Final Submittal

SUMMARY OF
DELAWARE 2002 RATE-OF-PROGRESS PLAN
FOR KENT AND NEW CASTLE COUNTIES

For Demonstrating Progress toward Attainment of the 1-Hour National Ambient Air Quality Standard for Ground Level Ozone

Submitted to:

US Environmental Protection Agency

By

Delaware Department of Natural Resources and Environmental Control
in Conjunction with
Delaware Department of Transportation

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Acronym List

AIRS	-	EPA's Aerometric Information Retrieval System.
AFS	-	AIRS Facility Subsystem.
AMS	-	AIRS Area and Mobile Subsystem.
AQM	-	Air Quality Management Section
BEA	-	Bureau of Economic Analysis
CAAA	-	Clean Air Act Amendments of 1990
CMSA	-	Consolidated Metropolitan Statistical Area
CO	-	Carbon Monoxide
DelDOT	-	Delaware Department of Transportation
DNREC	-	Delaware Department of Natural Resources and Environmental Control
EPA	-	United States Environmental Protection Agency
EPS2.0	-	EPA's Emissions Preprocessor System software
FMVCP	-	Federal Motor Vehicle Control Program
HPMS	-	Highway Performance Monitoring System
I/M	-	Inspection and Maintenance
LEV	-	Low Emission Vehicle
MPO	-	Metropolitan Planning Organization
mmBTU	-	Million British Thermal Unit
mmcf	-	Million Cubic Feet
NAAQS	-	National Ambient Air Quality Standard
NLEV	-	National Low Emission Vehicle
NOx	-	Oxides of Nitrogen
OTAG	-	Ozone Transport Assessment Group
OTC	-	Ozone Transport Commission
OTR	-	Ozone Transport Region
PAPS	-	Point and Area Projection System
PERC	-	Perchloroethylene
POTW	-	Publicly Owned Treatment Works
RACT	-	Reasonably Available Control Technology
RPP	-	Rate-of-Progress Plan
RVP	-	Reid Vapor Pressure
SCC	-	Source Classification Code
SIC	-	Standard Industrial Classification
SIP	-	State Implementation Plan
VHB	-	Vanasse Hangen Brustlin, Inc.
VOC	-	Volatile Organic Compound

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INTRODUCTION

1. Background

This document contains the summary of Delaware's State Implementation Plan (SIP) revision for the milestone year of 2002 to address adequate rate of progress toward attainment of the 1-hour ozone National Ambient Air Quality Standard (NAAQS) as set forth in the Clean Air Act Amendments of 1990 (hereafter referred to as CAAA)[1]. The plan is hereafter referred to as "Delaware 2002 Rate-of-Progress Plan", or simply as "the 2002 RPP".

The CAAA sets forth National Ambient Air Quality Standards for six air pollutants that pose public health risks and environmental threats. Delaware exceeds the standard for only one of these pollutants, i.e., the ground level ozone. High levels of ozone can harm the respiratory system and cause breathing problems, throat irritation, coughing, chest pains, and greater susceptibility to respiratory infection. High levels of ozone also cause serious damage to forests and agricultural crops, resulting in economic losses to logging and farming operations. Ozone is generally not directly emitted to the atmosphere, but formed in the atmosphere by chemical reactions between volatile organic compounds (VOC), nitrogen oxides (NOx), and carbon monoxide (CO) in the presence of sunlight. Consequently, in order to reduce ozone concentrations, the CAAA requires specific amounts of reductions in anthropogenic VOC emissions and/or NOx emissions over a specified period of years until the ozone standard is attained. These periodic emission reductions are termed as "rate of progress" toward the attainment of the ozone NAAQS.

The CAAA defines five nonattainment classifications for areas that exceed the 1-hour ozone NAAQS based on the severity of the pollution problem. In order of increasing severity, they are marginal, moderate, serious, severe, and extreme. Attainment dates depend on the classification designation for individual areas.[2] The CAAA also establishes the Ozone Transport Region (hereafter referred to as OTR) where the interstate transport of air pollutants from one or more states contributes significantly to violations of the ozone NAAQS in one or more other states. This single transport region for ozone includes the states of Delaware, Connecticut, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont, and the Consolidated Metropolitan Statistical Area (CMSA) that includes the District of Columbia.[3] The OTR includes the Philadelphia Consolidated Metropolitan Statistical Area (CMSA) which is classified as a severe nonattainment area (Figure 1). As shown in Figure 1, Kent and New Castle Counties in Delaware fall within the Philadelphia CMSA. Thus, these two counties are subject to all requirements set forth for the severe ozone nonattainment class. All discussions and data presented in this summary document and the 2002 RPP apply only to Kent and New Castle Counties.

Section 182 (d) of the CAAA requires states to submit a State Implementation Plan (SIP) to the United States Environmental Protection Agency (EPA), for each ozone nonattainment area

[1] Federal Clean Air Act, 42 *U.S.C.A.* 7401 *et seq*., as amended by the Clean Air Act Amendments of 1990, P.L. 101-549, November 15, 1990.
[2] Clean Air Act Amendments of 1990, Title 1, Part D, Section 181.
[3] Clean Air Act Amendments of 1990, Title 1, Part D, Section 184 (a).

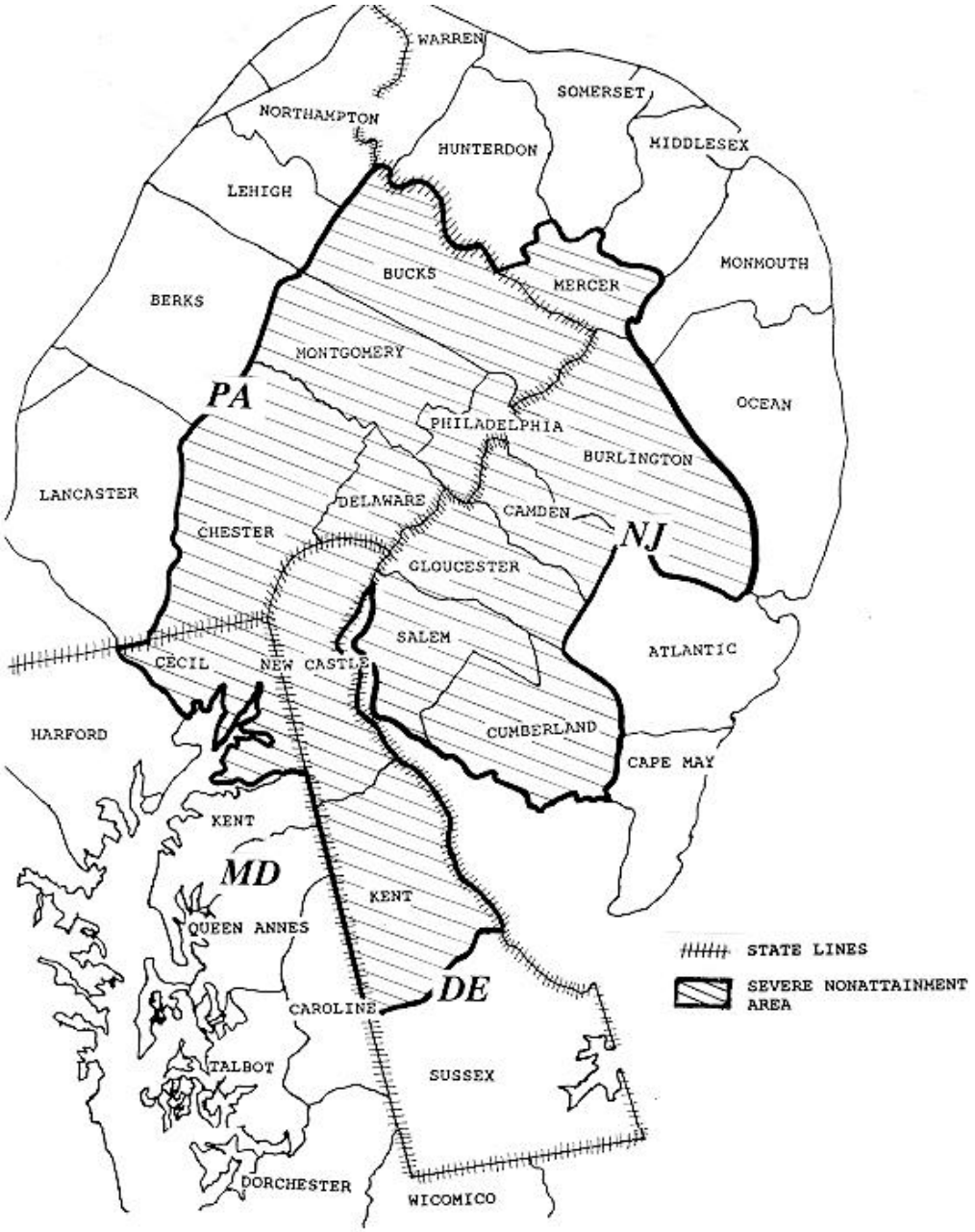


Figure 1. Philadelphia Consolidated Metropolitan Statistical Area (CMSA) Nonattainment Area.[4]

[4] This map is adapted from *Major CO, NO_2 and VOC Sources in the 25-Mile Boundary Around Ozone Nonattainment Areas, Volume 1: Classified Ozone Nonattainment Area*,EPA/4-92-005a, U.S. Environment Protection Agency, Office of Air Quality Planning and Standards, Office of Air and Radiation, Research Triangle Park, NC, February, 1992.

classified as severe or above, that achieves a 15% net reduction, by November 15, 1996, of actual anthropogenic (human-caused) volatile organic compound (VOC) emissions. In addition to the 15% reduction, Section 182(d) also requires states to submit SIP revisions that achieve an actual VOC emission reduction of at least 3% per year averaged over each consecutive 3-year period beginning November 15, 1996, until the area's applicable attainment date. These rate-of-progress emission reductions are based on the states' 1990 emission levels. The SIP revision for the 1990-1996 reductions is termed as "15% Rate-of-Progress Plan (RPP)" and the plans for an average 3% per year reduction over each 3-year period after 1996 is termed as "Post-1996 Rate-of-Progress Plans". The CAAA also provides for crediting of VOC emissions reductions achieved in the 1990-1996 period to the post-1996 rate-of-progress plans if they are in excess of the 15% VOC reductions requirement, and substitution of any anthropogenic nitrogen oxides (NOx) emissions reductions, net of growth, occurring in the post-1990 period for the post-1996 VOC emission reduction requirements. In addition to the average annual 3% VOC/NOx emission reduction, Section 182(d) of CAAA also requires the States to provide for photochemical grid modeling demonstrations for the attainment of ozone NAAQS by the applicable attainment date.

Through a memorandum dated on March 2, 1995, from Mary D. Nichols, Assistant Administrator for Air and Radiation, EPA provides for the States with serious and above ozone nonattainment areas a two-phased approach to the post-1996 RPPs.[5] Briefly, in Phase I, the States are required to develop a plan for the milestone year of 1999 which includes necessary control measures to achieve a 9% reduction of VOC and/or NOx emissions between 1996 and 1999. In Phase II, the States are required to assess the regional and local control measures necessary to meet the rate-of-progress requirements and achieve attainment. On December 23, 1997, EPA provided further guidance, along with a memorandum from Richard D. Wilson, Acting Assistant Administrator of Air and Radiation, on how to prepare the Phase II submittal.[6]

2. Delaware State Implementation Plan Submittals

All the rate-of-progress emission reductions aforementioned are based on the States' 1990 emission levels. Delaware's *1990 Base Year Ozone Emission Inventory*, which is an inventory of the 1990 actual VOC, NOx, and CO emissions from all sources in Delaware, was submitted to EPA as a SIP revision on May 27, 1994, and was approved by EPA on March 25, 1996. Since the ozone NAAQS attainment date for Kent and New Castle Counties is 2005, Delaware is required to submit the 15% RPP, and RPPs for three post-1996 milestone years, i.e., 1999, 2002, and 2005. Delaware's 15% RPP was submitted to EPA as a SIP revision in February 1995. In this plan, Delaware showed that, by implementing necessary control measures, the required 15% VOC emission reduction could be successfully met by 1996. The 15% RPP was conditionally approved by EPA in May 1997. Delaware's 1999 RPP, the first post-1996 SIP revision developed according to the Phase I requirements set forth in the Nichols' Memorandum (please see Footnote 4), was submitted to EPA in December, 1997. In June 1999, Delaware submitted to EPA the Amendments of the 1999 RPP. In the 1999 RPP (as amended in June 1999), Delaware shows that the 9% VOC

[5] *Memorandum: Ozone Attainment Demonstrations*, Mary D. Nichols, Assistant Administrator for Air and Radiation, U.S. EPA, Washington, D.C. 20460, March 2, 1995.

[6] *Memorandum and Guidance for Implementing the 1-Hour Ozone and Pre-Existing PM_{10} NAAQS*, Richard D. Wilson, Acting Assistant Administrator for Air and Radiation, U.S. EPA, Washington, D.C. 20460, December 23, 1997.

and/or NOx emission reductions required for the 1996-1999 period can be successfully met by implementing additional control measures in this time period. Delaware also demonstrates that an additional 3% VOC/NOx emission reduction can be achieved, without further rulemaking activities, to meet the contingency requirements specified by EPA.[7] In May 1998, Delaware submitted to EPA the Phase II attainment demonstration document based on EPA's guidance. In this Phase II document, Delaware makes a commitment to submit a SIP revision to EPA before the end of 2000 to address the emission reductions for the post-1999 rate-of-progress milestone years up to the attainment date for the 1-hour ozone NAAQS (Delaware's attainment date for the 1-hour ozone NAAQS is 2005). Both Phase I and Phase II submittals are currently under EPA's review.

On July 18, 1997, EPA revised the 1-hour ozone NAAQS with an 8-hour standard at a level of 0.08 ppm.[8] However, the 1-hour standard will continue to apply to a nonattainment area for an interim period until EPA makes a determination that the area has air quality meeting the 1-hour standard. As a consequence, the provisions of Section 182 of the CAAA will continue to apply to the subject nonattainment areas until EPA makes determinations that these areas have met the 1-hour ozone standard (please see Footnote 5). The continuation of the 1-hour standard requires that Delaware submit to EPA, before the end of 2000, fully adopted Rate-of-Progress Plans for the milestone year of 2002 and for the milestone year of 2005. Delaware 2002 Rate-of-Progress Plan is for the milestone year of 2002. Delaware's 2005 Rate-of-Progress plan will be addressed in a separate SIP revision.

3. Organization of the 2002 RPP

The 2002 RPP is a fully-adopted Rate-of-Progress Plan with (a) emission target calculations for the milestone year of 2002, and (b) all control measures and regulations adopted and/or to be adopted as necessary to achieve the rate-of-progress requirements set forth for 2002. In general, the document contains five parts as explained below.

Part I. The 1990 Base Year Inventory Summary and 2002 Target Levels of VOC and NOx Emissions

The 2002 Target Levels of VOC and NOx Emissions are the maximum amounts of anthropogenic VOC and NOx emissions allowed in the years of 2002 in Kent and New Castle Counties in order to meet the 3% per year VOC/NOx reduction requirements. As previously mentioned, the basis for calculating the these target levels is the 1990 Base Year Emission Inventory, which is an inventory of actual VOC, NOx, and CO emissions that occurred in Delaware in 1990. Section 182(c)(2)(C) of CAAA allows NOx reductions that occur after 1990 to be used to meet the post-1996 rate of progress requirements. The condition for meeting the rate-of-progress requirements is that the sum of all creditable VOC and NOx emissions must equal 3% per year averaged over the applicable milestone period. In the event of NOx substitution, separate target levels of emissions will have to be calculated for VOC and NOx. Part I presents a summary of the 1990 Base Year Inventory

[7] *Guidance on the Post-1996 Rate-of-Progress Plan and the Attainment Demonstration*, Office of Air Quality Planning and Standards, US EPA, Research Triangle Park, NC, February 1994.

[8] Environmental Protection Agency: *National Ambient Air Quality Standard for Ozone;* Final Rule. *Federal Register*, Vol. 62, No. 138, Friday, July 18, 1997.

and presents also the 6-step process for determining the 2002 Target Levels of VOC emissions with and without NOx substitution.

Part II. The 2002 Current Control Projection Inventory & Required VOC and NOx Emission Reductions

The Current Control Projections are estimates of the amount of VOC and NOx emissions that will occur in 2002, taking into account the effects of economic growth, and assuming no new emission control measures would be implemented between 1990 and the corresponding milestone year, i.e., 2002. The purpose of calculating the 2002 Current Control Projection Inventory is to determine the amount of growth in VOC and NOx emissions by 2002 that must be offset. Part II discusses the methodology used to develop 2002 growth factors and shows how the growth factors are used to determine the 2002 Current Control Projection Inventory.

