Pennsylvania
Department of Environmental Protection

Proposed
State Implementation Plan Revision
for the Rate of Progress Plan for the One-hour Ozone National Ambient Air Quality Standard for the Philadelphia Interstate Nonattainment Area

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I. Introduction, Purpose and Background

This State Implementation Plan (SIP) revision demonstrates that the overall emission reduction obtained in the five-county Pennsylvania portion of the Philadelphia-Wilmington-Trenton Interstate Ozone Nonattainment Area continues to support predicted achievement of the "rate of progress" (ROP) requirements of the Clean Air Act (CAA) when highway emissions are modeled using EPA's new MOBILE6 model.

ROP Demonstration: The Commonwealth submitted a series of SIP revisions that contained ROP plans to fulfill the requirement of section 182(c) of the CAA (42 U.S.C.A. §7511a(c)) for a three percent per year reduction in volatile organic compounds (VOCs) beginning in 1996. (The CAA also required a 15% reduction over 1990 levels by 1996.) EPA approved the post-1996 ROP SIP revision, using the old EPA highway vehicle emissions model MOBILE 5a-H on October 26, 2001. (66 FR 54143.)

Attainment Demonstration: A SIP revision to demonstrate attainment of the one-hour ozone National Ambient Air Quality Standard (NAAQS) by 2005, when highway emissions are recalculated using EPA's new model (MOBILE6), was submitted to EPA on January 17, 2003. On May 28, 2003 EPA found it adequate for conformity purposes (68 FR 31700); on October 10, 2003 EPA issued a direct final rule to approve this SIP revision, which became effective December 9, 2003 (68 FR 58608).

Transportation conformity budgets were established in the SIP revision using MOBILE6 for the attainment year, which is also the final year for which ROP demonstrations are required for the one-hour ozone standard

The highway on-road source control measures, transportation infrastructure and vehicle inputs to the model assumed in this ROP SIP revision are consistent with those utilized in Pennsylvania's plan to achieve attainment of the one-hour ozone standard.

Pursuant to the federal transportation conformity rule (40 CFR §93.118(e)(4)(iv)), this SIP revision shows that the levels of motor vehicle emissions calculated using MOBILE6 also continue to support achievement of ROP requirements for 2005 in the Pennsylvania portion of the interstate nonattainment area, in addition to supporting the demonstration of attainment.

II. Background - Environmental and Health Impacts of Ozone; Legal Standards

What is ozone? Ground-level ozone continues to be a significant air pollution problem in Pennsylvania. Reducing concentrations of ground-level ozone is important because ozone levels above the health-based standard are a serious human health threat, and also can cause damage to important food crops, forests, and wildlife. Ozone in the troposphere, also called ground-level ozone, should not be confused with stratospheric ozone – located in the upper atmosphere – which protects the earth by blocking out damaging solar radiation.

Health Effects. Repeated exposure to ozone pollution may cause permanent damage to the lungs. Even when ozone is present in low levels, inhaling it triggers a variety of health

problems including chest pains, coughing, nausea, throat irritation, and congestion. It can also worsen bronchitis, heart disease, emphysema, and asthma, and reduce lung capacity. Asthma is a significant and growing threat to children and adults. Ozone can aggravate asthma, causing more asthma attacks, increased use of medication, more medical treatment and more frequent visits to hospital emergency clinics.

Healthy people also experience difficulty in breathing when exposed to ozone pollution. Because ozone pollution usually forms in hot weather, anyone who spends time outdoors in the summer may be affected, particularly children, the elderly, outdoor workers and people exercising. Children are most at risk from exposure to ozone because they are active outside, playing and exercising, during the summertime when ozone concentrations are at their highest levels. Millions of Pennsylvanians live in areas where the ozone health-based standards are exceeded.

Environmental Effects. Ground-level ozone damages plant life and is responsible for 500 million dollars in reduced crop production in the United States each year. Ozone interferes with the ability of plants to produce and store food, making them more susceptible to disease, insects, other pollutants, and harsh weather. It damages the foliage of trees and other plants, ruining the landscape of cities, parks and forests, and recreation areas. One of the key components of ozone, nitrogen oxides, contributes to fish kills and algae blooms in sensitive waterways, such as the Chesapeake Bay.

