Appendix E

RFP Projected Inventories

1.0 Projection Inventories Overview

1.1 Introduction

In order to determine reasonable further progress (RFP) it is necessary to first grow the base inventory to the year of interest and then account for the reductions achieved from any control measures, federal or State, which were applicable prior to or in that year. The starting inventory for the projections is the 2002 emission inventories for summer emissions in tons per day for volatile organic compounds (VOCs) and oxides of nitrogen (NO_x). The projected emission inventories are "grown" from the 2002 actual emission inventory and then "controlled".

In order to project future year emissions, it is necessary to determine appropriate growth factors and the applicable control efficiency, rule effectiveness and rule penetration for each component of the inventory. The difference in the controlled and uncontrolled emissions will give the emission reductions (benefits) associated with instituted control measures.

1.2 Growth Overview

The projected emission inventories for 2002 were calculated by first estimating growth in each source category, in each of the inventory sectors (point, area, nonroad, onroad). As appropriate, the 2002 actual emission inventories were used as the base for applying factors to account for inventory growth. The United States Environmental Protection Agency (USEPA) preferred approach for projecting emissions growth incorporates locality-specific estimates [1] such as population, employment, historical averaging or other category specific activity such as fuel consumption and product output.

Annual growth rates were evaluated for each of the emission categories, in each of the four emission sectors (point, area, nonroad, onroad). In three of the emission sectors (point, area, nonroad) growth factors were calculated for a specific range of years and used in spreadsheets or databases to calculate future year emissions. Point source growth factors were calculated utilizing information from the USEPA Economic Growth Analysis System (EGAS) computer program and the United States Department of Energy (USDOE) projection data. Area source growth was predicted using the USDOE projection data and other activity indicators specific to each category. Nonroad growth was projected utilizing the USEPA National Non-Road Emissions Model and other federal and state specific data. Onroad growth was projected using travel demand models.

[1] Economic Growth Analysis System Version 4.0 Reference Manual, E.H. Pechan & Associates, Inc., January 26, 2001.

The EGAS computer program is an economic and activity forecast computer program developed by the USEPA to calculate growth factors. The program utilizes data from Regional Economic Models, Inc. (REMI), the U.S. Department of Commerce Bureau of Economic Analysis (BEA), Wharton Econometric Forecasting Associates (WEFA), the Bureau of Labor Statistics American Workforce (BLS), a commercial energy model, an industrial energy model, a household energy model, a VMT module, a physical output module and an electric utility model. EGAS calculates growth factors based on standard industrial classification (SIC) codes and translates these growth factors to growth by SCC categories. EGAS version 5.0 was run using the baseline WEFA forecast with no model responses suppressed.

The growth factors used are discussed in more detail, by specific emission sector, in Sections 2.0 though 5.0 below.

1.3 Control Measures Overview

Once the emission inventories are grown, the next step is to determine which control measures within each of the various emission sectors would be in place during or prior to that year, and includes the emission reduction benefits from those control measures at that time. Once the grown emissions are "controlled," the emissions that are expected with each and every control measure in place are compared to RFP emission target levels. The combined effect of growth and controls represents the inventory projection. The combination of control measures represents a coherent set of actions that are directed towards meeting the RFP requirements. Post-2002 control measure benefits (including benefits from pre-2002 and post-2002 rules) were applied to each emission sector as appropriate. When all the benefits are summed and subtracted from uncontrolled emission levels, the result is the projected "controlled" inventory.

The control measures included in the projections, the years the RFP plans were affected by them, and the emission benefits are shown in Tables 6.1, 6.2, and 6.3 of Section 6.3 for the State and the New Jersey portions of the Northern New Jersey/New York/Connecticut nonattainment area, the Southern New Jersey/Philadelphia nonattainment area, respectively. The control measures are described in Chapter 4.

More details regarding the benefits from control measures for each sector are provided below.