Part III. The 2002 Control Strategy Projection Inventory and Emission Control Measures

The 2002 Control Strategy Projections are estimates of the amount of VOC and NO_x emissions that will occur in 2002, taking into account the effects of economic growth and continued benefits of control strategies in the 15% RPP and the 1999 RPP, and ***including*** the benefits from new control measures that will be implemented during the 1999-2002 period. The purpose of calculating the 2002 Control Strategy Projection Inventory is to determine if the new national, regional and state level control measures, which will be implemented between 1999 and 2002 will reduce VOC and/or NOx emissions sufficiently to offset growth and to meet the 2002 Target Levels of VOC and NOx emissions calculated in Part I. Part III discusses the methodology used to develop the 2002 Control Strategy Projection Inventory and presents the individual control measures to be implemented by 2002 with their associated VOC and NOx emissions reductions.

Part IV. Contingency Plan for the 2002 RPP

Contingency measures are required by the CAAA to be included in the rate-of-progress plans to remedy the state's failure to meet the emission reduction target in a milestone year. The CAAA requires that, in the event of such a failure, the contingency measures can be implemented (1) without any further rulemaking actions by the state, and (2) to achieve an additional 3% emission reduction over the 1990 baseline level. Part IV discusses the contingency measures and the potential emission reductions associated with each measure.

Part V. Documentation

Numerous appendices are included in this part to backup the discussion and conclusions in Part I through Part IV. These appendices include background information, emission data, projection methodologies and calculations, relevant guidance memorandums from EPA, and other references cited in Part I through Part IV.

It should be pointed out that there exist minute discrepancies among numbers in various parts in this plan. These discrepancies are due to rounding errors in calculations and are of a magnitude of $\pm$0.001 TPD. These discrepancies do not affect the final calculation results and the conclusions of the plan.

4. Responsibilities

The agency with direct responsibility for preparing and submitting the 2002 RPP is the Delaware Department of Natural Resources and Environmental Control (DNREC), Division of Air and Waste Management, Air Quality Management Section (AQM), under the direction of Darryl D. Tyler, Program Administrator. The Delaware Department of Transportation (DelDOT), in conjunction with the consulting firm Vanasse Hangen Brustlin, Inc. (VHB), Watertown, MA, is responsible for performing the work associated with the on-road mobile source portions of this document. Various other Delaware agencies, including the Department of Labor, the Department of Public Safety, and the Department of Agriculture, provide information used in some portions of this document. These agencies will be referred to and acknowledged in appropriate locations in the document.

The working responsibility for Delaware's air quality planning falls within the Planning and Community Protection Branch of the Air Quality Management Section of DNREC, under the management of Raymond H. Malenfant, Program Manager. Alfred R. Deramo, Program Manager of Emissions Research, Planning and Attainment Group within the Planning and Community Protection Branch, is the project manager and chief editor of the 2002 RPP. Joseph Cantalupo, Manager of DelDOT's Intergovernmental Coordination Section, Office of Planning, is responsible for managing the work associated with the on-road mobile source portions of this plan. Thomas F. Wholley, Director of Air Quality Services, Vanasse Hangen Brustlin, Inc., is responsible for contract work associated with the on-road mobile source portions of this plan.

The following personnel of the Emissions Research, Planning and Attainment Group under Alfred R. Deramo are instrumental in preparing this plan:

Project Leader and Principal Author:
Frank F. Gao, Ph.D., P.E., Environmental Engineer.

Quality Assurance Reviewer:
Mohammed A. Mazeed, Ph.D., P.E., Environmental Engineer.

Technical Supporting Staff:

Point sources:	Kevin D. Yingling, Environmental Scientist.
	Marian A. Hitch, Senior Environmental Compliance Specialist.
Area Sources:	Jack L. Sipple, Environmental Scientist.
	Mark D. Eastburn, Environmental Scientist.
Off-Road Mobile Sources:	Margaret A. Jenkins, Environmental Scientist.
On-Road Mobile Sources:	Mark H. Glaze, Resource Planner.

PART I

THE 1990 BASE YEAR INVENTORY SUMMARY AND THE 2002 TARGET LEVELS OF VOC AND NOx EMISSIONS

Under the rate-of-progress provisions in Section 182(d) of the CAAA, Delaware is required to achieve an average 3% per year VOC emission reduction from the 1990 baseline emission levels in Kent and New Castle Counties in the milestone period of 1999-2002. In order to determine necessary and adequate control strategies for achieving the required emission reductions in the 2002 RPP, the target level of VOC emissions in the milestone year of 2002 must first be calculated. In addition, Section 182(c)(2)(C) of the CAAA permits the substitution of NOx emission reductions for the post-1996 VOC emission reductions required for the adequate rate-of-progress. Such NOx substitutions for VOC emission reductions require the calculation of the 2002 target level of NOx emissions.

The 3% per year rate-of-progress reductions in VOC and NOx emissions for the 1999-2002 period are determined from the 1990 Base Year Inventory after the inventory is adjusted for non-creditable emission reductions due to (1) Federal Motor Vehicle Control Program (FMVCP) tailpipe or evaporative standards promulgated prior to 1990, (2) Federal regulations specifying Reid Vapor Pressure (RVP) limits on gasoline for nonattainment areas, (3) State regulations required to correct deficiencies in Reasonably Available Control Technology (RACT) rules, and (4) State regulations required to establish or correct Inspection and Maintenance (I/M) programs. In this part of the 2002 RPP, a summary of the 1990 Base Year Inventory for Kent and New Castle Counties is first presented, followed by the procedures and calculations for estimating the 2002 target levels of VOC emissions with and without NOx substitution.

1.1. The 1990 Base Year Inventory Summary

The rate-of-progress provisions in the CAAA require states in nonattainment areas to submit to the EPA a current inventory of actual emissions from all sources of relevant pollutants.[9] This inventory is to be used as the basis for determining required emissions reductions. The calendar year 1990 is the time frame for this current emissions inventory which is called the 1990 Base Year Ozone State Implementation Plan (SIP) Emissions Inventory. Delaware's 1990 Base Year Inventory was submitted to the EPA as a SIP revision on May 27, 1994, and approved by EPA on March 25, 1996 (Reference 1, hereafter referred to as Delaware's 1990 Base Year Inventory).

The 1990 Base Year Inventory is categorized into point, stationary area, off-road mobile, on-road mobile and biogenic sources of emissions. Volatile organic compounds (VOC), nitrogen oxides (NOx), and carbon monoxide (CO) are the ozone precursor emissions reported for each category in the 1990 Base Year Inventory. Because CO is only marginally reactive in producing ozone, the CO component of the 1990 Base Year Inventory is not included in the rate-of-progress requirements. Therefore, only the VOC and NOx components of the 1990 Base Year Inventory

[9] CAAA, Title I, Part D, Sec. 172(c)(3) and Sec. 182.

are summarized in this part, as shown in Table 1. The values in Table 1-1 are reported in tons per day in the peak ozone season. The peak ozone season for Delaware is defined as from June 1 through August 31.

Table 1
1990 Base Year Inventory Summary of VOC and NOx Emissions (in TPD)
by County in Peak Ozone Season

	Kent		New Castle		Total NAA	
Source Category	**VOC**	**NOx**	**VOC**	**NOx**	**VOC**	**NOx**
Point Sources	3.242	6.130	27.078	85.767	30.320	91.897
Stationary Area Sources	12.967	1.202	34.754	5.398	47.721	6.600
Off-Road Mobile Sources	3.494	7.891	16.674	18.777	20.168	26.668
On-Road Mobile Sources	13.07	10.62	35.28	27.06	48.35	37.68
Biogenic Sources*	32.46	0.00	17.51	0.00	49.97	0.00
Total Emissions	**65.233**	**25.843**	**131.296**	**137.002**	**196.529**	**162.845**

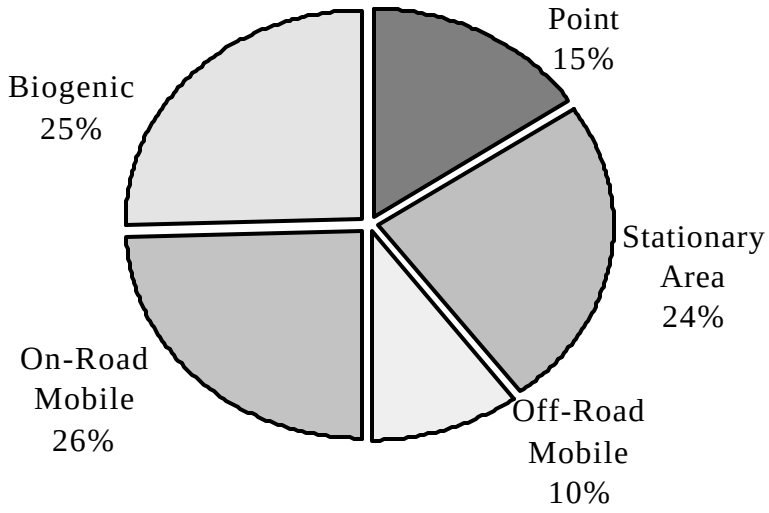
* NOx emissions from biogenic sources are considered negligible.

The percent VOC contribution of each source sector listed in Table 1 to the total VOC emissions from Kent and New Castle Counties is shown in Figure 2. These relative proportions are shown for the total inventory of all sources, as well as for the anthropogenic inventory that excludes biogenic emissions. The anthropogenic inventory is the inventory from which the Base Year Inventory is adjusted and the 2002 Target Levels of VOC (and NOx) emissions are calculated.

The percent NOx contribution of each source sector listed in Table 1 to the total NOx emissions from Kent and New Castle Counties is shown in Figure 3. All NOx emissions in the 1990 Base Year Inventory are from anthropogenic sources. The NOx emissions from biogenic sources are considered negligible and are not included in the 1990 Base Year Inventory.

The 1990 Base Year emissions data were downloaded from the EPA's Aerometric Information Retrieval System (AIRS) to a PC work file for the purpose of developing the 15% Rate-of-Progress Plan, the 1999 Rate-of-Progress Plan, and this 2002 Rate-of-Progress Plan. A more detailed explanation of the 1990 Base Year Inventory data and the methods used to develop the data is contained in Delaware's *1990 Base Year Ozone SIP Emissions Inventory for VOC, CO, and NOx*, Department of Natural Resources and Environmental Control, Air Quality Management Section, Dover, DE, as revised in May 1994 (Reference 1).

(a) Total VOC Emissions, 196.529 TPD



(b) Anthropogenic VOC Emissions, 146.559 TPD

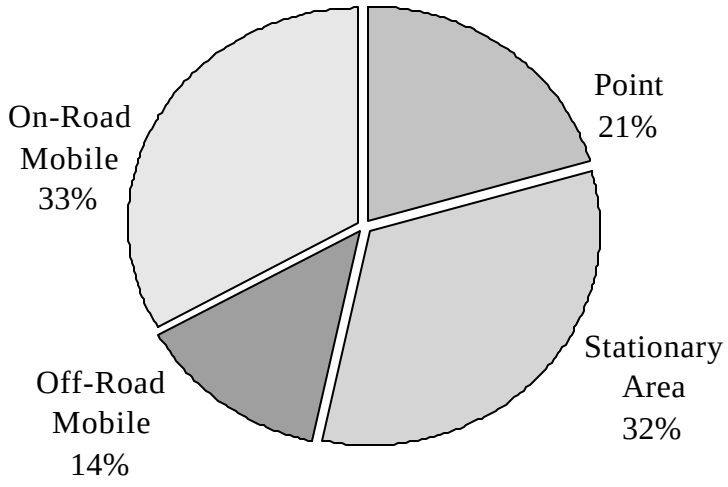


Figure 2. Contribution of Source Components to Total 1990 Base Year VOC Emissions in Delaware's Non-Attainment Area (NAA).

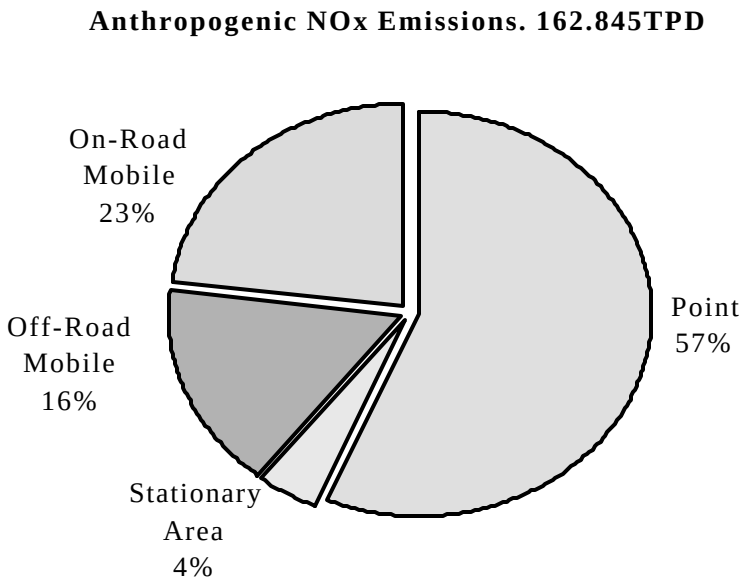


Figure 3. Contribution of Source Components to Total 1990 Base Year VOC Emissions in Delaware's Non-Attainment Area (NAA).

1.2. Guidance for Calculating Emission Target Levels for Post-1996 Milestone Years

The Clean Air Act Amendments of 1990 (CAAA) is the principal guidance for determining the target levels of VOC and NOx emissions in a state's Rate-of-Progress Plans (RPP). Based on the CAAA, EPA has issued various guidance documents for States to follow in their RPP development. This section of the 2002 RPP briefly outlines the requirements and procedures specified in the CAAA and relevant EPA guidance documents for determining emission target levels in the rate-of-progress milestone years.

The target levels of VOC and NOx emissions for a milestone year is the maximum amount of total anthropogenic VOC and NOx emission to be allowed for the entire subject nonattainment area (NAA) in that specific milestone year. The CAAA sets forth restrictions on certain control measures toward the VOC emission reductions to meet the rate-of-progress requirements. Briefly, all real, permanent, and enforceable post-1990 VOC emission reductions are creditable toward the rate-of-progress reductions except (1) the Federal Motor Vehicle Control Program (FMVCP) tailpipe or evaporative standards promulgated prior to 1990, (2) the Federal Regulations specifying Reid Vapor Pressure (RVP) limits for gasoline for nonattainment areas, (3) the State regulations required to correct deficiencies in Reasonably Available Control Technology (RACT) rules, and (4) the State regulations required to establish or correct vehicle Inspection and Maintenance (I/M)

programs.[10] After adjustments for these non-creditable emission reductions and for emissions of any photochemically non-reactive VOCs such as perchloroethylene (PERC), the 1990 Base Year Inventory for Anthropogenic Emissions is termed as the 1990 Adjusted Base Year (or Baseline) Inventory. This adjusted baseline inventory forms the basis for determining the rate-of-progress (i.e., percentage) emission reductions, and the corresponding emission target levels for individual milestone years. The basic procedures for developing the adjusted base year inventory are outlined in an EPA document entitled "*Guidance on the Adjusted Base Year Emissions Inventory and the 1996 Target for the 15 Percent Rate-of-Progress Plans*" (Reference 2, hereafter referred to as *The Guidance on the Adjusted Base Year Inventory*).

For the milestone year of 1996, the target level is required for VOC emissions only. This can be done by multiplying the VOC emission level in the 1990 Adjusted Base Year Inventory by 15% to obtain the required emission reduction, and subtracting it from the 1990 adjusted level. Details of Delaware's 1996 emission target calculations can be found in *The Delaware 15% Rate-of-Progress Plan*, Delaware Department of Natural Resources and Environmental Control, Dover, DE, February, 1995 (Reference 3). For the post-1996 milestone years, the target levels are to be calculated for VOC emissions, as well as for NOx emissions if NOx substitution is selected by states to meet the required rate-of-progress reductions. Section 182(c)(2)(C) of the CAAA allows states to use actual NOx emission reductions obtained after 1990 to meet the post-1996 VOC emission reduction requirements. If a state chooses to substitute its NOx emission reductions for VOC emission reductions, such substitution must meet the criteria outlined in the EPA's *NOx Substitution Guidance* (Reference 4). These criteria are (1) the sum of all creditable VOC and NOx emission reductions must equal 3% per year averaged over each applicable milestone period, and (2) the overall VOC and NOx emission reductions must be consistent with the area's modeled attainment demonstration. The second criterion, i.e., the consistency requirement, is modified by a policy memorandum issued by EPA on July 12, 1994.[11] The modification requires that (1) the State must have adopted RACT regulations for NOx emission control, and (2) the State must demonstrate, through modeling of at least one episode with photochemical Urban Airshed Modeling (UAM) or Regional Oxidant Modeling (ROM), the usefulness of NOx controls in reducing the ground-level ozone concentrations. The State of Delaware satisfies these two requirements. Delaware adopted NOx RACT regulations on November 24, 1993 and these regulations became effective on May 31, 1995 (Reference 5). The Sensitivity Analysis conducted by Rutgers University for the Philadelphia-New Jersey UAM Airshed has demonstrated that as much as 75% of VOC and 75% of NOx reductions could be necessary for the entire domain to achieve the ground-level ozone standard. Details of this analysis are presented in *The Delaware 1999 Rate-of-Progress Plan for Kent and New Castle Counties*, Department of Natural Resources and Environmental Control, Dover, DE, as amended in June 1999 (References 6 and 7). Delaware's two nonattainment counties (i.e., Kent and New Castle) are included in the modeled airshed domain. In addition, the Regional and Urban Scale Modeling (RUSM) performed by Ozone Transport Assessment Group (OTAG) has shown that NOx emission and transport controls are crucial for Delaware to reach attainment of the ozone standard (Reference 8). Therefore, Delaware meets the consistency requirement and can choose to control NOx emissions and substitute NOx emission reductions for VOC emission reductions to meet the rate-of-progress

[10] Clean Air Act amendment of 1990, Title I, Part D, Section 182(b)(1)(D).

