISSION REDUCTIONS

In general, to compute the required emission reductions, the number of years between the successive milestone years should be multiplied by 0.03. For example, for the Baltimore nonattainment area a multiplication of 0.03 by 3 would be done to determine that 9 percent emission reductions are necessary between 1996 and 1999, 1999 and 2002, and between 2002 and 2005. Next, this percentage figure is multiplied by the adjusted base year inventory calculated relative to the current milestone/attainment year to yield the emission reduction.

BGr = BEx * r
where:
BGr = Emission reduction requirement for milestone year
BEx = 1990 adjusted base year inventory calculated relative to year x
r = Percent reduction needed to meet the rate-of-progress requirement

5.2.2.5. STEP 5 - CALCULATE THE FLEET TURNOVER CORRECTION TERM

In the absence of any new requirements of the Act, there would still be some decrease in motor vehicle emission factors for many years as a result of fleet turnover, the gradual replacement of older pre-control vehicles with newer vehicles with emission controls. The Act does not allow States to take credit for these reductions for rate-of-progress requirements. These reductions are referred to by the EPA as the fleet turnover correction term.

The fleet turnover correction is needed to account for mobile source emission reductions that would have occurred under the pre-enactment tailpipe and gasoline volatility requirements between consecutive Post-1996 milestone years. For example, assume that a nonattainment area has met the milestone target for 1996. The further creditable emission reduction required to meet the *Post-1996 RPP* was calculated in Step 4. However, between 1996 and 1999, there will be some additional emission reductions due to fleet turnover of older vehicles that are not creditable. These reductions must also be subtracted from the 1996 target level to determine the 1999 target level.

The calculation of the fleet turnover correction term is simple and does not require any additional MOBILE model runs beyond what has been required in previous steps of this calculation. The fleet turnover correction term is calculated as follows:

Fleet Turnover Correction (FIX) = (Tailpipe/Gasoline Volatility Reductions)x - (Tailpipe/Gasoline Volatility Reductions)y

where:
x = current milestone year
y = previous milestone year

5.2.2.6 STEP 6 - CALCULATE THE POST-1996 TARGET LEVEL OF EMISSIONS

Since nonattainment areas are required to meet their 1996 target levels, the calculation of the 1999 target level must be based, in part, on the 1996 target level. Likewise, the calculation of each step subsequent target level will depend, in part, on the target level for the previous milestone. In Step 4, the adjusted base year inventory was multiplied by the total percent required reduction in order to determine the reductions required for the milestone. In step 5, the fleet turnover correction term was calculated to determine the amount of reductions between the consecutive milestones due to the Federal tailpipe and gasoline volatility standards. To calculate the target level of emissions for each milestone, the required emission reductions calculated in Step 4 and the fleet turnover correction term from Step 5 are subtracted from the previous milestone's target level. For the purposes of calculating the 1999 target, it may be necessary to recalculate the 1996 target if the base year inventory was significantly revised after submittal of the 15% RPP.

> Target Level = (previous milestone's target level) - (reductions required to meet the rate-of-progress requirement, calculated in Step 4) - (fleet turnover correction term, calculated in Step 5)

This target level represents the level of emissions that must be achieved in order for a nonattainment area to demonstrate that the rate-of-progress requirement will be met.

5.3 SAMPLE CALCULATION - 1999 MILESTONE YEAR VOC EMISSION TARGET LEVEL

This section presents the calculation for the 1999 milestone year for the Baltimore nonattainment area.

Figure 5.1 demonstrates how the 1999 VOC emission target level for the Baltimore nonattainment area is obtained. Flowcharts demonstrating the calculation of target levels for other Post-1996 milestone years for the Baltimore nonattainment area and Cecil County are included in Appendix C.

Step 1: Develop 1990 base year of emissions (Tons per day)

Point Source	42.0
Area Sources	122.4
Mobile Sources	134.2
Nonroad Sources	44.7
Biogenic Sources	+180.0
Total (1990 base year emissions)	**523.3**

Step 2: Develop 1990 rate-of-progress inventory

1990 Base Year	523.3
Biogenic Sources	-180.0
Total (1990 rate-of-progress inventory)	**343.3**

Step 3: Calculate the 1990 adjusted base year inventory for 1999

1990 rate-of-progress inventory	343.3
Tailpipe/Gasoline volatility reductions (1990-1999)	-44.5
Total (1990 adjusted inventory)	**298.8**

Step 4: Calculate the 3% per year emission reduction requirements

1990 adjusted inventory	298.8
3 percent per year (0.03 * 3)	x 0.09
Total (Emission reduction requirement)	**26.9**

Step 5: Calculate fleet turnover correction

Tailpipe/Gasoline volatility reductions from current milestone year	44.5
Tailpipe/Gasoline volatility reductions from previous milestone year	-39.7
Total (Fleet turnover correction)	**4.8**

Step 6: Calculate target level of emissions for 1999

1996 Target level	258.1
Emission reduction requirement	-26.9
Fleet turnover correction	-4.8
Total (1999 Target level)	**226.4**

6.0 CONTROL MEASURES TO MEET THE POST-1996 RATE OF PROGRESS REQUIREMENTS

This section includes brief summaries of the control measures which account for the emission reductions required the *Post-1996 RPP* requirements. Section 6.1, "Federally Mandated Measures", contains control measures that were mandated under the Act to be based upon national rules or guidance. Section 6.2, "Pending Federal Measures" include control measures that are required under the Act to be based upon national regulations. These control measures are appropriately addressed by a national regulations. Section 6.3, "State and Local Initiatives" are not expressly mandated requirements of the Act but represent among the most beneficial and cost effective control measures. Section 6.4, "Regional Measures" are control measures which have resulted from the Ozone Transport Commission for the Northeast. In addition, Tables 6.1 and 6.2 demonstrate the total emission reductions expected from considering the control measures used to meet the *15%* and *Post -1996 RPPs*.