Where does ground-level ozone come from? Ozone is not emitted directly to the atmosphere, but is formed by photochemical reactions between volatile organic compounds (VOCs) and oxides of nitrogen (NOx) in the presence of sunlight. The long, hot, humid days of summer are particularly conducive to ozone formation, so ozone levels are of concern primarily during the months of May through September.

The primary sources of man-made VOCs and NOx, the ozone precursors, are the evaporation of fuels and solvents (gasoline and consumer products), combustion of fuels (motor vehicles, power plants and non-road engines), and industrial processes.

What is the NAAQS for ozone? The one-hour ozone standard is 0.12 parts per million (ppm). This means that an exceedance of the standard occurs when the concentration, averaged over a rolling one-hour period, is more than this value (established by EPA to be rounded to 124 parts per billion (ppb)). A violation of the one-hour standard occurs at any monitor if four exceedances occur during a rolling three-year period.

III. ROP Results Using the EPA MOBILE6 Highway Vehicle Emissions Model

The purpose of this section is to compare the new MOBILE6 inventories with the previous MOBILE5a-H inventories. In order to perform this comparison, the Commonwealth's ROP plan was examined in order to extract mobile on-road inventories that best represent conditions in both the base year, 1990, and the attainment year, 2005. Inventories for both of these years are needed because the weight of evidence method was used to demonstrate attainment. Due to the use of the weight of evidence method, the determination of whether or not the rate of progress is

still demonstrated depends on the relative reduction of the ozone precursors between the base year and the attainment year. If these relative reductions with the new MOBILE6 inventories are equal to or greater than the relative reductions with the previous MOBILE5 inventories, then ROP continues to be demonstrated.

In order to determine whether adequate attainment progress continues to be demonstrated with the new inventories revised with MOBILE6, inventories from the approved SIP were used to determine whether the percent reduction in ozone precursors is greater under MOBILE6 than under MOBILE5a-H or equal. The inventories were prepared for the 1990 base year as well as the attainment year of 2005 for the five-county Pennsylvania portion of the Philadelphia/Wilmington/Trenton nonattainment area.

The result of the comparison between the previous MOBILE5a-H inventory from the ROP SIP and the new MOBILE6 inventory is summarized in Table 1. Table 1 presents the relative reductions (expressed as percent reductions) in on-road mobile source ozone precursor inventories between the base year and the attainment year. The differences in percent reductions are shown between the ROP SIP inventories and the new MOBILE6 based inventories.

The MOBILE6 emission budgets show an increase in both the VOC and NO_x values relative to the MOBILE5 SIP budget. The increases are due primarily to certain changes in the MOBILE model between versions 5 and 6. The model changes that are contributing most significantly to the increases are the enhanced ability of the MOBILE model to account for emission increases due to vehicle acceleration and air conditioning. Although MOBILE5 accounted for the effects of vehicle acceleration by basing emissions on certain standard drive cycles, emission factors generated by MOBILE6 are based on drive cycles that are designed to more closely match real world driving conditions. In addition, the adjustments to emission factors due to air conditioning were made more accurate between MOBILE5 and MOBILE6.

Increases in percent reductions mean that the new inventories predict lower ozone precursor emissions in the attainment year relative to the base year. Similarly, decreases (as shown) in percent reductions mean that the new inventories predict higher ozone precursor emissions in the attainment year relative to the base year. In Table 1, the magnitude by which the ozone precursor emissions are lower or higher is represented by the calculated "increase" or "decrease", respectively.

Table 1
Comparison of the On-Road MOBILE5 Inventories from the ROP SIP to the New On-Road MOBILE6 Inventories (Tons Per Day Unless Designated Otherwise)

	Pennsylvania Portion of Philadelphia/Wilmington/ Trenton Area - 2005 Attainment Year -	
	VOC	**NO_x**
MOBILE5a-H - ROP SIP-1990 MOBILE5a-H - ROP SIP-Attainment Year	187.90 61.76	158.33 86.42
MOBILE5a-H - ROP SIP-Reductions MOBILE5a-H - ROP SIP-% Reductions	126.14 67.13%	71.91 45.41%
MOBILE6 - 1990 MOBILE6 - Attainment Year	239.95 79.69	252.93 144.73
MOBILE6 - Reductions MOBILE6 - % Reductions	160.26 66.79%	108.20 42.78%
Difference in % Reductions (MOBILE6 – MOBILE5a-H)	-0.34%	- 2.63%
Increase (+) or Decrease (-)[1]	-0.82	- 6.65

Note: The "increase" or "decrease" was calculated by multiplying the differences in % reductions by the new 1990 MOBILE6 inventories. The "decrease" is calculated for the purpose of demonstrating that the MOBILE6 inventory continues to effectively (with a loss of predicted reductions) meet the objectives of the attainment demonstration and ROP.