[11] Memorandum: *Clarification of Policy for Nitrogen Oxides (NOx) Substitution*, John S. Seitz, Director, Office of Air Quality Planning and Standards, US EPA, July 12, 1994, included in Appendix H.

requirements.

To determine the control strategies for achieving a 9% VOC/NOx emission reduction for each 3-year period after 1996, the target levels of VOC and NOx emissions for the three post-1996 milestone years (i.e., 1999, 2002, and 2005 for Delaware) need to be calculated. For these post-1996 milestone years, the target levels of VOC and NOx emissions for a subject milestone year depend on the target levels in the previous milestone year. According to EPA's *Guidance on the Post-1996 Rate-of-Progress Plan and the Attainment Demonstration* (Reference 9, hereafter referred to as *The Guidance on the Post-1996 RPP*), the following equation must be used for calculating emission target levels for a subject milestone year

$$TL_x = TL_y - BG_r - FT_x \qquad (1)$$

where:
- x = subject milestone year (e.g., 2002),
- y = previous milestone year (e.g., 1999),
- TL_x = target level of emissions for year x,
- TL_y = target level of emissions for year y,
- BG_r = Emission reduction required for year y,
- FT_x = Fleet turnover correction for year y to year x.

1.3. The 2002 Target Levels of VOC and NOx Emissions

From Equation (1), it can be seen that the target level of VOC and NOx emissions for a subject milestone year (i.e., 2002) is calculated by subtracting, from the target levels in the previous milestone year (i.e., 1999), the required rate-of-progress emission reductions (i.e., 9% for the period of 1999-2002) and the fleet turnover correction for the corresponding milestone period. There are six major steps in calculating the target level of emissions for the milestone year 2002. The first four steps are needed to calculate the required rate-of-progress emission reductions, the fifth step is to calculate the fleet turnover corrections, and the last step is to obtain the target level.

Step 1. Development of the 1990 Base Year Inventory

The 1990 Base Year Inventory has been fulfilled in Delaware's 1990 Base Year Ozone SIP Emission Inventory (Reference 1). A summary by source sector of the 1990 Base Year Inventory of VOC and NOx emissions in Delaware's two severe nonattainment counties (Kent and New Castle) has been presented in Table 1.

Step 2. Development of the 1990 Rate-of-Progress or Baseline Inventory

The 1990 Baseline Inventory is the "baseline" from which Delaware calculates the 9% rate-of-progress emission reductions for the subject 1999-2002 milestone period. This baseline inventory accounts for only anthropogenic emissions from sources within Kent and New Castle Counties. Therefore, this baseline inventory is obtained by removing, from the 1990 Base Year Inventory, (1) biogenic emissions, (2) any emissions from sources outside Kent

and New Castle Counties, and (3) the non-reactive perchloroethylene (PERC) emissions (for VOC inventory only). Delaware's 1990 Base Year Inventory for Kent and New Castle Counties (see Table 1) does not include emissions from any outside sources. It does include, however, the biogenic and PERC emissions. Perchloroethylene was originally classified by EPA as a photochemically reactive VOC for emission inventory purposes. The EPA reclassified PERC as photochemically ***non-reactive*** after Delaware's 1990 Base Year Inventory was compiled. Because only the photochemically ***reactive*** VOCs participate in the formation of ozone, the PERC emissions, which are now considered not participating in the formation of ozone, need to be subtracted from the 1990 Base Year Inventory. Calculations for the 1990 Baseline Inventory for VOC emissions are shown below.

1990 Base Year Total VOC Emissions (Kent and New Castle Counties Only):

65.233 TPD (Kent) + 131.296 TPD (New Castle) = 196.529 TPD

Emissions from Outside Nonattainment Area: None

1990 Base Year Total Biogenic VOC Emissions:

32.460 TPD (Kent) + 17.510 TPD (New Castle) = 49.970 TPD

1990 Base Year Total PERC Emissions (See Appendix A): 0.716 TPD

1990 Baseline VOC Emissions = 1990 Base Year Inventory - (Outside Emissions + Biogenic Emissions + PERC Emissions)
= 196.529 - (0 + 49.970 + 0.716) = **145.843 TPD**

The 1990 Baseline Inventory for NOx emissions will be the same as the 1990 Base Year Inventory (Table 1), since (1) biogenic NOx emissions are negligible, (2) there are no NOx emissions from outside sources in the 1990 Base Year Inventory, and (3) correction for PERC emissions does not apply to NOx emissions. The 1990 Baseline Inventory for both VOC and NOx emissions is summarized in Table 2.

Table 2
1990 Baseline Inventory Summary for VOC and NOx Emissions (in TPD)

	Kent		New Castle		Total NAA	
Source Sector	**VOC**	**NOx**	**VOC**	**NOx**	**VOC**	**NOx**
Point Sources	3.242	6.130	26.938	85.767	30.180	91.897
Stationary Area Sources	12.779	1.202	34.366	5.398	47.145	6.600
Off-Road Mobile Sources	3.494	7.891	16.674	18.777	20.168	26.668
On-Road Mobile Sources	13.07	10.62	35.28	27.06	48.35	37.68
TOTAL EMISSIONS	**32.585**	**25.843**	**113.258**	**137.002**	**145.843**	**162.845**

Step 3. Development of the 1990 Adjusted Baseline Inventory

According to Section 182(b)(1)(D) of the CAAA, emission reductions resulted from the Federal Motor Vehicle Control Program (FMVCP) and Reid Vapor Pressure (RVP) regulations promulgated prior to 1990 are not creditable for achieving the adequate rate- of-progress emission reductions. Therefore, the 1990 Baseline Inventory needs to be adjusted by subtracting the VOC (and NOx) emission reductions that are expected to occur between 1990 and the subject milestone year 2002 due to the FMVCP and RVP regulations. The result of this adjustment is called "the 1990 Adjusted Baseline Inventory relative to 2002".

The FMVCP/RVP VOC and NOx emission reductions that are expected to occur between 1990 and a subject milestone year are determined using the on-road mobile source emission modeling software (MOBILE5a) provided by EPA. The MOBILE5a input and output files for the 1990 Adjusted Baseline Inventory for on-road mobile sources are provided by Delaware Department of Transportation (DelDOT), through its contractor, Vanasse Hangen Brustlin, Inc., Watertown, MA (hereafter referred to as VHB). These files are included in Appendix B of the 2002 RPP. The calculations and results for the non-creditable FMVCP/RVP emission reductions for the target years of 1999 and 2002 are presented in Table 3.

Table 3
Non-Creditable FMVCP/RVP Emission Reductions (in TPD)

Description	**VOC**	**NOx**	
1990 Baseline On-Road Mobile Source Emissions	48.350	37.680	(a)
1990 Adjusted Base Year On-Road Mobile Source Emissions			
Adjusted for 1999	36.850	33.730	$(b)_{1999}$
Adjusted for 2002	35.660	33.240	$(b)_{2002}$
FMVCP/RVP Emission Reductions			
For 1990-1999	11.500	3.950	$(a)-(b)_{1999}$
For 1990-2002	12.690	4.440	$(a)-(b)_{2002}$

The 1990 Adjusted Baseline Inventory relative to a subject milestone year is obtained by subtracting the corresponding FMVCP/RVP emission reductions from the 1990 Baseline Inventory presented in Step 2. The calculations and results are shown in Table 4. This all-source adjusted inventory is the baseline for calculating the required rate-of-progress emission reductions, as shown in the next step.

Step 4 - Calculation of Required Creditable Reductions

The percent reductions required for VOC and NOx emissions are calculated separately. However, the sum of all creditable VOC and NOx emission reductions must be equal to the 3% per year required reduction. The VOC emission reduction that can be applied for the

Table 4
1990 Adjusted Baseline VOC and NOx Emissions (in TPD)

Description	VOC	NOx	
1990 Baseline Inventory (All-Source Emissions)	145.843	162.845	(a)
FMVCP/RVP Emission Reductions			
For 1990-1999	11.500	3.950	$(b)_{1999}$
For 1990-2002	12.690	4.440	$(b)_{2002}$
1990 Adjusted Baseline Inventory Emissions			
Adjusted for 1999	134.343	158.895	$(a)-(b)_{1999}$
Adjusted for 2002	133.153	158.405	$(a)-(b)_{2002}$

2002 RPP is obtained by subtracting the sum of non-creditable fleet turnover correction factor and the expected VOC emissions level in 2002 from the 1999 target level of VOC emissions. The expected level of VOC emissions (i.e., the control strategy projection) in 2002 is 101.139 TPD (See Table 15 in Part III), and the fleet turnover correction factor for the 1999-2002 period is 1.190 TPD. Therefore, 7.877 TPD of VOC emission reduction can be utilized for meeting the 1999-2002 rate-of-progress requirements. The calculations and result are summarized in Table 5.

Table 5
VOC Emission Reductions (in TPD) Creditable for 3% Per Year
Rate-of -Progress Requirement for 1999-2002 Period

Description	Emissions	
1990 Baseline VOC Emission Adjusted for 2002	133.153	(a)
1999 VOC Target Level*	110.206	(b)
VOC Fleet Turnover Correction for 1999-2002	1.190	(c)
2002 VOC Control Strategy Projections	101.139	(d)
Creditable VOC Emission Reductions for 1999-2002	7.877	(e)=(b)-(c)-(d)
% of VOC Reductions for 2002 Rate-of-Progress	5.92%	(f)=(e)/(a)x100

* The 1999 target level is obtained from Delaware's 1999 RPP as amended in June 1999 (Reference 7).

The percentage of VOC reduction creditable toward the 3% per year rate of progress is determined from the 1990 Adjusted Base Year Inventory of VOC emissions. The total creditable VOC emission reduction of 7.877 TPD is converted to an equivalent percentage and is found to be 5.92%. The percent NOx reduction that can be substituted to meet the average 3% per year rate-of-progress requirement is obtained from the fact that the sum of creditable VOC and NOx emission reductions must be equal to 9% between 1999 and 2002, which requires a 3.08% for NOx emission reduction. The required NOx emission

reduction is then calculated to be 4.879 TPD, as indicated in Table 6.

Table 6
NOx Emission Reductions (in TPD) Creditable for 3% Per Year
Rate-of -Progress Requirement for 1999-2002 Period

Description	Emissions	
1990 Baseline NOx Emission Adjusted for 2002	158.405	(a)
% VOC Reductions for 2002 Rate-of-Progress	5.92%	(b)
% NOx Reductions for 2002 Rate-of-Progress	3.08%	(c)
Total % of VOC/NOx Reduction	9.00%	(d)=(b)+(c)
NOx Emission Reductions Required for 1999-2002	4.879	(e)=(a)x(c)

In summary, the emission reductions required to meet the average 3% per year rate-of-progress requirement for the 1999-2002 period are 7.877 TPD and 4.879 TPD for VOC and NOx, respectively.

Step 5. Calculation of Corrections for Fleet Turnover

It is anticipated that there will be some decrease in motor vehicle emissions for many years as a result of fleet turnover, i.e., the gradual replacement of older pre-control vehicles by newer vehicles with the control required by the CAAA, even in the absence of any additional and new controls. The CAAA does not allow States to take credit from these fleet-turnover reductions for achieving rate-of-progress purposes. Therefore, the emission reductions due to any fleet turnover during the post-1996 milestone periods are not creditable for the corresponding milestone year. The fleet turnover correction for each post-1996 target level is obtained by subtracting the 1990 Baseline On-Road Mobile Source Emissions adjusted to the subject milestone year (i.e., 2002) from the 1990 Baseline On-Road Mobile Source Emissions adjusted to the previous milestone year (i.e., 1999). The calculations and results for 2002 are shown in Table 7.

Table 7
Fleet Turnover Corrections for On-Road Mobile Source
VOC and NOx Emissions (TPD)

Correction (TPD)	VOC	NOx	
For 2002-2005	0.706	0.227	$(b)_{2002}$-$(b)_{2005}$*

*Data are obtained from Table ~~1-8~~ 3.

Step 6 - Calculation of 2002 Target Levels of VOC and NOx Emissions

The target levels of VOC and NOx emissions in 2002 are calculated using Equation (1), i.e., by subtracting the required emission reductions (in step 4) and the fleet turnover

corrections (in step 5) from the target levels of the previous milestone year of 1999 (References 6 and 7). The calculations and results are summarized in Table 8.

Table 8
Target Levels of VOC and NOx Emissions in 2002 (in TPD)

Description	**VOC**	**NOx**	
1999 Target Level*	**110.206**	**148.964**	(a)
Emission Reduction for Rate-of-Progress	7.877	4.879	(b)
Fleet Turnover Correction for 1999-2002	1.190	0.490	(c)
Target Level for 2002	**101.139**	**143.595**	(d)=(a)-(b)-(c)

* The 1999 target levels are obtained from Delaware's 1999 RPP as amended in June 1999 (Reference 7).

The target levels shown in Table 8 are the maximum VOC and NOx emissions to be allowed in 2002, under the requirements of adequate rate-of-progress toward the attainment of the 1-hour ozone standard, for Delaware's two severe nonattainment counties, i.e., Kent and New Castle Counties. Delaware must limit its VOC and NOx emissions in Kent and New Castle Counties to or below these target levels in 2002.

PART II

THE 2002 CURRENT CONTROL PROJECTION INVENTORY AND THE REQUIRED VOC AND NOx EMISSION REDUCTIONS

In addition to the 15% VOC emissions reductions, plus offsetting emission growth, by the year 1996, Section 182(c)(2) of the Clean Air Act Amendments of 1990 (CAAA) requires each serious and above ozone nonattainment area to achieve 3% per year emissions reductions, net of growth, averaged over each consecutive 3-year period after 1996 until the year of attainment. In other words, the Post-1996 Rate-of-Progress Plan and Attainment Demonstration requires that the nonattainment area not only reduce the VOC emissions from the baseline inventory by 9 percent for each 3-year milestone period, but also offset any growth in emissions due to increased economic activity in each 3-year period. For the period of 1999-2002 in Delaware, the 9% emission reductions from the 1990 Baseline Inventory emission levels include 7.877 TPD of VOC reduction and 4.879 TPD of NOx reduction, as determined in Part I. The Part II of the 2002 RPP sets forth the methodology used in determining the total amount of VOC and NOx emission reductions required for the 1999-2002 period, including the emission reductions that are required to offset emission growth.

In order to determine the total amount of VOC and NOx emission reductions required for the 1999-2002 period, the emission levels in the milestone year 2002 must be estimated. For this purpose, the 2002 growth factors are developed for the various emission source categories, as presented in Section 2.2 of the 2002 RPP. The 1990 baseline emissions are then multiplied by these growth factors, and the resulting inventory is called **the 2002 Current Control Projection Inventory**. The 2002 Current Control Projection Inventory is an estimation of VOC and NOx emissions that will occur in 2002, if no new emission control measures are implemented between 1990 and 2002. The difference between the 2002 Current Control Projection Inventory and the 2002 Target Level of Emissions (discussed in Part I of this plan), is the total amount of emissions that Delaware must plan to reduce in order to meet the 9 percent VOC reduction requirement for the 1999-2002 period. This part of the 2002 RPP contains a detailed discussion of how the total VOC and NOx emission reductions are determined.

2.1 The 2002 Current Control Projection Inventory Summary

The 2002 Current Control Projection Inventory of VOC and NOx emissions for Kent and New Castle Counties is summarized in Tables 9 for VOC and Table 10 for NOx. Also included in these tables, for comparison purposes, are the 1990 Baseline Inventory emissions from individual source sectors. The 1990 data presented in Tables 9 and 10 are obtained from Table 2. The Current Control Projection and Baseline VOC and NOx emission data are shown graphically in Figures 4 and 5, respectively. Figure 6 shows the relative proportions of VOC and NOx emissions for each source sector in the 2002 Current Control Projection Inventory for the entire severe nonattainment area (NAA) in Delaware. Figures 7 and 8 respectively show the 2002 Current Control Projection Inventory VOC and NOx emissions by county.

The point, stationary area, and off-road mobile source portions of the 2002 Current Control Projection Inventory are essentially created by multiplying 1990 Baseline Inventory emission levels by the appropriate growth factors. The on-road mobile source emissions are projected by multiplying emission factors generated from the MOBILE5a software by the projected 2002 vehicle miles traveled (VMT), as explained in Section 2.3 in the 2002 RPP.