Table 6.1 - Summary of Emission Benefits For The Baltimore Area (Tons Per Day)
1990-1999

Ref. No.	Control Measure	VOC	NOx
Federally Mandated Measures			
6.1.1	Inspection and Maintenance	21.7	17.2
6.1.2	Tier I and EVP	6.9	16.7
6.1.3	Reformulated Gasoline	12.5	-1.3
6.1.4	Stage II and OBVR	8.1	0.0
6.1.5	NOx RACT	0.0	4.8
6.1.6	Non-road Diesel Engines	0.0	4.7
Pending Federal Measures			
6.2.1	Small Gasoline Engine Equipment	6.1	-0.3
State and Local Measures			
6.3.1	Open Burning	3.6	0.8
Regional Measures			
6.4.1	OTC NOx Phase II	0.0	87.2
Previous Measures			
	FMVP and RVP	52.8	44.3
	15% RPP Reductions	30.3	
Total Reductions in Progress		**142.0**	**174.1**
FMVCP/RVP and Growth			**93.7**
VOC Equivalent Reductions[10]		**55.4**	
Total VOC Reductions Obtained		**197.4**	
Total VOC Reductions Required[11]		**155.3**	
Reduction Surplus (+) or Shortfall (-)		**+42.1**	

[10]NOx emission reductions may be substituted for VOC emissions reductions at a rate of 1% of VOC inventory for 1% of NOx inventory. For 1999, this 1% for 1% rate is 1.45 tons of NOx for each ton of VOC ((467.9-35.8) tons of NOx / (343.0-44.5) tons of VOC). VOC Equivalent reductions is equal to ((174.1-93.7) / 1.45).

[11]Total VOC Reductions Required equals the projected (uncontrolled) emissions (Table 4.2) subtracted from the emissions target level (Table 5.1) ((381.7 - 226.4) tons of VOC).

Table 6.2 - Summary of Emission Benefits For Cecil County (Tons Per Day) 1990-1999

Ref. No.	Control Measure	VOC	NOx
Federally Mandated Measures			
6.1.1	Inspection and Maintenance	1.3	1.2
6.1.2	Tier I	0.2	0.7
6.1.3	Reformulated Gasoline	0.4	-0.1
6.1.4	Stage II and OBVR	0.4	0.0
6.1.5	NOx RACT	0.0	0.0
6.1.6	Non-road Diesel Engines	0.0	0.2
Pending Federal Measures			
6.2.1	Small Gasoline Engines	0.2	0.0
State and Local Measures			
6.3.1	Open Burning	4.4	1.0
Regional Measures			
6.4.1	OTC NOx Phase II	0.0	0.0
Previous Measures			
	Tier 0 and RVP	2.9	2.0
	15% RPP Reductions	1.5	
Total Reductions in Progress		**11.3**	**5.0**
Emission Reduction Target Levels[12]		**7.5**	
Reduction Surplus (+) or Shortfall (-)		**+3.8**	

[12]Total VOC Reductions Required equals the uncontrolled emissions (Table 4.3) minus the emissions target level (Table 5.1)

6.1. FEDERAL MANDATES

6.1.1 ENHANCED VEHICLE INSPECTION AND MAINTENANCE (ENHANCED I/M)

This measure involves implementing a vehicle emission inspection and maintenance program with stricter requirements than the current "basic" program.

Description of Source Category

This measure affects light duty gasoline vehicles, light duty gasoline trucks and heavy duty gasoline vehicles up to 26,000 pounds.

Control Strategy

The Act requires enhanced motor vehicle inspection and maintenance (I/M) programs in serious, severe, and extreme ozone nonattainment areas with urbanized populations of 200,000 or more. In Maryland this required enhanced I/M program impacts the 8 jurisdictions currently operating a basic I/M program as well as 6 new jurisdictions, for a total of 14 of the 23 jurisdictions in the state.

The Department expects to obtain VOC emissions reductions by adopting regulations for an enhanced vehicle emissions I/M program that will contain test procedures which will detect more emissions-related faults, cover a larger geographic area in the state, and allow fewer waivers from emissions standards. Tailpipe emissions will be measured over a transient driving cycle conducted on a dynamometer, which provides a much better indication of actual on-road vehicle performance than the existing idle test. Evaporative emissions control equipment will be checked for function and integrity, resulting in large emissions reductions not achieved with the current program. The geographic expansion will bring approximately 500,000 additional cars into the program. In addition, the projected waiver rate will decrease from approximately 15% of failed vehicles to 3%.

Estimated Emissions Reductions and Methodology

The EPA's mobile emissions factor model, MOBILE5a, with locality-specific inputs and appropriate design parameters for Maryland's enhanced I/M program, was used to estimate the VOC and NOx emissions reductions obtained from this control strategy (see table below). The specific methodologies and assumptions associated with modeling the enhanced I/M program are the same as those used in modeling the basic I/M program, with a few exceptions. Using the emission reductions in the output to MOBILE5a, the expected reductions for 1999 in tons per day are:

	VOC	**NOx**
Baltimore	21.7	17.2
Cecil	1.3	1.2

6.1.2 TIER I NEW VEHICLE EMISSION STANDARDS AND NEW FEDERAL EVAPORATIVE TEST PROCEDURES

The Act requires a new and cleaner set of federal motor vehicle emissions standards (Tier I standards) to be phased in beginning with model year 1994. The Act also required a uniform level of evaporative emission controls, which are more stringent than most evaporative controls used in existing vehicles.

Description of Source Category

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

Control Strategy

The federal program will require more stringent exhaust emissions standards as well as a uniform level of evaporative emissions controls, demonstrated through new federal evaporative test procedures. The Tier I exhaust standards are to be phased in beginning with model year 1994. Tier I cars will emit 0.077 fewer grams of VOCs per mile than their predecessors.