The revised inventories predict that VOC and NO_x emissions in the attainment year relative to the base year are higher, i.e., an emission reduction "decrease" of 0.82 tons per day (tpd) for VOC and an emission reduction "decrease" of 6.65 tpd for NO_x. In order to evaluate the net effect of these changes, a means of substitution of VOC reductions with NO_x reductions is needed. Section 182 (c)(2)(C) of the CAA allows for the substitution of VOC emission reductions with NO_x emission reductions if it can be demonstrated that such substitution yields equivalent ozone reductions. Pennsylvania made such an equivalency demonstration in its Phase I Ozone SIP revision. (42 U.S.C.A. §7511a(c)(2)(C).) The other states in the Philadelphia/Wilmington/Trenton nonattainment area have also made such equivalency demonstrations. A NO_x-to-VOC ratio of 1.37 was calculated for the area, i.e., 1 ton of NO_x emission reduction is equivalent to 1.37 tons of VOC in terms of ozone reduction. The 6.65 tpd NO_x "decrease" is therefore equivalent to: 6.65 tpd NO_x x 1.37 = 9.11 tpd VOC.

In terms of their effects on ROP, the net effect for both VOC and NO_x is a VOC emission reduction decrease or shortfall of 0.82 tpd + 9.11 tpd = 9.93 tpd for the Philadelphia/Wilmington/Trenton nonattainment area.

Based on Pennsylvania's MOBILE6 revision of its on-road mobile emissions, the result of the ROP test is that the Pennsylvania portion of the Philadelphia/Wilmington/Trenton nonattainment area has lost the equivalent of 9.93 tpd of VOC emission reductions.

In order to continue demonstrating adequate emission reductions for ROP, credit from recently adopted control programs developed pursuant to the Ozone Transport Commission Model Rules, need to be added to the SIP.

The base year and attainment year inventories for the Pennsylvania portion of the nonattainment area from the ROP SIP as modified by the MOBILE6 on-road inventories are summarized in Table 2.

Table 2
Inventory Summaries

	Pennsylvania Portion of the Philadelphia/Wilmington/ Trenton Area (Tons Per Day)			
	VOC		**NO_x**	
	1990	**2005**	**1990**	**2005**
Point Sources (ROP SIP)	153	139	162	146
Area Sources (ROP SIP)	194	156	47	47
Non-Road Sources (ROP SIP)	81	68	72	31
Subtotal	428	363	281	224
Emission Reductions (OTC Model Rules)*				
• Consumer Products	-	5.33	-	-
• Portable Fuel Containers	-	3.11	-	-
• AIM Coatings	-	11.47	-	-
• Mobile Equip. Refinishing	-	4.09	-	-
• Solvent Cleaning Operations	-	17.87	-	-
OTC Model Rules Subtotal	-	*41.89*	-	-
Point/Area/Non-Road Sources Subtotal with OTC Model Rules Adjustment	428	321	281	224
On-Road Sources (MOBILE6 SIP)	240	80	253	145
Total Emissions (All Sources)	**668**	**401**	**534**	**369**

* These estimated emission reductions are from "Control Measure Development Support Analysis of Ozone Transport Commission Model Rules", E.H. Pechan and Associates, Inc., March 31, 2001.

These new measures achieve a total reduction of 41.89 tons per day of VOC, more than adequate to offset the loss of 9.93 tpd of equivalent VOC as a result of MOBILE6.

IV. Highway Budget for Purposes of Transportation Conformity

DEP performed modeling with MOBILE6 for 2005 and submitted it to EPA in January 2003 to fulfill the requirement to update the attainment plan with the new model. As stated above, that SIP revision was approved by direct final action on October 10, 2003. (68 FR 58608.) The same modeling was used in the calculation of the ROP demonstration. The ROP conformity budget is the same as the attainment budget:

2005	**VOC**	**NOx**
Tons per day	79.69	144.73
Kilograms per day	72,293	131,296