Table 9
Summary of VOC Emissions in 2002 Current Control Projection Inventory (in TPD)

Source Sector	Kent County		New Castle		Total NAA	
	1990*	2002	1990*	2002	1990*	2002
	Baseline	Projection	Baseline	Projection	Baseline	Projection
Point	3.242	3.361	26.938	27.914	30.180	31.275
Stationary Area	12.779	13.762	34.366	37.227	47.145	50.989
Off-Road Mobile	3.494	4.093	16.674	18.170	20.168	22.263
On-Road Mobile	13.070	16.500	35.280	44.250	48.350	60.750
Total Emissions	**32.585**	**37.716**	**113.258**	**127.561**	**145.843**	**165.277**

* 1990 Baseline Inventory data are obtained from Table 2.

Table 10
Summary of NOx Emissions in 2002 Current Control Projection Inventory (in TPD)

Source Sector	Kent County		New Castle		Total NAA	
	1990*	2002	1990*	2002	1990*	2002
	Baseline	Projection	Baseline	Projection	Baseline	Projection
Point	6.130	6.989	85.767	94.840	91.897	101.829
Stationary Area	1.202	1.347	5.398	6.036	6.600	7.383
Off-Road Mobile	7.891	9.024	18.777	21.175	26.668	30.199
On-Road Mobile	10.620	13.180	27.060	34.290	37.680	47.470
Total Emissions	**25.843**	**30.540**	**137.002**	**156.341**	**162.845**	**186.881**

* 1990 Baseline Inventory data are obtained from Table 2.

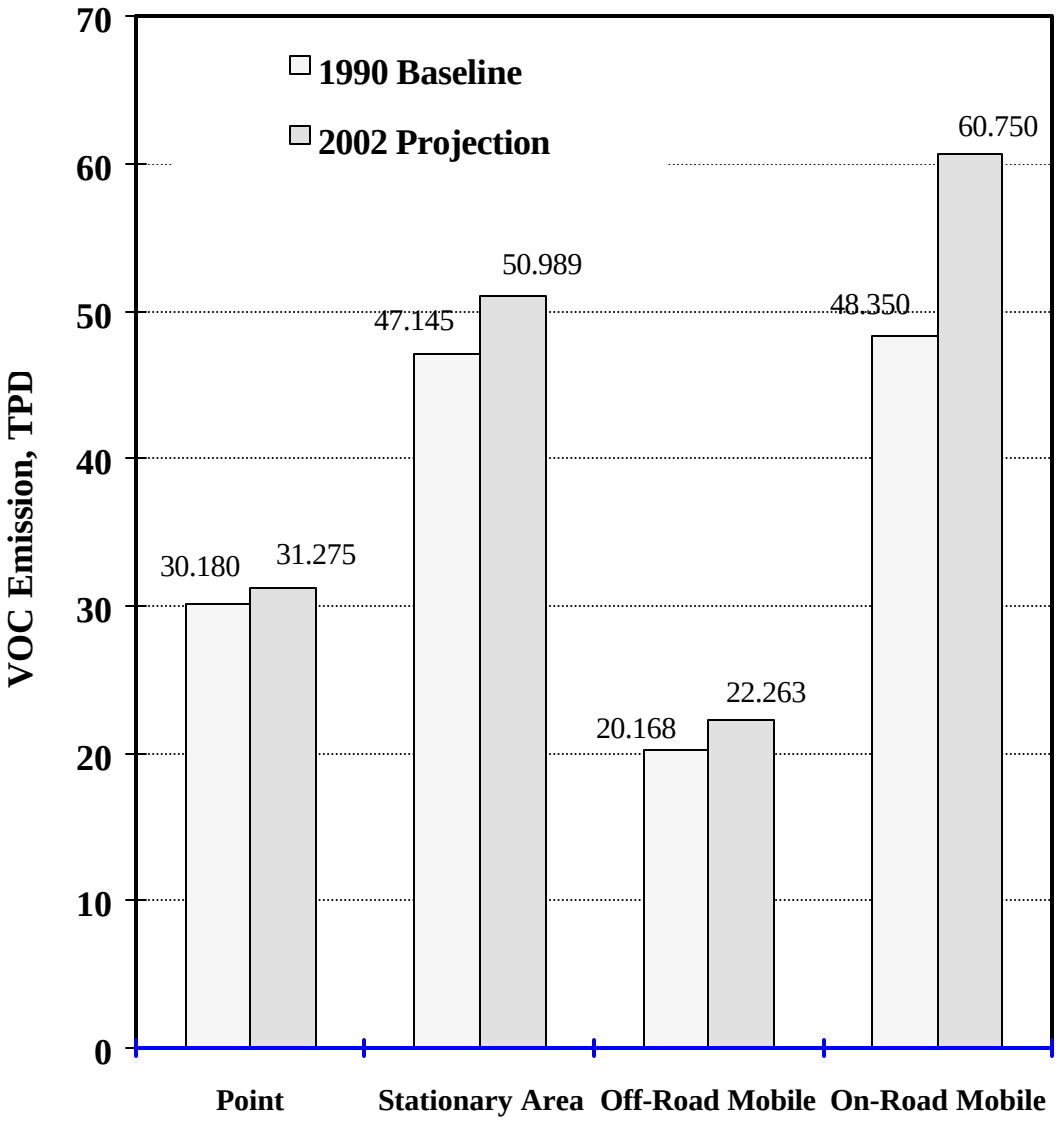


Figure 4. Comparison of VOC Emissions in 2002 Current Control Projection Inventory And 1990 Baseline Inventory

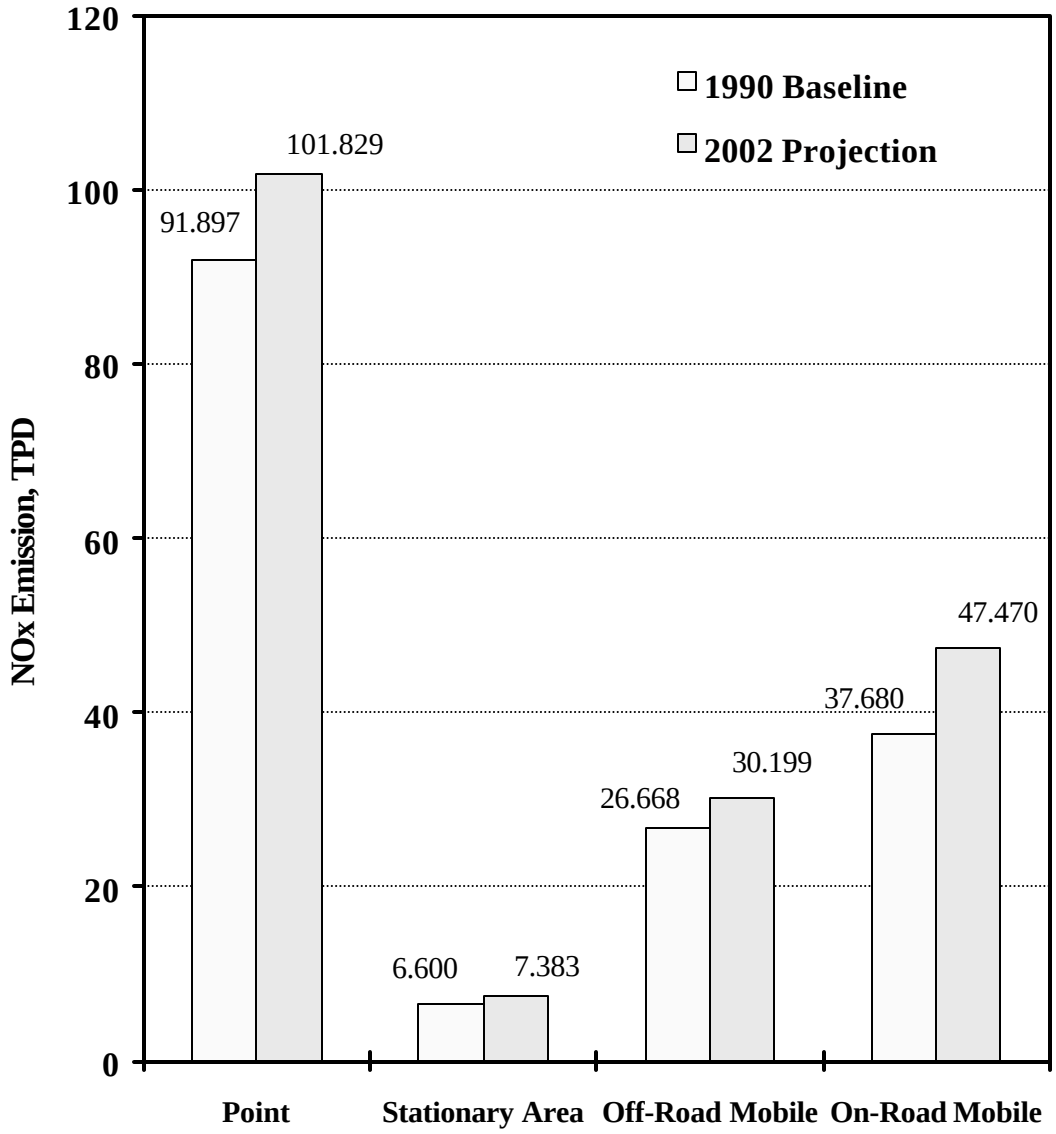


Figure 5. Comparison of NOx Emissions in 2002 Current Control Projection Inventory And 1990 Baseline Inventory

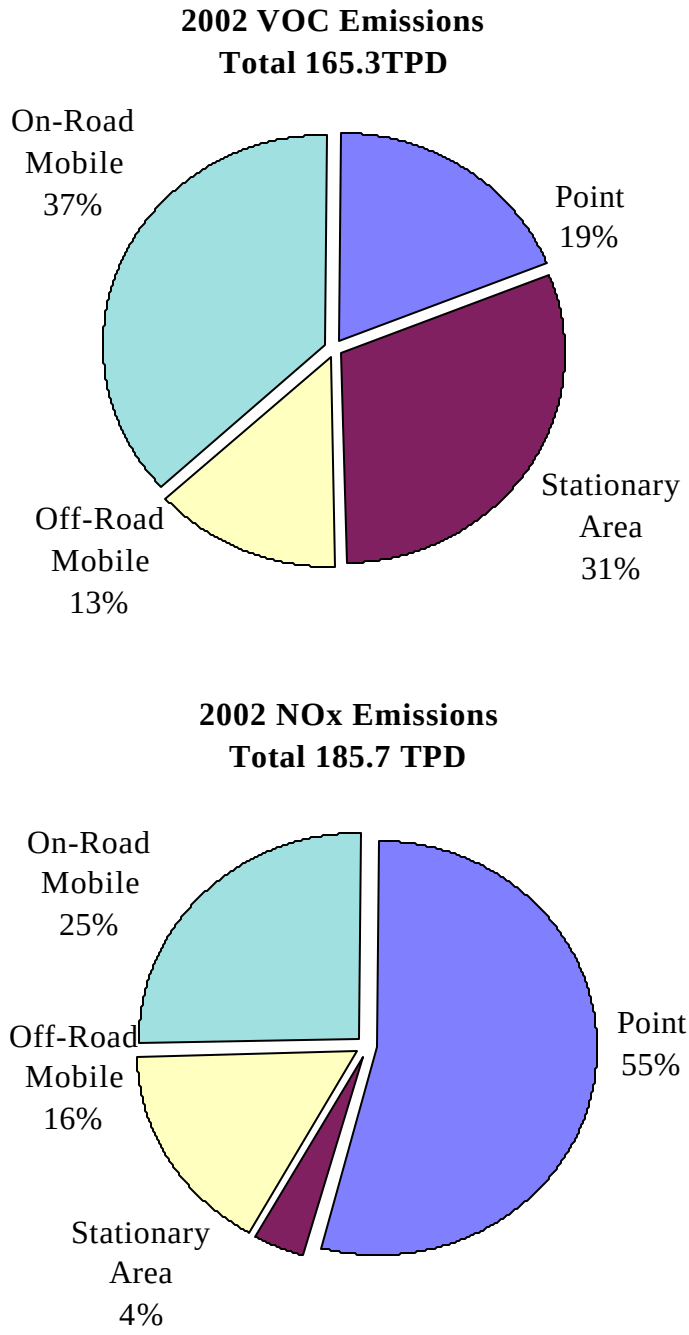
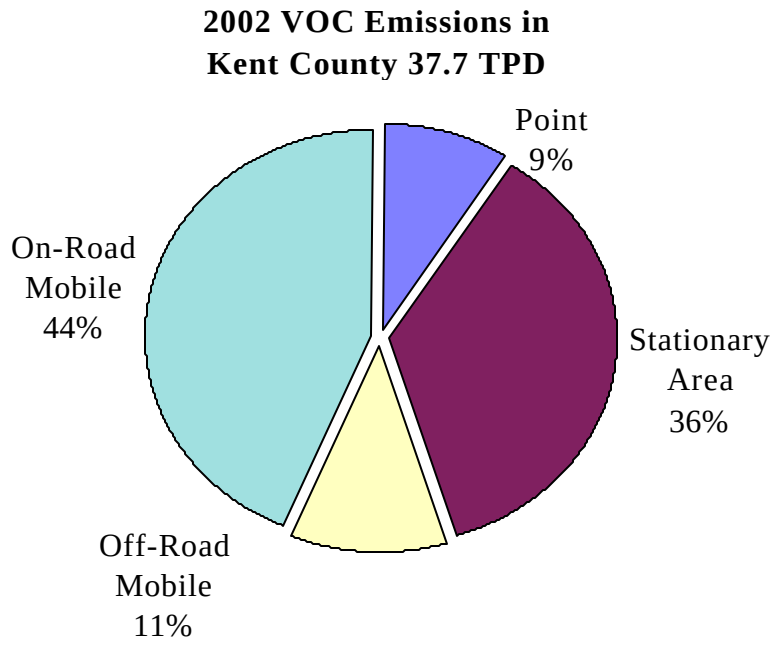


Figure 6. Total 2002 Current Control Projection Inventory VOC and NOx Emissions By Source Sector



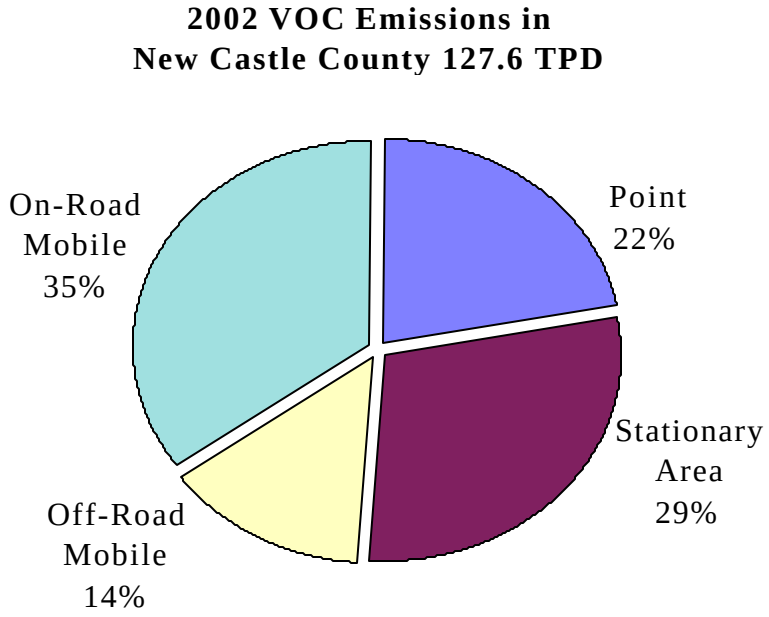
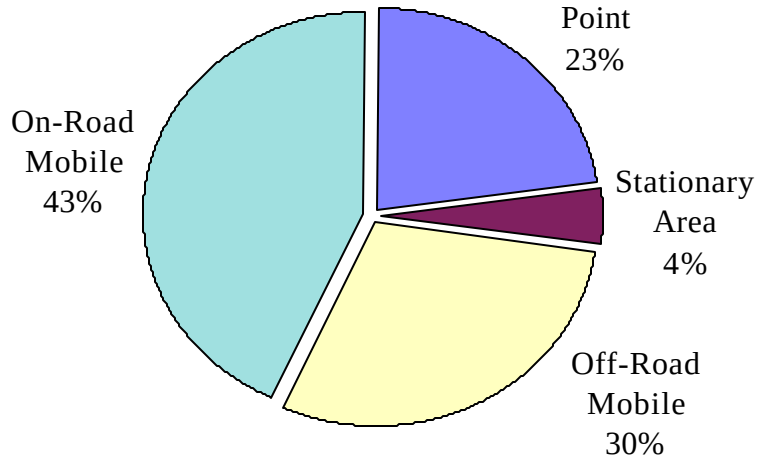


Figure 7. Total 2002 Current Control Projection Inventory VOC Emissions By County and Source Sector

2002 NOx Emissions in
Kent County 30.1 TPD



2002 NOx Emissions in
New Castle County 155.4 TPD

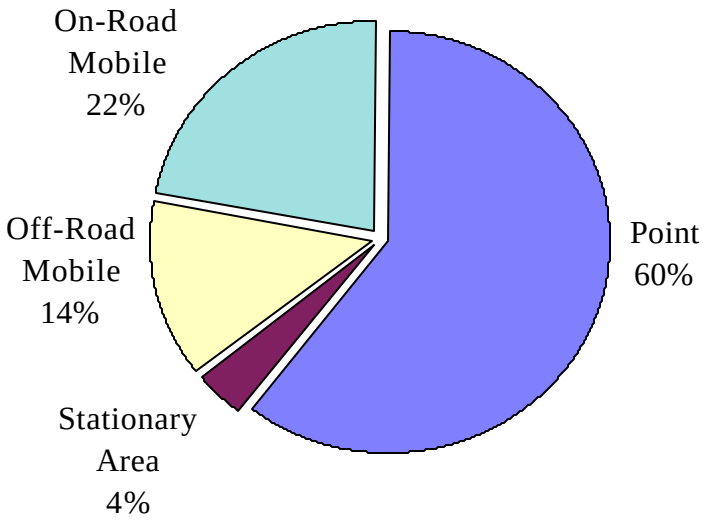


Figure 8. Total 2002 Current Control Projection Inventory NOx Emissions By County and Source Sector

2.2 Calculation of Total Required VOC and NOx Emissions Reductions

According to the rate-of-progress provisions in the CAAA, Delaware's 2002 RPP for the severe nonattainment area (i.e., Kent and New Castle Counties) is required not only to achieve a 9% of the 1990 baseline from the 1999 targets, but also to offset any growth in emissions between 1999 and 2002. In other words, the total emission reductions for meeting the adequate rate of progress consist of two components: (1) any growth in emissions occurring between 1999 and 2002 that must be offset, plus (2) the average 3% per year emission reductions for the 1999-2002 period.