Expected Emissions Reductions and Methodology

The MOBILE5a emissions factor model automatically applies these controls unless the input file has been modified to disable the Act's tailpipe standards and the evaporative test procedure. Using the emission reductions in the output to MOBILE5a, the expected reductions by 1999 in tons per day are:

	VOC	**NOx**
Baltimore	6.9	16.7
Cecil	0.2	0.7

6.1.3 REFORMULATED GASOLINE

This federally mandated measure requires the use of lower polluting "reformulated" gasoline in the Baltimore nonattainment area and Cecil County.

Description of Source Category

All gasoline powered vehicles are affected by this control measure. Vehicle refueling emissions at service stations are also reduced. In addition, emissions from gasoline powered nonroad vehicles and equipment will be reduced by this control strategy.

Control Strategy

The Act requires significant changes to conventional fuels for areas that exceed the health-based ozone standard. They require the EPA to establish specifications for reformulated gasoline that would achieve the greatest reduction of VOCs and toxic air pollutants achievable considering costs and technological feasibility.

At a minimum, reformulated gasoline must not cause an increase in NOx emissions, must have an oxygen content of at least 2.0% by weight, must have a benzene content no greater than 1.0% by volume and must not contain any heavy metals. Most importantly, the Act requires a reduction in VOC and toxic emissions of 15% over base year levels beginning in 1995 and 25% beginning in the year 2000.

Beginning in January of 1995, only gasoline that the EPA has certified as reformulated may be sold to consumers in the nine worst ozone nonattainment areas with populations exceeding 250,000. Other ozone nonattainment areas are permitted to "opt-in" to the federal reformulated gasoline program.

Use of reformulated gasoline is required in Cecil County and the Baltimore nonattainment area.

Expected Emissions Reductions and Methodology

The emissions factor used in calculating the reduction from this measure was determined using MOBILE5a. Activity levels were developed using both HPMS VMT data and locality specific transportation model data as developed by the Baltimore Metropolitan Council (BMC), which provides support staff and structure for the Transportation Steering Committee, the Metropolitan Planning Organization (MPO) for the Baltimore Metropolitan Area.[13] . Using the emission reductions in the output to MOBILE5a, the expected reductions by 1999 in tons per day are:

[13]The specific methodologies and assumptions utilized to arrive at the activity levels and emissions factors used to determine the emissions reductions associated with reformulated gasoline are described in detail in the 1990 base inventory documentation entitled "1990 Inventory of Highway Vehicle Emissions for the Baltimore Ozone Nonattainment Area, the Queen Anne's/Kent County Ozone Nonattainment Area, the Cecil County, Maryland portion of the Philadelphia, Pennsylvania Ozone Nonattainment Area, and the remainder of the State Maryland" dated August 23, 1993 (MDE, 1993a).

	VOC	NOx
Baltimore	12.5	-1.3
Cecil	0.4	-0.1

6.1.4 STAGE II AND NEW VEHICLE ON-BOARD VAPOR RECOVERY SYSTEMS

These two seperate measures the installation of Stage II vapor recovery nozzles at gasoline pumps and the requirement of onboard refueling emissions controls for new passenger cars and light trucks beginning in the 1998 model year. Maryland adopted Stage II vapor recovery regulations for the Baltimore and Washington nonattainment areas and Cecil County in January of 1993.

Description of Source Category

When motor vehicle fuel tanks are refueled at a gasoline dispensing facility, gasoline vapors in the fuel tank are displaced by incoming gasoline. The vapors are discharged directly to the air.

Vehicle refueling emissions are the fuel vapors displaced from a vehicle tank when it is filled. These emissions account for a significant portion of the volatile organic compounds (VOCs) released into the air by motor vehicles and contribute to the formation of ozone and smog. In addition, gasoline vapors contain air toxics.

Control Strategy

The Stage II vapor recovery regulation requires that the dispensing system be equipped with nozzles that are designed to return the vapors through a vapor line into the gasoline storage tank. The vapors may be forced back to the storage tank by the pressure of the incoming liquid (vapor balance system) or by a vacuum pump or other mechanical device that creates a vacuum at the nozzle to more efficiently contain the vapors (vapor assist system). Maryland requires all systems used to be approved by the California Air Resources Board (CARB) which ensures a minimum control efficiency of 95 percent.

In addition, an EPA rule requires the use of onboard refueling vapor recovery (ORVR) systems for new passenger cars and light trucks beginning in model 1998. Light trucks include pickups, mini-vans, and most delivery and utility vehicles. Heavy duty vehicles and trucks over 8,500 pounds gross vehicle weight rating (GVWR) are exempt from the ORVR requirement. Upon full implementation, the ORVR rule will cover over ninety percent of all new gasoline-powered vehicles sold in Maryland.

Essentially, the ORVR system operates by storing the vapors displaced from the fuel tank during a refueling event and subsequently routing these VOC vapors to the engine, where the vapors are burned during vehicle operation. The EPA has allowed manufacturers to retain some flexibility in meeting the requirements. Although the EPA has not prescribed any particular technology, most past ORVR designs have been canister-based. In such a system, the displaced VOC vapors are stored in a canister by being adsorbed onto a bed of activated carbon contained within the canister. During vehicle operation, a manifold vacuum is used to pull ambient air over the carbon bed, stripping the VOCs from the canister. This VOC-rich purge gas is then routed to the engine and burned.

Emissions Reductions and Methodology

Using MOBILE5a, the expected emissions reduction for these measures are listed below.

	VOC	NOx
Baltimore	8.1	0.0
Cecil	0.4	0.0

6.1.5 REASONABLY AVAILABLE CONTROL TECHNOLOGY -- NOx RACT

This measure requires control of nitrogen oxides (NOx) emissions by installing RACT.

Description of Source Category

NOx RACT will apply to industrial, and commercial fuel burning equipment and combustion installations. Title I of the Act requires major sources to submit proposed RACT by November 15, 1993. Affected sources must achieve compliance with RACT by May 1995.

NOx emissions vary significantly from source to source, even with sources that are similar in size and design. NOx emissions depend upon numerous factors such as age of equipment, characteristics of fuel being burned, configuration of and type of burners, and operational techniques.

Because of the significant variability in emissions, it is difficult to establish emission standards even for classes of sources. Therefore, NOx emission control requirements should be established on a case-by-case basis.