2.2.1. Determination of Growth in Emissions for the 1999-2002 Period

The growth in emissions for the 1999-2002 period can be obtained from the current control projections of 1999 and 2002. The 2002 current control projections for VOC and NOx emissions are presented in Tables 9 and 10, respectively. The 1999 current control projection inventories of VOC and NOx emissions can be obtained from Delaware's 1999 Rate-of-Progress Plan, as amended in June 1999 (References 6 and 7). For comparison purpose, the 1999 Current Control Projection Inventories are summarized in Tables 11 and 12 for VOC and NOx emissions, respectively.

Table 11
Summary of 1999 Current Control Projection Inventory VOC Emissions (in TPD)

Source Sector	Kent County		New Castle County		Total NAA	
	1990 VOC Baseline	1999 VOC Projection	1990 VOC Baseline	1999 VOC Projection	1990 VOC Baseline	1999 VOC Projection
Point	3.242	3.267	26.938	27.194	30.180	30.461
Stationary Area	12.779	13.473	34.366	36.482	47.145	49.955
Off-Road Mobile	3.494	3.923	16.674	17.699	20.168	21.622
On-Road Mobile	13.070	15.460	35.280	42.240	48.350	57.700
Total Emissions	32.585	36.123	113.258	123.615	145.843	159.738

Table 12
Summary of 1999 Current Control Projection Inventory NOx Emissions (in TPD)

Source Sector	Kent County		New Castle County		Total NAA	
	1990 NOx Baseline	1999 NOx Projection	1990 NOx Baseline	1999 NOx Projection	1990 NOx Baseline	1999 NOx Projection
Point	6.130	6.538	85.767	96.693	91.897	103.231
Stationary Area	1.202	1.311	5.398	5.893	6.600	7.204
Off-Road Mobile	7.891	8.555	18.777	19.919	26.668	28.474
On-Road Mobile	10.620	12.570	27.060	32.580	37.680	45.150
Total Emissions	25.843	28.974	137.002	155.085	162.845	184.059

The growth in emissions is determined by subtracting the 1999 current control projections from the 2002 current control projections. A summary of the growths in VOC and NOx emissions for the 1999-2002 period is presented in Table 13. As indicated in Table 13, a growth of 5.539 TPD in VOC emissions and a growth of 2.822 TPD in NOx emissions for the 1999-2002 period must be offset in Delaware's nonattainment area.

Table 13
Summary of Emission Growths between 1999 and 2002 (in TPD)

	Growth in VOC Emissions			Growth in NOx Emissions*		
Source Sector	**Kent**	**New Castle**	**Total NAA**	**Kent**	**New Castle**	**Total NAA**
Point	0.094	0.720	0.814	0.451	-1.853	-1.402
Stationary Area	0.289	0.745	1.034	0.036	0.143	0.179
Off-Road Mobile	0.170	0.471	0.641	0.469	1.256	1.725
On-Road Mobile	1.040	2.010	3.050	0.610	1.710	2.320
Total Emissions	1.593	3.946	5.539	1.566	1.256	2.822

* The minus sign (-) indicates decline instead of growth.

2.2.2. Determination of VOC and NOx Emission Reductions for the 1999-2002 Period

In its 1999 Rate-of-Progress Plan, as amended in June 1999 (Reference 7), Delaware has determined its 1999 emission target levels of 110.206 TPD for VOC and 148.964 TPD for NOx. In Part I of this 2002 RPP, it has been determined that the total nonattainment area (i.e., Kent and New Castle Counties) have to meet a target level of 101.139 TPD for VOC emissions and a target level of 143.595 TPD for NOx emissions. The VOC and NOx emission reductions required to meet the 2002 target levels can be determined as follows:

VOC Reduction Without Growth = 1999 Target Level - 2002 Target Level

= 110.206 – 101.139 = 9.067 TPD

Total VOC Reduction Required beyond the 1999 RPP Target Level

= Emission Growth + Reduction Without Growth

= 5.539 + 9.067 **= 14.606 TPD**

The total VOC emission reductions of 14.606 TPD, besides the 159.738 - 110.206 = 49.532 TPD of VOC emission reductions required in the previous RPPs, is the additional VOC emission reduction needed to meet the 2002 target level of VOC emissions. In other words, Delaware's 2002 RPP for Kent and New Castle Counties must show a total reduction of 49.532 + 14.606 = 64.138 TPD in VOC emissions from the 2002 Current Control Projections. The same reduction can be calculated by taking the difference of the 2002 Current Control Projection and 2002 Target Level of VOC emissions, as shown below:

Required VOC Reduction for 1990-2002 Period

= 2002 Current Control Projection - 2002 Target Level

= 165.277 – 101.139 = **64.138 TPD**

The required NOx emission reductions can be determined using similar procedures:

NOx Reduction Without Growth = 1999 Target Level - 2002 Target Level
= 148.964 – 143.595 = 5.369 TPD

Total Required NOx Reduction beyond 1999 RPP Target Level
= Emission Growth + Reduction Without Growth
= 2.822 + 5.369 **= 8.191 TPD**

The total NOx emission reductions of 8.191 TPD, besides the 184.059 - 148.964 = 35.095 TPD reductions to satisfy the 1999 RPP requirements, is the additional NOx reductions needed to meet the 2002 target level of NOx emissions. In other words, the total nonattainment area of Kent and New Castle Counties must show a total NOx emission reduction of 35.095 + 8.191 = 43.286 TPD from the 2002 Current Control Projection of VOC emissions. The same reduction can be obtained by taking the difference of the 2002 Current Control Projection and 2002 Target Level of NOx emissions as shown below:

Required NOx Reduction for 1990-2002 Period
= 2002 Current Control Projection - 2002 Target Level
= 186.881 – 143.595= **43.286 TPD**

A summary of the required VOC and NOx emission reductions is presented in Table 14. These required reductions form the basis on which Delaware develops its emission control strategies in this rate-of-progress plan.

Table 14
VOC and NOx Emission Reductions Required in the 2002 RPP (in TPD)

VOC Emissions			**NOx Emissions**		
Target Level	Current Control Projection	Required Reduction	Target Level	Current Control Projection	Required Reduction
101.139	165.277	64.138	143.595	186.881	43.286

PART III

THE 2002 CONTROL STRATEGY PROJECTION INVENTORY AND EMISSION CONTROL MEASURES

In Part I, Delaware has determined its VOC and NOx emission targets in the milestone year of 2002 to meet the average 3% per year rate-of-progress requirement, plus offsetting the emission growth. In Part II, Delaware has determined that, in order to meet those emission targets, a 64.138 TPD VOC emission reduction and a 43.286 TPD emission reduction must be achieved in this 2002 Rate-of-Progress Plan for Kent and New Castle Counties. These emission reductions will be accomplished by implementation of VOC emission control measures proposed in the 15% RPP, VOC and NOx emission controls in the 1999 RPP and additional national, regional and state control measures necessary for further VOC and NOx emission reductions. In order to show that the reductions associated with these control measures are adequate to meet the 2002 VOC and NOx emission targets, the 1990 Baseline emissions are projected to 2002 including the effects of both growth and the new control measures. The resulting inventory is called **the 2002 Control Strategy Projection Inventory.** The total VOC and NOx emissions in the 2002 Control Strategy Projection Inventory must be equal to or less than the 2002 target levels of VOC and NOx emissions in order to show that the control measures are adequate for fulfilling the rate-of-progress requirements of VOC and NOx emission reductions.

The 2002 target levels of VOC and NOx emissions have been calculated in Part I to be 101.139 TPD and 143.595 TPD, respectively. Part III of the 2002 RPP discusses the 1999 Control Strategy Projection Inventory, the control measures that Delaware will implement to meet the average 3% per year rate-of-progress requirement for the 1999-2002 period, the sources affected by these control measures, and the expected reductions from each control measure.

3.1 The 2002 Control Strategy Projection Inventory Summary

The 2002 Control Strategy Projection Inventory is summarized in Tables 15 and 16 for VOC and NOx emissions, respectively. As shown in Tables 15 and 16, the total 2002 Control Strategy Projections for VOC and NOx emissions are 101.139 TPD and 142.077 TPD, respectively, in the peak ozone season. The 2002 Control Strategy Projection of VOC emissions is the same as the target level, and the total 2002 Control Strategy Projection of NOx emissions is less than the required target level of 143.595 TPD. Therefore, the control measures that are included in the 2002 RPP are considered to be adequate for meeting the average 3% per year rate-of-progress requirement, plus offsetting the emission growth for the 1999-2002 period.

Figure 9 shows a graphic comparison by source sector of the 1990 Baseline Inventory (from Part I), the 2002 Current Control Projections (from Part II), and the 2002 Control Strategy Projections (from Table 15) for VOC emissions. Figure 10 shows the relative proportions of the 2002 Control Strategy Projections of VOC emissions from each source sector for the entire nonattainment area. Figure 11 shows the relative proportions of the 2002 Control Strategy Projections of VOC emissions by county.

Table 15
Summary of 2002 Control Strategy Projection Inventory VOC Emissions (in TPD)

Source Sector	Kent County	New Castle County	Total NAA
Point	1.392	21.923	23.315
Stationary Area	9.981	26.693	36.674
Off-Road Mobile	2.864	13.546	16.410
On-Road Mobile	6.300	18.440	24.740
Total Emissions	**20.537**	**80.602**	**101.139**

Table 16
Summary of 2002 Control Strategy Projection Inventory NOx Emissions (in TPD)

Source Sector	Kent	New Castle	Total NAA
Point	5.040	67.252	72.292
Stationary Area	0.985	4.839	5.824
Off-Road Mobile	8.175	18.686	26.861
On-Road Mobile	9.810	27.290	37.100
Total Emissions	**24.010**	**118.067**	**142.077**

Figure 11 shows a graphic comparison by source sector of the 1990 Baseline Inventory (from Part I), the 2002 Current Control Projections (from Part II), and the 2002 Control Strategy Projections (from Table 16) for NOx emissions. Figure 12 shows the relative proportions of the 2002 Control Strategy Projections of NOx emissions from each source sector for the entire nonattainment area. Figure 13 shows the relative proportions of the 2002 Control Strategy Projections of NOx emissions by county.

The 2002 Control Strategy Projections for point sources, stationary area sources, and off-road mobile sources are calculated primarily using the projection equations provided in the *Guidance for Growth Factors, Projections, and Control Strategies for the 15 Percent Rate-of-Progress Plans*, EPA-452/R-93-002, Office of Air Quality Planning and Standards, US EPA, March 1993 (Reference 13, hereafter referred to as the *Guidance for Growth/Projections/Strategies*). Other equations are also used for some specific cases. These equations are either obtained from other EPA guidance documents or derived from emission-related data provided by EPA. The control strategy projections of the on-road mobile sources are developed using EPA's MOBILE5a software in accordance with *Procedures for Preparing Emissions Projections*, EPA-450/4-91-019, Office of Air Quality Planning and Standards, US EPA, July 1991 (Reference 12, hereafter referred to as *Procedures for Emission Projections*).

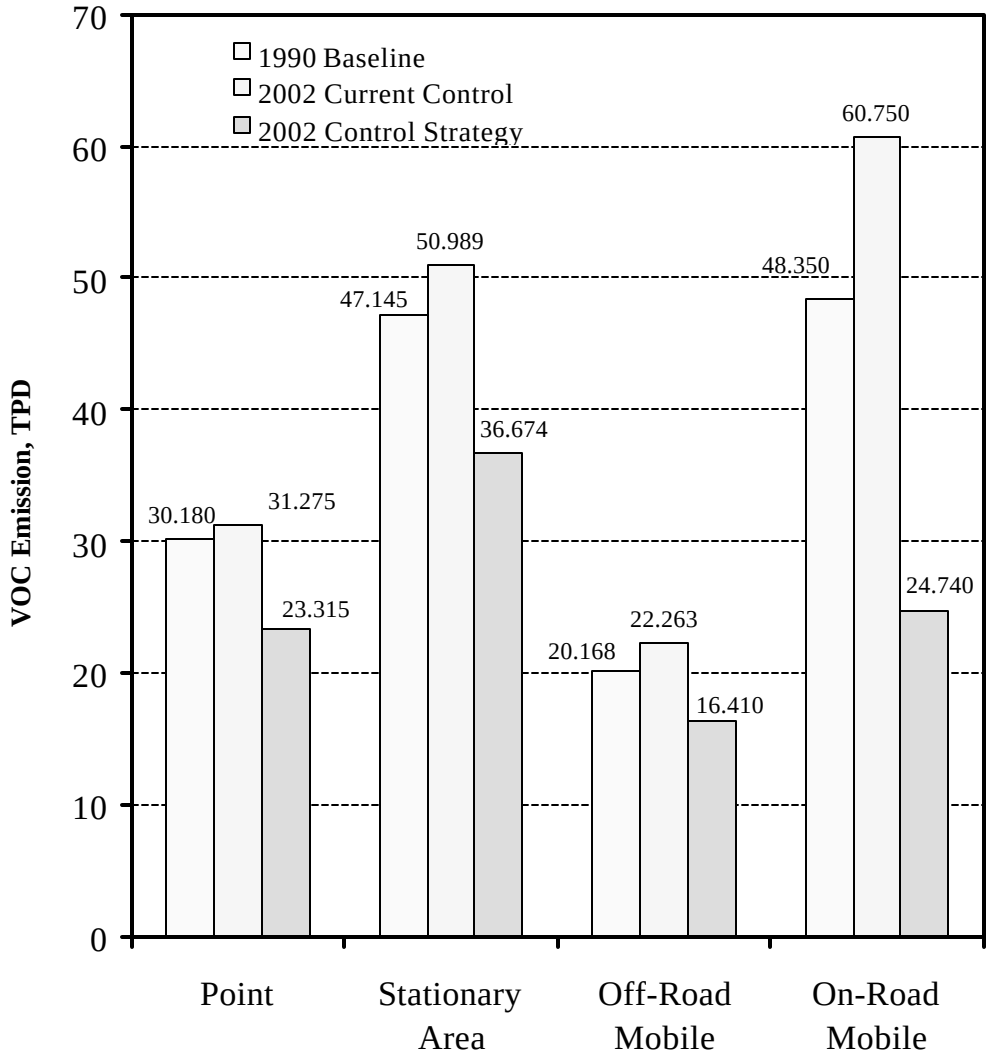


Figure 9. Comparison of VOC Emissions in 1990 Baseline, 2002 Current Control And 2002 Control Strategy Projection Inventories

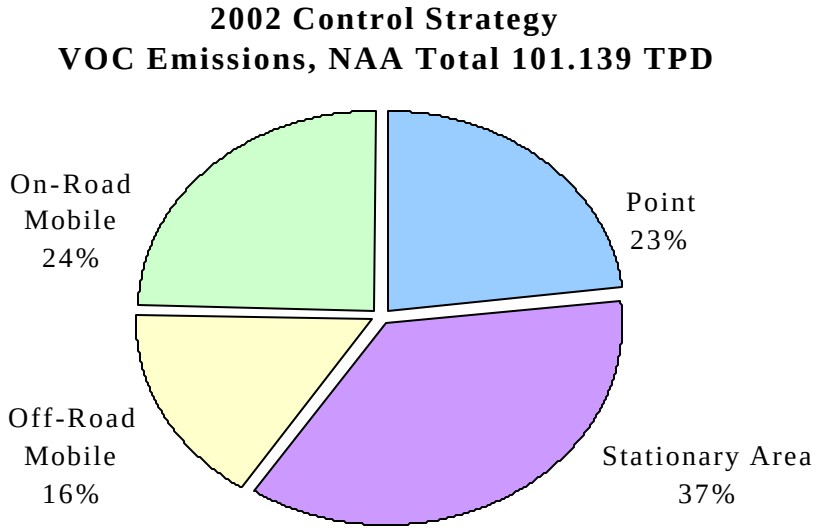


Figure 10. Contribution of Each Source Sector to Total 2002 VOC Control Strategy Projection in Delaware's Nonattainment Area (NAA).

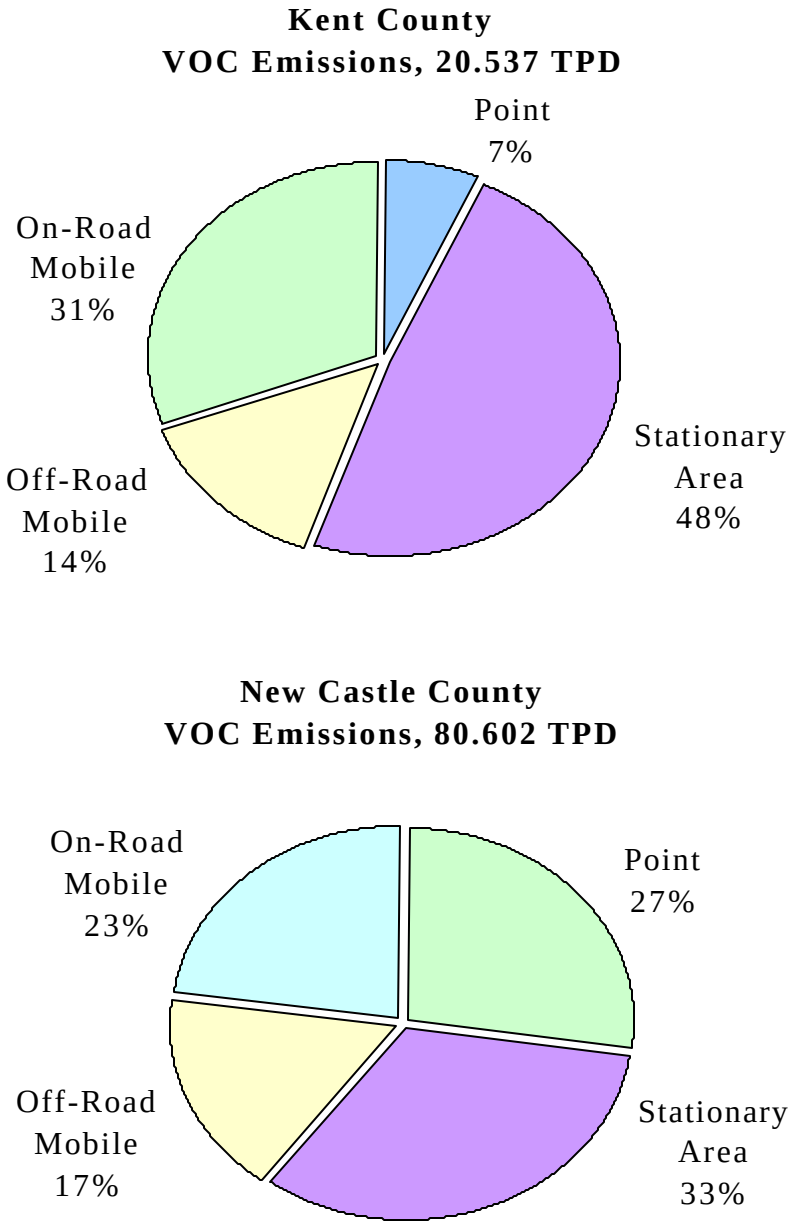


Figure 11. Contribution of Each Source Sector to 2002 VOC Control Strategy Projection in Each Nonattainment County.

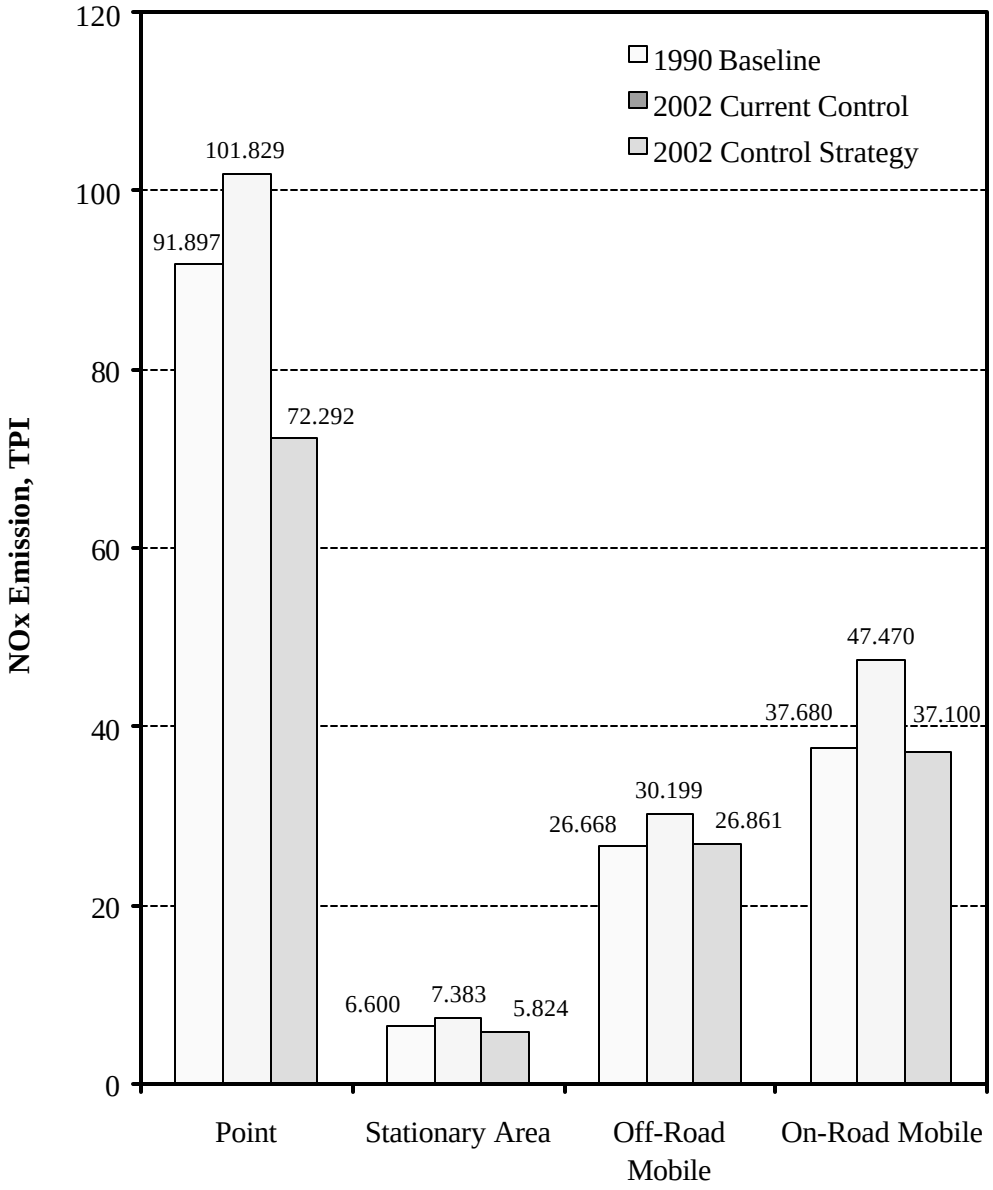


Figure 12. Comparison of NOx Emissions in 1990 Baseline, 2002 Current Control And 2002 Control Strategy Projection Inventories

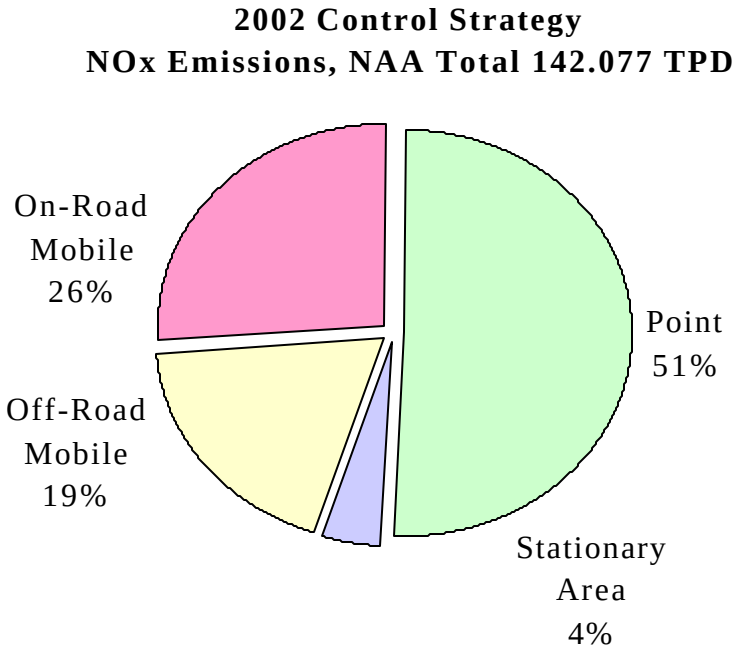
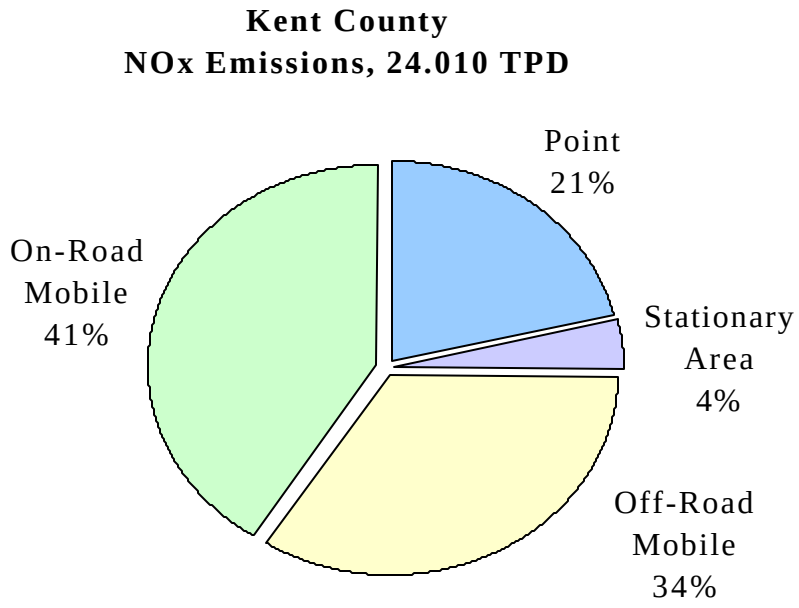


Figure 13. Contribution of Each Source Sector to Total 2002 Control Strategy Projection NOx Emissions in Delaware's Nonattainment Area (NAA).



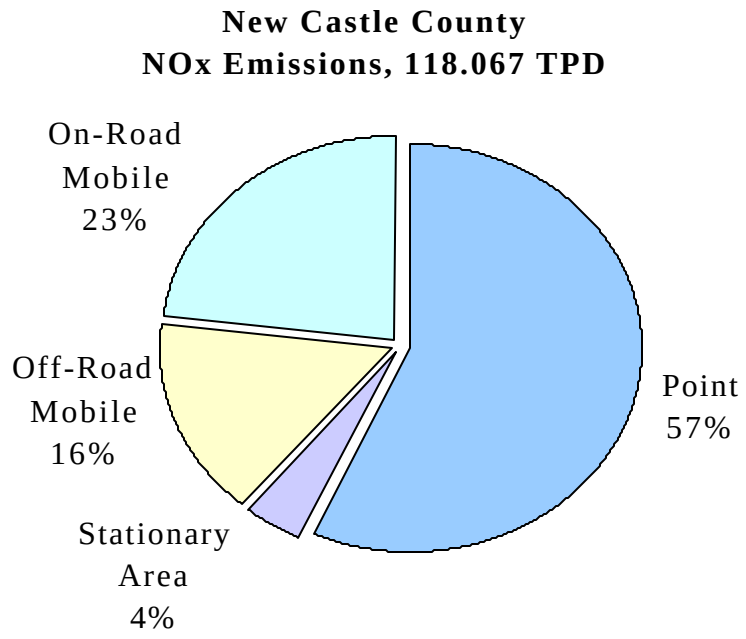


Figure 14. Contribution of Each Source Sector to 2002 Control Strategy Projection NOx Emissions in Each Nonattainment County.

3.2 Point Source 2002 Control Strategy Projection Methodology

Emissions from point sources are projected on a source-specific (process-by-process) basis in accordance with the *Guidance for Growth/Projections/Strategies* (Reference 13). In this guidance document and its following memoranda for amendments and corrections, EPA provides methods and projection equations for estimating future year emissions from individual point sources. Selection of method or equation to be used to project emissions from a point source is dependent on whether or not the source will have new controls by the milestone year of 2002.

A. Method 1

The VOC and NOx emissions for point sources that will have new controls by 2002 are projected at allowable emissions rates using the point source projection equations from Section 6.4 of the *Guidance for Growth/Projections/Strategie*s. These same equations have been used to determine the 2002 Current Control Projections in Part II of this Plan. However, the projection data used for the 2002 Control Strategy Projections differ from those used for the 2002 Current Control Projections. For the control strategy projections, the controlled emissions factors, process control efficiencies (*CE*), controlled emissions rates, and rule effectiveness (*RE*) values for the processes with new controls by 2002 are used to reflect the controls that will be in place in 2002. For the current control projections in Part II, all parameters are related to controls, if any, that were in place in 1990.

For sources that will have new controls by 2002, the Control Strategy Projections are determined using one of the following five projection equations (Reference 13):

$$EMIS_{py} = ORATE \times EMF_{py,pc} \times \left[1 - \frac{CE_{py}}{100} \times \frac{RE_{py}}{100}\right] \times GF_{py} \qquad \text{(P-1)}$$

$$EMIS_{py} = ORATE \times EMF_{py} \times \frac{200 - RE_{py}}{100} \times GF_{py} \qquad \text{(P-2)}$$

$$EMIS_{py} = CRTPOL \times \frac{1 - \frac{CE_{py}}{100} \times \frac{RE_{py}}{100}}{1 - \frac{CEQEFF}{100} \times \frac{RULEFF}{100}} \times GF_{py} \qquad \text{(P-3)}$$

$$EMIS_{py} = CRTPOL \times \frac{\frac{200 - RE_{py}}{100}}{\frac{200 - RULEFF}{100}} \times \frac{EMF_{py}}{EMF_{by}} \times GF_{py} \qquad \text{(P-4)}$$

$$EMIS_{py} = ER_{py} \times \frac{CRTPOL}{EMIS_{bya}} \times \frac{200 - RE_{py}}{100} \qquad \text{(P-5)}$$

where:

$EMIS_{py}$	= Projection Year Emissions (Tons per Peak Ozone Season Day);
$ORATE$	=1990 Base Year Ozone Season Operating Rate (Production Units/Day);
$EMF_{py,pc}$	= Projection Year Pre-control Emissions Factor (Mass of Pollutant/Production Unit);
CE_{py}	= Projection Year Control Efficiency (Percent);
RE_{py}	= Projection Year Rule Effectiveness (Percent);
GF_{py}	= Projection Year Growth Factor (Dimensionless);
EMF_{py}	= Projection Year Post-control Emissions Factor (Mass of Pollutant/Production Unit);
$CRTPOL$	= 1990 Baseline Ozone Season Actual Emissions (Tons Per Peak Ozone Season Day);
$CEQEFF$	= 1990 Base Year Control Efficiency (Percent);
$RULEFF$	= 1990 Base Year Rule Effectiveness (Percent);
EMF_{by}	= 1990 Base Year Emissions Factor ;
ER_{py}	= Projection Year Annual Emissions Cap (Mass of Pollutant/Year);
$EMIS_{bya}$	= 1990 Base Year Annual Emissions (Tons Per Year).