Control Strategy

The Department currently has a NOx RACT regulation in place, which provides affected sources with two options to comply. The first one, called the case-by-case option, requires companies to submit specific RACT proposals for approval by the Department. The second option allows sources to meet a predetermined emission standard. The regulation required major sources that are subject to Title IV, Phase I of the Act, to submit a RACT proposal by July 15, 1993; all other sources were required to do so by November 15, 1993.

Those sources that choose to meet the emissions limits, must either demonstrate compliance using Continuous Emission Monitoring (CEM) or stack test data, or must submit a plan for compliance. Regardless of the option chosen, companies must achieve compliance by May 31, 1995. The regulation also allows companies that operate at more than one location in the State to average or "bubble" within the State. This means that a given company must meet total, rather than source specific, emissions limits. This allows companies greater flexibility in deciding where and how to control emissions.

Expected Emissions Reductions and Methodology

Cecil County does not have any point source which emits NOx emissions. The expected emission reductions were determined from the NOx RACT proposals from the various affected utilities for the Baltimore nonattainment area. From the NOx RACT proposals the Department has determined the following emission reductions by 1999 in tons per day from this control strategy:

	VOC	**NOx**
Baltimore	0.0	4.8
Cecil	0.0	0.0

6.1.6 NONROAD DIESEL ENGINES

This Federally mandated measure requires heavy duty farm, construction equipment, and other equipment manufactured after 1996 to meet EPA's emissions standards.

Description of Source Category

Heavy duty farm and construction equipment includes asphalt pavers, rollers, scrapers, rubber-tired dozers, agricultural tractors, combines, balers, and harvesters. This measure applies to all compression-ignition engines at or above 37 KW (50 horsepower) except engines used in aircraft, marine vessels, locomotives and underground mining activity. NOx emissions result from combustion of diesel fuel used to power this equipment.

Control Strategy

EPA has the authority to require emission standards for nonroad mobile sources under section 213(a)(3) of the Act. EPA has promulgated regulations for NOx emissions and smoke standards for new heavy duty farm and construction equipment with gross maximum power output measured at or above 37 KW (50 horsepower). The NOx emissions standard is 9.2 grams per kilowatt hour (6.9 grams per brake horsepower hour). NOx standards will be phased in depending upon the horsepower of the engine, beginning with the 1996 model year. The first standards to take effect will be for engines at or above 175 hp and at or below 750 hp.

Projected reductions are technically achievable within a short time period because the emissions control technologies necessary to meet the proposed standards are known to be effective on similar on-highway engines.

Expected Emissions Reductions and Methodology

Calculations on the expected emission reductions and the methodology used are included in Appendix D.

The expected emission reductions by 1999 in tons per day are as follows:

	VOC	**NOx**
Baltimore	0.0	4.7
Cecil	0.0	0.2

6.2 PENDING FEDERAL PROGRAMS

6.2.1 SMALL GASOLINE ENGINES

This Federally mandated measure requires small gasoline-powered engine equipment, such as lawn and garden equipment, manufactured after August 1, 1996 meet EPA's emissions standards.

Description of Source Category

Small gasoline-powered engine equipment includes lawn mowers, trimmers, generators, compressors, etc. These measures apply to equipment with engines of less than 25 horsepower. VOC emissions result from combustion and evaporation of gasoline used to power this equipment.

Control Strategy

EPA will pursue a two-phased approach to regulate this type of equipment. In the first phase, EPA will propose regulations through the normal regulatory process. These regulations will be similar to California's regulation for 1995 and later utility and lawn and garden equipment engines. The second phase of regulation will use a consultative approach of negotiated rulemaking to develop consensus on important issues, such as useful life, in-use emissions, evaporative emissions, test procedures, and market based incentive programs.

Expected Emissions Reductions and Methodology

Calculations on the expected emission reductions and the methodology used are included in Appendix D.

The expected emission reductions by 1999 in tons per day are the following:

	VOC	NOx
Baltimore	6.1	0.0
Cecil	0.2	0.0

6.3 STATE AND LOCAL INITIATIVES

6.3.1 OPEN BURNING BAN

This control measure would ban open burning during the peak ozone season.

Description of Source Category

Open burning refers to the method of burning which releases uncontrolled emissions. Open burning is primarily used for the disposal of brush, trees, yard waste and as a method of land clearing by both developers and individual citizens alike. Emissions from open burning include oxides of nitrogen, hydrocarbons, carbon dioxide, carbon monoxide and other toxic compounds. Emissions levels from open burning are high due to the inefficient and uncontrolled manner in which the material is burned.

Control Strategy

The Department adopted a regulation that prohibits open burning during the peak ozone period (June to August). The seasonal prohibition would affect only those counties which lie within the serious and severe nonattainment areas. Certain exemptions however must be in place so as not to adversely affect the agriculture industry or restrict fire training and recreational activities.

Estimated Emissions Reductions and Methodology

The 1990 base year emissions estimate for the Baltimore area using EPA approved emission factors for this category was 3.6 tons per day of VOC and 0.8 tons per day of NOx. No growth is assumed for the projected emissions.

The control measure for this category consists of an open burning ban, therefore, the emissions reductions expected would equal the emissions estimate.

The expected emission reductions by 1999 in tons per day are the following:

	VOC	NOx
Baltimore	3.6	0.8
Cecil	4.7	1.0

6.4 REGIONAL STRATEGIES

6.4.1 OZONE TRANSPORT COMMISSION (OTC) NOx PHASE II

Description of Source Category

On Tuesday, September 27, 1994, the OTC initiated a major agreement to cut emissions of NOx from power plants and other major stationary sources of pollution throughout the Northeast and Mid-Atlantic States. The agreement, in the form of a Memorandum of Understanding (MOU), recognizes that further reductions in NOx emissions are needed to enable the entire Ozone Transport Region (OTR) to meet the NAAQS.