Depending on the method that is used to estimate the 1990 Baseline emissions and the type of projection year control data available, one of these five equations is used to project emissions from each process that will have new controls by 2002. Equation P-1 is used when the 1990 baseline emissions are calculated using a pre-control emission factor, and a control efficiency is used to factor the control measure into the emissions estimation. Equation P-2 is used when emissions are calculated using a post-control emissions factor; that is, the emissions factor accounts for the affect of the control measure on emissions. Equation P-3 is used when 1990 baseline emissions are calculated by material balance or test data, and a control efficiency is used to factor the control measure into the emissions estimation. Equation P-4 is used when 1990 baseline emissions are calculated by material balance or test data, and the control level is represented by an emissions factor rather than by a control efficiency. Equation P-5 is used when permit limits or emission caps are used to represent the effect of the control measures on emissions. This equation is originally presented in the aforementioned EPA's document and recently amended by EPA in a guidance memorandum[12]. According to this memorandum, the term ER_{py} can be an emission cap on other than an annual basis, and then the term $EMIS_{bya}$ should be modified to reflect the same time period.

[12] Memorandum: Correction Errata to 15 Percent Rate of Progress Guidance Document. G.T. Helms, Group Leader, Ozone Policy and Strategies Group, Office of Air Quality Planning and Standards, US EPA, Research Triangle Park, NC, March 17, 1999. The memorandum is included in Appendix I.

Delaware has compiled the 2002 control data for point sources from Federal and State regulations and air emissions permits that have been issued in the post-1990 time frame. The required emission and control data are inserted into the appropriate projection equation for each process. Wherever applicable, a default RE value of 80% for the projection year is used, as suggested by EPA (Reference 14). The calculation results from these equations, which include the effects of both emission growth and new controls, are the 2002 Control Strategy Projections of emissions from individual processes.

The following is an example of control strategy projection calculation for a point source process that will have new controls by 2002.

Example Point Source Emission Projection Calculation:
The Delaware Regulations Governing Solid Waste have been revised in 1990 to include requirements for installation of gas control systems at all sanitary landfills. Control efficiencies for each affected landfill are determined based on design data for the proposed gas control systems. For the Cherry Island facility located in New Castle County, a control device efficiency (flare efficiency) of 98% and a capture efficiency of 51.49% are used to project the VOC emissions. The overall control efficiency for the Cherry Island landfill is:

Overall Control Efficiency CE_{2002}= 0.98 x 51.49 = 50.46%

Other projection data for the Cherry Island landfill are:

CRTPOL	= 0.268 TPD in the peak ozone season;
RE_{2002}	= 80%;
CEQEFF	= 0%;
RULEFF	= 0%;
GF_{2002}	= 1.09.

Using Equation P-3, the 2002 projected VOC emissions value for the Cherry Island landfill with the addition of new controls can be calculated as:

$$EMIS_{2002} = 0.268 \times \frac{1 - \frac{50.46}{100} \times \frac{80}{100}}{1 - \frac{0}{100} \times \frac{0}{100}} \times 1.09 = 0.174 TPD$$

B. Method 2

All sources that will not have new controls by 2002 are projected by multiplying their 1990 baseline emissions with the appropriate growth factors, that is,

$$EMIS_{py} = CRTPOL \times GF_{py} \qquad \text{(P-6)}$$

Therefore, for sources that will not have new controls by 2002, the 2002 Control Strategy

Projection emissions are equal to the 2002 Current Control Projection emissions that are determined in Part II of the 2002 RPP.

A summary of the 2002 Control Strategy Projections for point source emissions is presented in Table 17.

Table 17
2002 Control Strategy Projections for Point Source Emissions (in TPD)

Source		Kent		New Castle	
SIC	Category Name	VOC	NOx	VOC	NOx
16	Construction	0.060	0.078	0.022	0.028
20	Food Manufacturing	0.030	0.060	0.000	0.000
22	Textiles	0.000	0.000	0.883	0.087
25	Furniture and Fixtures	0.502	0.010	0.000	0.000
26	Paper Manufacturing	0.030	0.085	0.260	0.146
28	Chemicals & Allied Products	0.197	0.055	6.313	3.653
2911	Petroleum Refining	0.000	0.000	4.337	47.714
2951	Asphalt Paving Mixtures	0.000	0.000	0.022	0.028
30	Rubber/Plastic Manufacturing	0.000	0.000	0.974	0.003
33	Primary Metal Industry	0.047	0.000	0.000	0.000
34	Fabricated Metal Products	0.000	0.000	0.077	0.000
37	Transportation Equipment	0.000	0.000	7.014	0.653
38	Measr./Analyz/Control Instrumentation	0.053	0.000	0.000	0.000
42	Motor Freight Transportation	0.000	0.000	0.031	0.015
46	Pipelines	0.002	0.000	0.000	0.000
4911	Electric Utilities & Generators	0.046	4.660	0.226	14.026
4952	POTWs	0.217	0.000	1.322	0.000
4953	Landfills	0.027	0.000	0.182	0.000
80	Health Services	0.000	0.000	0.010	0.130
82	Educational Services	0.000	0.000	0.000	0.024
87	Engineering, Research	0.000	0.000	0.198	0.744
97	Federal, Civilian Government	0.181	0.092	0.051	0.000
Total Emissions by County		1.392	5.040	21.923	67.252
Total State NAA Emissions		**VOC:**	23.315	**NOx:**	72.292

3.3 Stationary Area and Off-Road Mobile Source 2002 Control Strategy Projection Methodology

Stationary area and off-road mobile source emissions are projected according to the *Guidance for Growth/Projections/Strategies* (Reference 13). The projection method for stationary area and off-

road mobile sources is dependent on whether or not sources will be subject to new controls by 2002. Stationary area and off-road mobile sources that ***will not*** be subject to new controls by 2002 are projected using the following equation:

$$EMIS_{py} = CRTPOL \times GF_{py} \qquad \text{(A-1)}$$

where $EMIS_{py}$ = emission in projection year (TPD in Peak Ozone Season);
$CRTPOL$ = 1990 baseline actual emission (TPD in Peak Ozone Season);
GF_{py} = growth factor for projection year (dimensionless).

For stationary area and off-road mobile sources that are subject to new controls by 2002, the 2002 Control Strategy Projections are determined in a manner similar to the point source 2002 Control Strategy Projections, using projection equations from the *Guidance for Growth/Projections/ Strategies*. The main difference between the point source projections and the stationary area and off-road mobile source projections is that point source emissions are projected on a process-by-process basis as described previously, while stationary area and off-road mobile source emissions are projected on a category-wide basis. Therefore, the 2002 Control Strategy Projection Inventory for stationary area and off-road mobile sources is determined using category-wide activity level data versus the process operating data that is used for point source projections.

The stationary area and off-road mobile source projection data reflects 2002 controls and rule effectiveness values. A **rule penetration** value is also factored into the emissions projection. Rule penetration factors are used in conjunction with rule effectiveness (as defined in Part II of this Plan) to adjust regulated stationary area source emissions estimates. **Rule penetration is the portion of an area source category that is affected by a regulation.** If a regulation applies to only a certain percentage of sources within a source category, a rule penetration factor is applied to ensure that the control efficiency and rule effectiveness adjustment affect only the emissions values for those regulated sources, and not the emissions values for the unregulated sources in the category.

1. Stationary Area Sources

In general, stationary area sources that will be subject to new controls by 2002 are projected using the following equation:

$$EMIS_{py} = ACTLEV \times EMF_{py} \times GF_{py} \times \left[N - \frac{CE_{py}}{100} \times \frac{RE_{py}}{100} \times \frac{RP_{py}}{100} \right] \qquad \text{(A-2)}$$

where $EMIS_{py}$ = emissions in projection year (TPD in Peak Ozone Season);
$ACTLEV$ = 1990 baseline activity level (activity units per day in Peak Ozone Season);
EMF_{py} = projection year emissions factor (mass of pollutant per activity unit);
GF_{py} = projection year growth factor (dimensionless);

CE_{py} = projection year control efficiency (percent);
RE_{py} = projection year rule effectiveness (percent);
RP_{py} = projection year rule penetration (Percent);
N = 1 if the future control is accounted for the CE factor, or
= 2 if the future control is accounted for the EMF factor, and in which case, CE should be set equal to 100% (see EPA's memorandum on March 17, 1999, included in Appendix H).

This equation is originally presented in the aforementioned EPA's document and recently amended by EPA in a guidance memorandum (See footnote 12 on page 37). In cases where the emission factor in a projection year (EMF_{py}) is equal to the 1990 baseline emission factor (EMF_{by}), the corresponding 1990 baseline emission ($CRTPOL$) can be used in Eq. (A-2) to replace the 1990 baseline activity level ($ACTLEV$) and the projection year emissions factor (EMF_{py}). This is because when $EMF_{py} = EMF_{by}$, $CRTPOL$ is equal to $ACTLEV$ times EMF_{py} in Eq. (A-2). Then, Eq. (A-2) becomes

$$EMIS_{py} = CRTPOL \times GF_{py} \times \left[1 - \frac{CE_{py}}{100} \times \frac{RE_{py}}{100} \times \frac{RP_{py}}{100}\right] \qquad \text{(A-2b)}$$

For gasoline dispensing facilities that will be subject to the Stage II vapor recovery controls, the projection equation differs slightly due to the nature of the projection year emission factor for Stage II vapor recovery. The projection year emission factor for Stage II Vapor Recovery is produced by modeling using EPA's MOBILE5a software on the basis of the state-specific motor vehicle input parameters. This emissions factor has already included the effects of the control efficiency, rule effectiveness, and rule penetration in the projection year. Therefore, the term $\frac{CE_{py}}{100} \times \frac{RE_{py}}{100} \times \frac{RP_{py}}{100}$ in Eq. (A-2) is not required for emission projections for those sources with the Stage II Vapor Recovery controls. Thus, for projecting emissions from sources affected by Stage II Vapor Recovery, Eq.(A-2) becomes:

$$EMIS_{py} = ACTLEV \times EMF_{py} \times CF \times GF_{py} \qquad \text{(A-3)}$$

where $EMIS_{py}$ = emission in projection year (TPD in Peak Ozone Season);
$ACTLEV$ = 1990 baseline activity level (gallons gasoline per day in Peak Ozone Season);
EMF_{py} = emissions factor in projection year from MOBILE5a (grams VOC per gallon gasoline);
CF = Conversion Factor (grams/gallon to tons/gallon);
GF_{py} = Growth Factor for projection year.

The following is a calculation example of 2002 Control Strategy Projection for a stationary area source category that will have new controls by 2002.

Example of Projection Calculation for Stationary Area Source

Section 34 of Delaware Air Regulation 24 prohibits the manufacture, mixing, storage, use, and application of cutback asphalt during the ozone season. The 2002 projected VOC emissions from cutback asphalt for Kent County can be determined using stationary area source projection Eq. (A-2) (or A-2b). The projection data for cutback asphalt emissions in Kent County are:

$ACTLEV$ = 45 tons asphalt/yr or 0.173 tons asphalt/day in Peak Ozone Season;
EMF_{2002} = EMF_{1990} = 420 lbs VOC/ton asphalt;
CE_{2002} = 100%;
RE_{2002} = 80%;
RP_{2002} = 100%;
GF_{2002} = 0.90.

The control efficiency and rule penetration are determined to be 100% from Section 34 of Regulation 24. The EPA's default 80% value is used for the projection year rule effectiveness. Using Equation A-2, the projected VOC emission is:

$$EMIS_{2002} = 0.173 \times 420 \times 0.90 \times \left[1 - \frac{100}{100} \times \frac{80}{100} \times \frac{100}{100}\right] \times \frac{1 ton}{2000 lbs} = 0.007 TPD$$

A summary of the 2002 Control Strategy Projections for stationary area source emissions is presented in Table 18.

2. Off-Road Mobile Sources - Using Reformulated Gasoline

Using reformulated fuel is one of the control measures that will affect off-road mobile source emissions by 2002. Emissions from off-road mobile sources that will be affected by reformulated fuel are projected using information provided in a memorandum entitled *VOC Emission Benefits for Nonroad Equipment with the Use of Federal Phase 1 Reformulated Gasoline*, dated August 18, 1993, from Phil Lorang, Director, Emission Planning and Strategies Division, Office of Mobile Sources, U.S. Environmental Protection Agency, Ann Arbor, Michigan (included in Appendix K). According to the memorandum, reformulated fuel will affect the exhaust and evaporative VOC emission components of the 2-stroke and 4-stroke engine categories. For Delaware, 86.51% of the VOC emissions from 2-stroke and 4-stroke engines is exhaust and 5.58% is evaporative. The remaining 7.91% of the VOC emissions from 2-stroke and 4-stroke engines is not significantly affected by reformulated fuel. The VOC emissions reduction is estimated to be 3.3% of the exhaust emissions and 3.5% of the evaporative emissions. Therefore, VOC emissions from 2-stroke and 4-stroke engines were projected using the following equation:

Table 18
2002 Control Strategy Projections for Stationary Area Source Emissions (in TPD)

Source		Kent		New Castle	
SCC	Category Name	VOC	NOx	VOC	NOx
2102	Industrial Fuel Consumption	0.007	0.489	0.036	2.880
2103	Commercial/Instit. Fuel Consumption	0.007	0.176	0.033	0.812
2104	Residential Fuel Consumption	0.150	0.172	0.103	0.623
2301	Chemical Manufacturing	0.008	0.000	0.156	0.000
2302	Food and Kindred Products	0.075	0.000	0.299	0.000
2308	Rubber/Plastics Production	0.075	0.000	0.438	0.000
2399	Industrial Processes: NEC	0.093	0.000	0.185	0.000
2401	Surface Coating	2.589	0.000	11.352	0.000
2415	Degreasing	0.721	0.000	2.888	0.000
2420	Dry Cleaning	0.101	0.000	0.207	0.000
2425	Graphic Arts	0.292	0.000	0.005	0.000
2461	Misc. Commercial Solvent Use				
	Pesticide Use	1.135	0.000	1.230	0.000
	Cutback & Emulsified Asphalt	0.013	0.000	0.007	0.000
2465	Misc. Consumer Solvent Use	0.874	0.000	3.404	0.000
2501	Petroleum Product Storage	0.569	0.000	1.824	0.000
2505	Petroleum Product Transport	0.869	0.000	1.822	0.000
2601	On-Site Incineration	0.157	0.036	0.689	0.207
2610	Open Burning	0.475	0.095	1.572	0.314
2660	Leaking Underground Storage Tanks	0.015	0.000	0.012	0.000
2810	Misc. Sources: Other Combustion				
	Structural & Forest Fires	0.103	0.017	0.013	0.003
	Prescribed Burning	0.009	0.000	0.001	0.000
2830	Accidental Releases	1.645	0.000	0.419	0.000
Total Emissions by County		9.981	0.985	26.693	4.839
Total State NAA Emissions		**VOC:**	**36.674**	**NOx:**	**5.824**

$$\begin{aligned} EMIS_{py} &= CRTPOL \times GF_{py} \times [86.51\% \times (1-3.3\%) + 5.58\% \times (1-3.5\%) + 7.91\%] \\ &= CRTPOL \times GF_{py} \times 0.9695 \end{aligned} \quad \text{(A-4)}$$

where $EMIS_{py}$ = emission in projection year (TPD in Peak Ozone Season);
GF_{py} = growth factor for projection year;
$CRTPOL$ = 1990 baseline emissions (TPD in Peak Ozone Season).

3. Off-Road Mobile Sources - New Emissions Standards

The EPA is under court order to promulgate new emissions standards for Heavy-Duty Compression Ignition (CI) or diesel engines, small nonroad Spark Ignition (SI) Engines, and outboard/Inboard Marine Engines. These new standards will result in VOC and/or NOx emission reductions from a wide variety of nonroad engines. In subsection 3.5.3, Delaware presents details of how to project emissions using these new emission standards.

A summary of the 2002 Control Strategy Projections for off-road mobile source emissions is presented in Table 19.

Table 19
2002 Control Strategy Projections for Off-Road Mobile Source Emissions (in TPD)

Source		Kent		New Castle	
SCC	Category Name	VOC	NOx	VOC	NOx
2260	2-Stroke Gasoline Vehicles	0.680	0.047	1.650	0.424
2265	4-Stroke Gasoline Vehicles	0.514	0.033	2.290	0.196
2270	Diesel Vehicles	0.508	3.581	1.076	9.893
2275	Aircraft	0.468	0.593	0.217	0.088
2280	Commercial Marine Vehicles	0.582	3.678	1.077	6.351
2282	Recreational Marine Vessels	0.086	0.009	7.127	0.734
2283	Military Marine Vessels	0.004	0.020	0.007	0.037
2285	Railroads	0.022	0.214	0.102	0.963
Total Emissions by County in 2002		2.864	8.175	13.546	18.686
Total State NAA Emissions in 2002		**VOC:**	**16.410**	**NOx:**	**26.861**

3.4 On-Road Mobile Source 2002 Control Strategy Projection Methodology

The on-road mobile source portion of 2002 Control Strategy Projection Inventory has been determined using the 2002 emission factors generated by MOBILE5a and the 2002 projected vehicle-miles-traveled (VMT) on the 2002 Delaware roadway network. The 2002 VMT projections are determined using the network-based travel-demand models for Kent and New Castle Counties. The 2002 VMT projections and the 1990 VMT projections, both are calculated by the travel-demand models, are used to derive a growth factor for each functional vehicle class. The growth factor is then applied to the 1990 VMT from the Highway Performance Monitoring System (HPMS) data. This methodology provides consistency with the 1990 Base Year Inventory methodology, since they are both based on VMT from HPMT. The on-road mobile source projection inventory has been developed by Vanasse Hangen Brustlin, Inc. (VHB), Watertown, MA, under contract with Delaware Department of Transportation (DelDOT).

A summary of the 2002 Control Strategy Projections for on-road mobile source emissions is presented in Table 20. The emission levels in Table 20 also serve as the on-road mobile source emission budgets for Kent and Newcastle Counties for purposes of meeting the transportation conformity requirements set forth in Section 182 of the CAAA.

Table 20
2002 Control Strategy Projections for On-Road Mobile Source Emissions (in TPD)

County	VOC	NOx
Kent	6.300	9.810
New Castle	18.440	27.290
Total NAA	24.740	37.100

3.5 Emission Control Measures and Emission Reductions

The control measures that Delaware includes in the 2002 RPP are summarized in Table 21 along with implementation dates for individual control measures. The VOC and NOx emission reductions from individual control measures are also listed in the table (in TPD in the peak ozone season). As indicated in Table 21, the total VOC and NOx emission reductions for Delaware's nonattainment area (i.e., Kent and New Castle Counties) for the 2002 RPP are 64.138 TPD and 44.804 TPD, respectively. As calculated in Part II, the emission reductions that Delaware needs to meet the 3% per year rate-of-progress requirement plus offsetting the growth for the 2002 milestone year are 64.138 TPD and 43.286 TPD for VOC and NOx, respectively. Therefore, the control measures listed in Table 3-7 are not only adequate to meet the emission reduction requirements for the 2002 milestone year, but also generate 1.518 TPD of surplus of NOx emission reductions. Delaware decides to use this NOx emission surplus in the contingency plan of the 2002 RPP to meet the contingency requirements set forth in the CAAA (See Part IV).

The control measures in Table 21 are grouped by point, area, off-road mobile, and on-road mobile

source sectors depending on which source sectors they affect. Several control measures affect both point and area sources, and therefore are listed under both source sectors. For sources that will be subject to new controls by 2002, the emission reductions are determined by subtracting the 2002 Control Strategy Projection emissions (described in this part) from the 2002 Current Control Projection emissions (described in Part II of this Plan), using the following equation,

$$\boldsymbol{ER_{2002} = Current\ Control\ Projection - Control\ Strategy\ Projection} \quad \text{(R-1)}$$

where ER_{2002} stands for "Emission Reduction (ER) in 2002". For sources that will not have new controls or will not be affected by new rules by 2002, their control strategy projections will be equal to their current control projections. Thus, emission reductions from those sources will be zero.

Table 21
Summary of VOC & NOx Emission Control Measures and
Expected Emission Reductions for 2002 (in TPD)

Control Measures And Regulations	Creditability	Effective Date	Emission Reduction	
			VOC	NOx
Point Source Controls				
RACT "Catch-Ups" in Kent County:				
Solvent Metal Cleaning	Creditable	31-May-95	0.547	0.000
Surface Coating of Metal Furniture	Creditable	31-May-95	0.037	0.000
Leaks from Synthetic Organic Chemical, Polymer, and Resin Manufact. Equip.	Creditable	31-May-95	0.004	0.000
Subtotal for RACT "Catch-Ups" in Kent			0.588	0.000
New RACT Regulations:				
Bulk Gasoline Marine Tank Vessel Loading Facilities	Creditable	31-Dec-95	1.896	0.000
SOCMI Reactor Processes and Distillation Operations	Creditable	1-Apr-96	0.026	0.000
Batch Processing Operations	Creditable	1-Apr-96	0.431	0.000
Offset Lithography	Creditable	1-Apr-96	0.085	0.000
Aerospace Coatings	Creditable	1-Apr-96	0.007	0.000
Industrial Cleaning Solvents	Creditable	1-Nov-96	0.518	0.000
Non-CTG RACT	Creditable	31-May-95	0.380	0.000
Delaware NOx RACT	Creditable	31-May-95	N/A	2.320
Subtotal for New RACT Regulations			3.343	2.320
Regional Controls:				
OTR Regional NOx MOU	Creditable	1-May-99	N/A	27.220
Federal Benzene Waste Rule and Delaware Air Regulation 24.28	Creditable	Spring 1995	1.722	0.000
Other Delaware Regulations:				
Sanitary Landfills	Creditable	9-Oct-93	0.345	0.000
Irreversible Process Changes	Creditable	1-Jan-96	1.964	0.000
Total for Point Source Reductions			**7.962**	**29.540**
Stationary Area Source Controls				
RACT "Catch-Ups" in Kent County:				
Solvent Metal Cleaning	Creditable	31-May-95	0.136	0.000
Cutback Asphalt	Creditable	31-May-95	0.026	0.000
Subtotal for RACT "Catch-Ups" in Kent			0.162	0.000

Table 21 (Continued)
Summary of VOC & NOx Emission Control Measures and
Expected Emission Reductions for 2002 (in TPD)

Control Measures And Regulations	Creditability	Effective Date	Emission Reduction	
			VOC	NOx
Stationary Area Source Controls (Cont'd)				
New RACT Regulations:				
Stage I Vapor Recovery-Gas. Disps. Facil.	Creditable	15-Nov-94	0.652	0.000
Emulsified Asphalt	Creditable	31-May-95	0.053	0.000
Motor Vehicle Refinishing	Creditable	1-Apr-96	1.324	0.000
Offset Lithography	Creditable	1-Apr-96	0.081	0.000
Aerospace Coatings	Creditable	1-Apr-96	0.033	0.000
Stage II Vapor Recovery	Creditable	15-Nov-94	1.882	0.000
Subtotal for New RACT Regulations			4.025	0.000
Other Delaware Regulations:				
Open Burning	Creditable	8-Feb-95	7.831	1.559
Federal Rules				
Consumer Products	Creditable	11-Sep-98	0.957	0.000
Architectural Coatings	Creditable	11-Sep-98	1.340	0.000
Total for Area Source Reductions			**14.315**	**1.559**
Off-Road Mobile Source Controls				
Reformulated Fuel	Creditable	1-Jan-95	0.033	0.000
New Emission Standards:				
For Small Spark Ignit. Engines	Creditable	EPA:	4.067	0.049
For Compression Ignit. Engines	Creditable	Court	0.732	2.824
For Marine Engines	Creditable	Ordered.	1.019	-0.060
For Locomotives	Creditable	31-Dec-01	0.000	0.521
Total for Off-Road Mobile Source Reductions			**5.851**	**3.334**
On-Road Mobile Source Controls				
FMVCP and RVP	Noncreditable	Pre-1990	19.930	2.530
Tier I Vehicle Emissions Standards	Creditable	Model Year 94	4.280	5.950
a. Basic I/M for Kent County	Creditable	1-Jan-91	1.210	0.530
b. ATP and Pressure Test for Kent		1-Jan-95		
ATP and Pressure Test for New Castle	Creditable	1-Jan-95	4.300	0.700
Reformulated Fuel	Creditable	1-Jan-95	5.880	-0.190
LEV Program	Creditable	1-Nov-99	0.410	0.850
Total for On-Road Mobile Source Reductions			**36.010**	**10.370**
Total Reductions from All Controls			**64.138**	**44.803**

PART IV

CONTINGENCY PLAN OF DELAWARE'S 2002 RPP

4.1 Contingency Requirements for Emission Reductions

The CAAA requires States with nonattainment areas to implement specific control measures if the area fails to make reasonable further progress, fails to meet any applicable milestone, or fails to attain the national ambient air quality standards by the applicable attainment date.[13] The EPA has interpreted this CAAA provision as a requirement for States with moderate and above ozone nonattainment areas to include sufficient contingency measures in their Rate-of-Progress Plans so that, upon implementation of such measures, additional emission reductions of at least 3% of the adjusted 1990 base year emissions would be achieved (Reference 13). Under the same provision of the CAAA, EPA also requires that the contingency measures must be fully-adopted control measures or rules, so that, upon failure to meet milestone requirements or attain the standards, the contingency measures can be implemented without any further rulemaking activities by the States and/or EPA.

To meet the requirements for contingency emission reductions, EPA allows States to use NOx emission reductions to substitute for VOC emission reductions in their contingency plans. The condition set forth by EPA for NOx substitution is that States must achieve a minimum of 0.3% VOC reductions of the total 3% contingency reduction, and the remaining 2.7% reduction can be achieved through NOx emission controls (Reference 9). Delaware decides to include both VOC and NOx emission controls in its contingency plan for the 2002 Rate-of-Progress Plan.

4.2 Control Measures to Meet Contingency Requirements

Delaware proposes to achieve the required contingency emission reductions through controls over both VOC and NOx emissions. The VOC emission reductions will be obtained from implementing an annual inspection schedule for the Stage II Vapor Recovery Systems, and the NOx emission reductions will be achieved through a combination of controls on various sources in the peak ozone season, as well as through improvement of rule effectiveness (*RE*) for the regional NOx emission control rule.

4.2.1 Stage II Vapor Recovery System with Annual Inspections

The CAAA requires States with moderate and above ozone nonattainment areas to submit a SIP revision requiring owners or operators of gasoline dispensing facilities to install and operate a system for gasoline vapor recovery during refueling process for motor vehicles.[14] Under this requirement, Delaware has developed its Stage II Vapor Recovery Program, which is defined in Section 36 of Delaware Air Regulation 24 (Reference 5). The Delaware's stage II vapor recovery regulation gives the regulatory agency the right to

[13] CAAA, Title I, Part D, Section 172(c)(9) and Section182(c)(9).
[14] CAAA, Title I, Part D, Section 182(b)(3).

perform compliance inspections as needed. Currently, a triennial inspection schedule is performed by the responsible agency (Underground Storage Tank Branch of DNREC). Delaware has taken credit for VOC emission reductions from this triennial inspection schedule in Part III of the 2002 RPP, where the emission reductions are estimated using a control efficiency (CE) of 95%, a rule penetration (RP) of 97%, and a rule effectiveness (RE) of 65.3% according to an EPA's guidance document. The total creditable VOC emission reduction from the triennial inspection is 1.88 TPD (Part III of the 2002 RPP).

Additional VOC emission reductions can be obtained from the Stage II Vapor Recovery Program when the inspection frequency is increased. If the program is conducted with an annual inspection schedule, the rule effectiveness (*RE*) value of this control will increase from 65.3% to 90.5%, resulting in additional VOC emission reductions. In other words, the program is more effective for reducing VOC emissions with a higher inspection frequency. Delaware proposes to perform an annual inspection schedule for its Stage II Vapor Recovery Program as a contingency measure. Based on a 95% control efficiency, a 97% rule penetration, and a 90.5% rule effectiveness, the emission factor generated from MOBILE5a is 0.88 grams of VOC per gallon of gasoline for both Kent and New Castle Counties.

According to EPA's guidance document *Procedures for Emissions Inventory Preparation, Volume IV: Mobile Sources* (Reference 22), the in-use efficiency of stage II vapor recovery system applies to both spillage and displacement. As determined in the 2002 RPP, the annual inspection in the Stage II Vapor Recovery Program will lead to additional VOC emission reductions of 0.05 TPD and 0.53 TPD from spillage and displacement, respectively. The total additional VOC emission reduction is therefore 0.58 TPD (0.05 + 0.53 = 0.58).

In Part I, Delaware has determined its 1990 adjusted baseline inventory level of VOC emissions to be 133.153 TPD. The additional 0.58 TPD VOC emission reduction estimated above is (0.58/133.153) = 0.0043 = 0.43% of the 1990 adjusted base year VOC emissions, thus, satisfying the 0.30% minimum requirement on VOC emission reductions for the contingency plan. The rest of the contingency reductions will be obtained through NOx controls, which will be discussed in the following subsection.

4.2.2 NOx Emission Controls in Peak Ozone Season

As determined above, 0.43% of the 3.00% contingency requirement will be obtained by VOC emission reductions from annual inspection of Stage II vapor recovery systems. The remaining 2.57% (i.e., 3.00% - 0.43% = 2.57%) is the percentage required for NOx reduction substitution. The adjusted 1990 base year NOx emission level has been determined to be 158.405 TPD in Part I (page 1-19). Thus, the NOx emission reductions for contingency purpose will be at least 158.405 x 2.57% = 4.07 TPD.

In Subsection 3.5, Part III of the 2002 RPP, Delaware has demonstrated that, through adequate NOx emission controls, a 1.52 TPD NOx emission reduction will be achieved, in

addition to those needed to meet the minimum rate-of-progress requirements for the 2002 RPP. Delaware shall use this additional 1.52 TPD NOx emission reduction in this contingency plan based on the following judgements. First, this additional reduction shall be achieved from a combination of control measures in the RPP. Second, all these control measures are fully-adopted measures or rules. Thus, no further rulemaking actions by the State and/or EPA are needed when this 1.52 TPD NOx reduction surplus becomes necessary to serve the contingency purpose. After including the above 1.52 TPD NOx reduction in the contingency plan, Delaware needs to achieve an additional 2.55 TPD (i.e., 4.07 – 1.52 = 2.55) in NOx emission reductions to meet the minimum requirement for the contingency purpose. This NOx reduction will be achieved through *RE* improvement.

Delaware has promulgated the OTC Regional NOx Controls through its Regulation 37 (*NOx Budget Program*, as amended in April 1999). As demonstrated in Appendix N of the 2002 RPP, the provisions in Regulation 37 give Delaware the capability to improve the rule effectiveness (*RE*) for all affected NOx sources from the default value of 80% to 92%. Applying this improved *RE* value of 92% to all affected sources, the projections of their NOx emissions in 2002 can be reevaluated. The total NOx emissions from these sources with a *RE* value of 92% is 29.77 TPD. If compared with the total reduction of 27.22 TPD obtained with the default RE of 80% (Table 3-17 in Part III of the 2002 RPP), the additional reduction will be 2.55 TPD (i.e., 29.77 – 27.22 = 2.55). This additional 2.55 TPD NOx emission reduction can be obtained through *RE* improvement without any further rule-making activities at both State and federal levels.

4.3 Summary of Contingency Measures and Emission Reductions

A summary of the contingency measures and the associated additional VOC and NOx emission reductions are presented in Table 22. As shown in Table 22 and in the discussions above, the contingency measures proposed herein are adequate for meeting the contingency requirements set forth by EPA.

Table 22. Summary of Contingency Measures and Emission Reductions

	Emission Reduction (TPD)	
Contingency Measures	**VOC**	**NOx**
Stage II Vapor Rec. with Annual Inspection	0.58	-
Required VOC Emission Reductions	0.58	-
NOx Controls in Peak Ozone Season	-	1.52
RE Improvement on NOx Regional Control Rule	-	2.55
Total NOx Emission Reduction	-	4.07
Required NOx Emission Reductions	-	4.07

PART V

DOCUMENTATION

This part presents a collection of supporting documents referred to in Part I through Part IV of the 2002 RPP. The documents are in appendix form and include the following:

APPENDIX A: Summation of Perchloroethylene Emissions from Delaware 1990 Base Year Emission Inventory.

APPENDIX B: Mobile 5a Input and Output Parameters for the 1990 Adjusted Base Year Inventory Relative to the Milestone Year 2002.

APPENDIX C: Development of Growth Factors for the 2002 Rate-of-Progress Plan.

APPENDIX D: Point Source Emission Projections for the 2002 Current Control Projection Inventory.

APPENDIX E: Stationary Area and Off-Road Mobile Source Emission Projections for the 2002 Current Control Pro and Control Strategy Inventories.

APPENDIX F: On-Road Mobile Source Projection Methodology and Data for the 2002 Current Control and Control Strategy Projection Inventory.

APPENDIX G: Point Source Emission Projections for 2002 Control Strategy Projection Inventory.

APPENDIX H: Collection of EPA Guidance Documents Referred in 2002 RPP (Hard copy).

APPENDIX I: VOC Emissions Reductions from the Federal Benzene Waste Rule and Delaware Regulation 24.28.

APPENDIX J: Mobile 5a Input and Output Files for Stage II Vapor Recovery with Triennial Inspection.

APPENDIX K: VOC and NOx Emission Reductions from New Emission Standards on Nonroad Diesel Engines.

APPENDIX L: Methodology for Determining VOC and NOx Emissions Reductions from On-Road Mobile Source Control Measures.

APPENDIX M: Mobile 5a Input and Output Files for Stage II Vapor Recovery with Annual Inspection.

APPENDIX N: Rule Effectiveness Improvement for NOx Emission Sources Covered by Delaware Regulation 37.

All appendixes are available upon request. Written request should be addressed to Mr. Alfred R. Deramo, Program Manager, ERPA/PCP/AQM/DNREC, 156 South State Street, Dover, DE 19901, or through fax at (302)739-3106, or via e-mail at aderamo@state.de.us.