Control Strategy

The agreement is a phased approach to controlling emissions of NOx from power plants and other large fuel combustion sources. The first phase (known as Phase II because one phase of emission reductions, RACT, has already been initiated), to be implemented in May 1999, would include three control zones in the region: an inner zone ranging from the Washington, D.C. metropolitan area northeast to southeastern New Hampshire; outer zone ranging out from the inner zone to western Pennsylvania; and a northern zone which includes much of northern New York and northern New England, including most of New Hampshire.

Control requirements vary with the zone in which sources are located, but the most stringent requirements are in the inner zone. The next phase (known as Phase III) includes additional pollution reductions and the equalization of control requirements in the inner and outer zones. New scientific data and modeling studies could provide the basis for a modified plan. These pollution reductions would be initiated in May 2003.

Estimated Emissions Reductions and Methodology

During Phase II, sources in the inner and outer zones will be required to limit emissions to 0.2 lbs of NOx per mmBTU or to make reductions of 55-65% form the 1990 base year inventory, whichever measure is less stringent. Sources in the northern zone will only be required to comply with RACT. During Phase III, sources in the inner and outer zones will be required to limit emissions to 0.1 to 0.15 lbs of NOx per mmBTU or to make a total reduction of 75% from the base year inventory. Sources in the northern zone will be required to limit emissions to 0.2 lbs of NOx per mmBTU or to reduce emissions by 50-65%. Therefore, affected sources in the Baltimore nonattainment area must reduce their emissions by 65% from their 1990 levels by 1999 and if necessary by 75% by 2003. The expected emissions reductions by 1999 in tons per day are the following:

	VOC	NOx
Baltimore	0.0	87.2
Cecil	0.0	0.0

6.5 PROJECTED CONTROLLED EMISSIONS

The following tables contain the projected emissions for 1999 based upon the implementation of the control measures included in this Chapter and the expected growth in emissions. Table 6.3 presents the projected controlled emissions for VOC and NOx for the Baltimore nonattainment area. Table 6.4 presents the projected controlled emissions for VOC only for Cecil County. Cecil County does not need NOx emission reductions to meet the rate-of-progress requirement through 1999.

Table 6.3: Projected Controlled Emissions for the Baltimore Nonattainment Area

VOC Emissions (tpd)			NOx Emissions (tpd)	
Source	**1990**	**1999**	**1990**	**1999**
Mobile	134.2	61.8	159.5	111.5
Point	42.0	39.1	223.2	148.6
Area	122.4	93.7	13.7	14.0
Nonroad	44.7	45.1	71.5	77.6
Total	**343.3**	**239.7**	**467.9**	**351.7**

Table 6.4: Projected Controlled Emissions for Cecil County Area

VOC Emissions (tpd)		
Source	**1990**	**1999**
Mobile	7.20	2.50
Point	0.56	0.59
Area	8.73	2.60
Nonroad	2.04	2.10
Total	**18.53**	**7.79**

7.0 TRANSPORTATION CONFORMITY

7.1 Background

It is necessary to balance growing metropolitan regions, expanding transportation systems, and healthy air quality. The Clean Air Act requires federal actions and funding must not take away from the progress made towards air quality improvements. Therefore, the Environmental Protection Agency (EPA) has established regulations to ensure that capital improvements to existing transportation networks will assist progress towards air quality goals. The Act defines three criteria to determine this conformity of transportation plans with air quality plans. The criteria are that transportation plans and projects must not prevent compliance with federal air quality standards, delay compliance with federal air quality standards, or increase the severity of the violation period.

The federal conformity regulations were published as a final rule on November 24, 1993 in the Federal Register and amended on August 13, 1997. The purpose of the rule is to ensure that transportation modifications will "conform" with air quality planning goals that are established in the air quality plan or State Implementation Plan (SIP). The EPA concluded that the best way to judge whether new transportation projects maintain and improve air quality was to analyze vehicle emissions and maintain those emissions at levels that are consistent with current air quality and the required emissions reductions under the Act. The target levels of emissions to comply with this rule are determined by air quality agencies working in cooperation with local governments and state departments of transportation. The federal conformity rule requires the establishment of a formal process to facilitate this consultation.

7.2 Consultation

The conformity rule requires air quality planning agencies to develop a consultation process with state departments of transportation and local officials. This process fosters understanding of the development process for air quality plans and transportation plans between the agencies. The Maryland Department of the Environment (MDE) works with the Baltimore Metropolitan Council (BMC) staff to inform the local officials of SIP issues. The preparation of this document reflects consultation with and input from State agencies including, the Maryland Department of the Environment, the Maryland Department of Transportation, as well as staff and transportation related input from the Transportation Steering Committee (TSC) of the Baltimore area.

The TSC is the designated Metropolitan Planning Organization (MPO) for the Baltimore region. This interagency process is very important. The federal conformity regulation has been amended twice and a third set of amendments has been proposed. These amendments make the conformity rule less prescriptive. Many former requirements can now be handled with greater flexibility through the interagency consultation process.

7.3 Conformity Tests

The goal of the conformity rule is to establish mobile emissions budgets in the air quality plan or attainment plan that will ensure that the region can comply with federal air quality standards. The final attainment demonstration that will establish a target level of emissions enabling the Baltimore region to comply with the federal air quality standards has not been completed. As discussed earlier in Chapter 2, a full photochemical modeling demonstration will be used to determine the final emissions targets. These demonstrations comprise the Phase II Attainment Demonstration. They will establish the overall level of emissions for all source sectors consistent with meeting federal air quality standards. Then, the reduction requirements will be apportioned over the various sectors of the inventory: stationary point sources, stationary area sources, nonroad mobile sources, and onroad mobile sources. (See inventory sources, Chapter 3) Until these emission target levels can be developed, the rule establishes interim criteria that must be met. These interim criteria are required until the air quality plan is approved by the EPA. The interim criteria are set to prevent increases in mobile source emissions during the development of the final mobile emissions budgets. Until the final target levels have been determined and apportioned, the conformity rule requires the fulfillment of three criteria:

- Mobile emissions from the build scenario must be less than emissions from the no build or current network for Volatile Organic Compounds (VOC) and Nitrogen Oxides (NO_X) (build/no build test),
- Mobile emissions must be maintained at less than 1990 levels for VOC and NO_X,
- Mobile emissions for any pollutant with an established budget must be less than or equal to the emissions budget for that pollutant.

7.3.1 Build/No Build Test

The build/no build test is a test which requires that emissions from future projects be equal to or less than emissions from the existing transportation network. The no build alternative would not include any modifications or improvements to the transportation network. This alternative may not meet the needs of the community to relieve congestion, although emissions may be increased due to the decreased flow of traffic. The build alternative includes transportation projects designed to relieve or improve congestion or to serve new development. Improvements to the transportation system may increase emissions, by allowing a greater volume of traffic or encouraging more travel by improving the accessability of likely destinations. If the build alternative increases emissions, mitigation measures would have to be developed and implemented in order to ensure conformity to the SIP.

7.3.2 Emissions Less Than 1990 Levels

Another test to ensure that transportation projects conform to the SIP is that the emissions levels must be less than the 1990 levels for VOC and NO_X. This criterion is met if the regional VOC and NO_X emissions (for ozone nonattainment areas) predicted in the "Action" scenario are less than the emissions predicted from the "Baseline"(1990) scenario in each analysis year, and if this can reasonably be expected to be true in the periods between the first milestone year and the analysis years. The regional analysis must show that the "Action" scenario contributes to a reduction in emissions from the 1990 emissions by any nonzero amount.

7.3.3 Emissions Budgets

On March 24, 1994, MDE submitted a 15% Rate of Progress Plan for Volatile Organic Compounds (VOCs) that explicitly established a mobile emissions budget for VOC of 72.5 tons/day. This budget was for the milestone year of 1996. It established a cap on VOC mobile emissions from 1996 forward until a subsequent mobile emissions budget for the next milestone year is established.

The Phase I Plan establishes mobile emissions budgets for the milestone year of 1999. Since the Phase I Plan proposes control strategies for both VOC and NOx, it will set mobile emissions budgets for the year 1999 and forward for both VOC and NOx. Once a region submits a control strategy SIP to the EPA, mobile source emission budgets are established for that region and 45 days after the submission any new conformity determinations must comply with those budgets. Mobile source emissions in the TIP and Plan cannot exceed the mobile emissions budget established by the approved SIP. The transportation plans are required to conform with the mobile budget for appropriate milestone years established in the SIP that are covered in the TIP, as well as long range planning projection years, such as 2010 and 2020.

7.4 Establishing Mobile Emissions Budget Levels

Several options in the federal conformity rule provide flexibility in establishing and using mobile emissions budgets so the transportation planning process can function smoothly. The clean air benefits associated with each option are not equal. The five options are discussed below followed by a recommended approach and budget.

7.4.1 Option 1 - The Implicit Mobile Source Emissions Budget

The Implicit Mobile Source Emissions Budget sets the budget at the level of projected onroad mobile source emissions for the appropriate SIP milestone year after the anticipated control measures have been subtracted. For example, within the Phase I Plan in this document is a 9 % Reduction Plan which must be realized by 1999. Therefore, the milestone year is 1999 and the projected mobile emissions for 1999 that appear in this plan represent the implicit VOC and NOx mobile emissions budgets.

The implicit mobile source emissions budget maximizes the benefits of all mobile and stationary source control programs because all emissions reductions are used for cleaner air. Emissions reductions within a source sector are used to reach emission target levels and offset growth. An implicit budget can be used with other options to provide flexibility in meeting the mobile emissions budget. Whether all emission reductions are used for cleaner air then depends upon the additional options selected and how these options are used.

7.4.2 Option 2 - Margin of Safety

The margin of safety option establishes a budget that allows more mobile source emissions than predicted after the application of the mobile control strategies, i.e., more emissions than the implicit mobile source budget. The additional growth allowance must be offset using emissions reductions from another source sector(s) whether the allowance is needed or not. This option requires using some reductions in the plan to offset mobile source growth instead of using all reductions for cleaner air.

7.4.3 Option 3 - Trading Emissions Reductions Among Source Sectors

This option uses the implicit mobile source emissions budget as the budget and establishes a mechanism in the SIP that allows the application of emissions reductions from other source sectors to meet the mobile source budget if circumstances require this for the transportation planning process to operate smoothly. Since the trading mechanism is only used if necessary, this option does not automatically establish a more lenient budget. Unless the trading mechanism is used, all reductions contribute to cleaner air. The trading mechanism does provide an emergency option that can be used in the conformity process. The trading mechanism proposed in this document is described in Section 7.5.2.

7.4.4 Option 4 - A Special SIP Covering Years Beyond Normal SIP Time Frames

In some cases, the long range transportation plan may not be able to continue to meet the mobile source emissions budget in the years beyond the scope of the SIP. In this case, it is possible to create a SIP, applicable to years beyond the attainment or maintenance plan, which identifies future emissions reductions and applies them to offset growth in mobile source sector. Reduction credits committed to this use are not available for other purposes such as use in the attainment plan. Again this option diverts emissions reductions from clean air to offset growth.

7.4.5 Option 5 - Change the Mobile Source Emissions Budget

Under the August 15, 1997 conformity rule amendments, a mobile source emissions budget could be changed through the interagency consultation process, go to public hearing and become effective after 45 days if no objections are raised by EPA. This greater flexibility in budget creation and adoption will allow budget changes in a shorter time frame than regular SIP revisions. This option also provides a safety cushion in the conformity process. However, changing the budget to be more lenient may require additional reductions to meet the required reduction milestones.

7.5 Recommended Approach to Conformity

The recommended approach for establishing the mobile source emissions budget in the Phase I plan for 1999 is the use of the implicit mobile emissions budget (Option 1). This will encourage the transportation community to manage growth and maintain emissions levels. This approach will maximize the benefits of all mobile and stationary source control programs.

7.5.1 1999 Mobile Source Emissions Budget

This 9 Percent Plan will establish a mobile source emissions budget of 61.8 tons/day of VOC and 111.5 tons/day of NO_x for the Baltimore nonattainment area for the milestone year 1999. These budgets have been developed with the help of the Maryland Department of Transportation and the Baltimore Metropolitan Council staff. The budgets and approach have been agreed to by MDE, MDOT and the TSC under the interagency consultation process set forth in CFR 51.402. These budgets are based on estimates of projected growth in vehicle miles traveled and anticipated reductions from a variety of mobile source control strategies. This budget will be the benchmark used to determine if the region's long range transportation plan (LRP) and five year transportation improvement program (TIP) conform with the Maryland SIP.

This 9 Percent Plan will establish a mobile source emissions budget of 3.0 tons/day of VOC and 6.2 tons/day of NO_x for Cecil County for the milestone year 1999. These budgets have been developed with the help of the Maryland Department of Transportation. These budgets are based on estimates of projected growth in vehicle miles traveled and anticipated reductions from a variety of mobile source control strategies. This budget will be the benchmark used to determine if the long range transportation plan (LRP) and transportation improvement program (TIP) for Cecil County contained in the WILMAPCO Metropolitan Transportation Plan conform with the Maryland SIP.

7.6 The Trading Mechanism

Conformity regulations allow the mobile budget to be increased if credits from another source category are used to reduce overall emissions levels in the SIP to the target level of emissions that would have been achieved if the mobile emissions budget had been followed. Therefore, if mobile source emission reductions from available control measures are not sufficient to meet the mobile source emissions budget, it is possible to increase the mobile emissions budget by substituting emission reduction credits from another source category.

An explicit mobile source emissions budget has been developed for the Baltimore Region using Option 1. Through the use of this option the Region has recognized its responsibility to develop transportation plans and improvement programs that comply with emissions reduction targets established for the mobile source sector. The trading mechanism proposed here provides a safety mechanism to resolve problems which may occur due to unexpected emission changes.

Section 51.456 allows trading of emission credits among source sector budgets if the specific trade is described in a SIP revision or if a trading mechanism has been established through the SIP process. The conformity rule allows such trading provided that emissions trading does not delay the achievement of any prescribed milestones, such as the 3% per year reduction requirement or delay attainment. In reduction credit trading, all source sectors must continue to meet their budgets.

This SIP provides the following mechanism for trading reductions among source sectors until such time as a SIP revision establishing a formal banking and trading program is submitted by the Department.

1) The trading mechanism does not infer additions to the mobile source VOC or NO_x budget.

2) In the event that mobile emissions projections change due to changes in planning assumptions or mobile emissions reductions programs, and the designated MPO cannot meet the conformity budget through the application of reasonable mitigation measures, the Interagency Consultation Committee, must agree unanimously to the appropriation of these reduction credits to meet the mobile source emissions budget requirement. It must be demonstrated within the latest SIP submittal that the reduction credits considered for transfer are not needed to ensure that total emissions from all sources will be consistent with the demonstration of the required emissions reduction milestone.

3) The Maryland Department of the Environment will submit a letter of committal to EPA stating the use of these emission reduction credits to meet the mobile source emissions budget.

The Department would like to receive public comment on this recommended approach as well as on the other options to establishing a mobile emissions budget. The Department would like to receive public comment on the trading mechanism and its use.

8.0 Phase I Attainment Plan Commitments

EPA guidance requires that two-phase submissions must each contain several components. In order for the EPA to approve the Phase I Attainment Plan, the plan must contain the following components:

I. a) All mandatory CAA measures required before November 1994,
   1) VOC and NOx RACT on major sources
   2) enhanced I/M
   3) reformulated gasoline
   4) rate of progress (9%) requirements
   5) clean fuel fleets

   b) the commitment to further reductions in NOx from point sources
   c) regional Low-Emissions Vehicles (LEV) program or the 49-state (LEV) car program

II. Enforceable commitments to:
   a) participate in a consultative process to address regional transport
   b) adopt additional control measures necessary to attain the ozone NAAQS by 1999, meet rate-of-progress requirements, eliminate significant contributions to nonattainment downwind
   c) adopt additional control measures needed to meet further rate-of-progress requirements
   c) identify any reductions needed from upwind areas to meet the NAAQS

The Phase II Attainment will use from Urban Airshed Modeling (UAM) to demonstrate that the Baltimore Nonattainment Area and Cecil County will meet the NAAQS for ozone by 2005. The Phase II Attainment SIP should be submitted to the EPA by the middle of 1997. This section describes the components in this document that meet the requirements of the Phase I submissions as well as the commitments the states have made consistent with those requirements.

8.1 Implementation of Mandatory CAA Measures

Chapters 4 through 8 and the Appendices provide documentation for all mandatory CAA measures required before November, 1994, and those chapters contain documentation that the rate-of-progress requirements have been met, Section 8.7 specifically addresses the rate-of-progress requirements. Chapter 6 also provides information on the implementation of the mandatory measures, VOC and NOx RACT on major sources, enhanced I/M, and reformulated gasoline.

Also contained in this document, presented in Appendix H, are calculations that demonstrate that the Baltimore Nonattainment Area and Cecil County has met the requirements for the rate-of-progress plan to reduce emissions from 1990 levels by 15% by 1996. This information demonstrates that the states have moved forward with implementation of each measure in the implementation varies for each control measures, some variability exists in the implementation schedule for these measures.

8.2 Commitment to Further Reduce NOx Emissions fromLarge Point Sources

The EPA's requirement to further reduce emissions of NOx from large point sources can be met by participating in the Ozone Transport Commision's Phase II NOx Memorandum of Understanding. The State of Maryland is a signatory to the Ozone Transport Commision Phase II NOx Memorandum of Understanding (OTC-MOU, see Appendix F). The OTC MOU provides that the signatory states will propose regulations to either reduce NOx emissions by 65% form the 1990 baseyear levels, or meet a NOx emissions limit of 0.2 pounds NOx per million BTU, by no later than May 1, 1999. Affected sources must further reduce NOx emissions by May 1, 2003, either by achieving a 75% emission reduction from 1990 baseyear levels, or by meeting a NOx emissions limit of 0.15 pounds NOx per million BTU.

The EPA requires that the Phase I Attainment Plan include a commitment to additional controls on NOx point sources. Maryland will meet this requirement by signing the OTC Phase II NOx Memorandum of Understanding.

8.2.1 Emission Benefit Calculations

The emission reductions associated with the Phase II NOx requirements will vary from source to source, since they are intended to exceed NOx RACT benefits. NOx RACT benefits, which are credited under Measure 6.2.8 above, vary in their emissions rates relative to the OTC MOU cap of 0.2 pounds NOx per million BTU. Detailed information on NOx emission reductions is included in Appendix F.

8.3 Commitment to Implement a Low-Emission Vehicle Program

Maryland has committed to the adoption and participation in a National Low-Emission Vehicle Program. Maryland will adopt regulations in support of a National LEV program which is consistent with the EPA final rule.

8.4 Commitment to Adopt Additional Controls to Meet Rate-of-Progress Requirements

Maryland is commiting to adopt the remainder control measures needed to meet the Post-1999 rate-of-progress requirements, pending the results of the OTAG, for the Baltimore nonattainment area and Cecil County. Target levels for the 2002 and 2005 milestone years are included in Chapter 5. Documentation concerning these target levels are included in Appendix C.

8.5 Commitment to Adopt Additional Controls to Address the Transport Issue

Maryland is actively participating in the Ozone Transport Assessment Group (OTAG) process to address regional transport issues. Maryland is participating in the OTAG workgroups as well and the OTAG policy group. OTAG modeling results are just becoming available, these results and their relationship with local modeling initiatives are being analyzed and discussed. Modeling results from the OTAG will also be incorporated as boundary conditions in one of the episodes being modeled for the Baltimore-Washington domain.

Maryland has commited to participate in the OTAG as the EPA's designated consultative process to address regional transport and to assist in identifying any reductions needed from upwind areas to meet the National Ambient Air Quality Standard (NAAQS) as well as eliminating significant contributions to nonattainment areas downwind. Maryland has submitted a letter to the EPA formalizing this commitment.

In addition, Maryland is commiting to eliminate the Baltimore nonattainment area and Cecil County contribution to modelled nonattainment area in downwind areas. This commitment is to be based upon the OTAG and other regional modeling and the local modeling being prepared for the Baltimore-Washington domain.

8.6 Commitment to Adopt Additional Control Measures to Attain the Health Standard for Ozone

Maryland is commiting to implementing additional control measures in order to meet the NAAQS for ozone, if the need for additional control measures is shown through the photochemical modeling excercises required by the EPA for serious and above nonattainment areas. Modeling results are expected to be available in time to submit the Phase II Attainment Plan to the EPA.

Modeling results from the OTAG as well as empircal analyses of monitored ozone data will be evaluated when determining the degree of additional control measures needed to bring the Baltimore nonattainment area and Cecil County into attainment with the NAAQS for ozone by 2005. All data and analyses used in this evaluation will be submitted as part of the Phase II Attainment Plan package.

9.0 CONTINGENCY MEASURES

The Act requires the State to adopt specific contingency measures that will take effect without further action by the State or the EPA if the State fails to reduce VOC/NOx emissions by 9 percent from 1990 emission levels by 1999.

For both requirements, the contingency measures identified by the State must be sufficient to secure an additional 3 percent reduction in ozone precursor emissions in the year following the year in which the failure has been identified. If the shortfall is less than 3 percent, a contingency measure need only cover that smaller percentage. If the shortfall is greater than 3 percent, the State, in an annual tracking report to EPA, must either identify the additional actions it will take to cure the shortfall before the next milestone or maintain a reserve of contingency measures capable of covering a shortfall greater than 3 percent. Early implementation of an emission reduction measure to be implemented in the future is acceptable as a contingency measure.

For a nonattainment area which fails to meet the 15 percent reduction requirements, and where it has been demonstrated that NO_x controls are needed to attain the primary NAAQS for ground level ozone, measures that produce a combination of NO_x and VOC reductions may serve as contingency measures provided that 0.3 percent out of every reduction of 3 percent is attributable to a reduction in VOC emissions. For the NO_x contingency measures to be acceptable, States must demonstrate through modeling that NO_x reductions are needed in the nonattainment area and adhere to EPA's NO_x substitution policy.

The EPA's preliminary regional modeling analysis has demonstrated that substantial reduction in NO_x emissions may be necessary to achieve the ozone standard in Maryland as well as in the northeast region (EPA, 1991b and OTC, 1992). For 1996, the 3 percent VOC contingency requirement for the Baltimore nonattainment area equals 9.0 tons/day. The 3 percent contingency requirement for Cecil County equals 0.5 tons/day. Although the 15 percent Rate-of Progress plan provides for excess VOC reductions needed to meet the 1996 emission reduction milestone, the State proposes to issue a committal in lieu of contingency measures (for the Baltimore nonattainment area and Cecil County).

In the event that measures listed in Chapter 6 do not result in meeting the post-1996 3 percent-per-year target levels, the following contingency plan has been developed.

9.1 Surplus Reductions from Existing Measures

Some emission control strategies listed to meet the Post-1996 RPP target levels are expected to result in more emission reductions than are needed to meet the requirements. If other measures fail to meet expected reductions, the excess from the following measures will be used to make up the difference.

9.1.1 NOx Emission Control Measures

NOx emission control measures which are included in this *Post-1996 RPP* will have a surplus of emissions benefits in relation to target levels required for the Baltimore nonattainment area.

9.1.2 VOC Control Measures

VOC emission control measures which are included in the Cecil County provide a surplus of 3.8 tons per day. This include control measures such as open burning which provide an emission reduction of 4.4 tons per day.

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