2.0 Point Sources

2.1 Growth

The growth projections are categorized by source classification codes (SCCs) for each county, nonattainment area, and the entire State. SCCs are the USEPA's primary identifying emission element codes. For point sources they are made up of 8-digits which contain 4 levels of the description. The first level uses the first digit and provides the most general information on the category of the emissions. There are five major categories, which split the major industries into groups. The categories are external combustion boilers, internal combustion sources, manufacturing processes, petroleum and solvent evaporation, and waste disposal. The second level of description is associated with the first 3-digits of the code and subdivides them into the above mentioned industry groups. The third level of description includes the first six digits and identifies a specific industry or emission source category. The fourth level of description is associated with the full eight-digit code. The last 2 digits specify the particular emitting process.

There are two sets of factors that were used to determine growth over time in the point source sector. The first set of growth factors utilized USEPA's EGAS. The second set came from the USDOE's Annual Energy Outlook Projections. The USDOE's growth factors were used for all point sources that were based on fuel consumption. The rest of the point sources used the EGAS growth factors.

2.2 Controls

New Jersey and the USEPA have and will develop rules that require control measures to reduce point source emissions of air pollutants. The control measure strategy affected the source categories differently. The 2002 emission inventory was used as a base and adjusted to account for actual 2005 emissions. The adopted control measures (pre-2002) and control measures anticipated to be adopted (post-2002), which affect the point source sector are shown in Table E1.

Table E1: Point Source Control Measures

Control Measures	Sector	Pollutant	Point Source Category
Pre-2002 with benefits achieved Post-2002, Federal, On the Books			
New Jersey's NO_x Budget Program	Point	NO_x	Fossil fuel fired indirect heat exchangers with a max rated heat input capacity of at least 250 MMBtu per hour; and all fossil fuel fired electric generating units with a rated output of at least 15 MW
Post-2002 New Jersey On the Books			
NOx RACT Rule 2006	Point and Area	NO_x	NG boilers, Oil Combustion turbines, NJ & diesel engines
USEPA MACT Standards	Point	NO_x	
Post-2002, New Jersey, Beyond on the Way			
ICI Boilers	Point and Area	NO_x	Indirect heat exchangers, boilers, process heaters, duct burners
CAIR	Point	NO_x	EGU's
Post-2002, Federal, Beyond on the Way			
ACO – PSEG	Point		Mercer , Hudson, & Kearny
Refinery Enforcement Initiative	Point		Valero, Citgo, Conoco Phillips, Sunoco Coastal Eagle Point

A more detailed discussion of each of the control measures is included in Chapter 4. A discussion of the control measure control factors is included below.

Control Measure Calculations

New Jersey's NO_x Budget Program

New Jersey's NO_x budget program imposed stringent reductions in allowances to sources in 2003. The base emission budget for 2003 was decreased to 8,200 tons from 17, 340 tons. The 2003 base emission budget will be constant until the end of 2008, when the program will be replaced by Clean Air Interstate Rule (CAIR). The decrease in allowances caps the emissions from this source category and gains a reduction of 79.58 tons per day of NO_x emissions in 2008.

NO_x Reasonably Available Control Technology (RACT) Rule 2006

This rule became operative at the end of 2005 with emission benefits to be seen for purposes of this RFP in 2008. Large natural gas fired boilers $\geq$ 100 Million British thermal units/hour (MMBtu/hr) had their NO_x emission limit lowered from $\leq$0.20 to $\leq$0.10 lb/MMBtu. Annual tune-ups are required for smaller boilers phased-in starting in 2007 and ending in 2010. Oil-fired combustion turbines are subject to lower NO_x emission limits. Combined or regenerative cycle will have their emission limit reduced from 0.35 lb/MMBtu to 0.26 lb/MMBtu. Simple cycle turbines will be reduced from 0.4 lb/MMBtu to 0.3 lb/MMBtu. Reciprocating engines burning natural gas and diesel also had their emission limits tightened. As a result of the rule becoming more stringent it was estimated that the emission reduction for 2008 is 6.80 tons per day of NO_x emissions from the various pieces of equipment.

USEPA Maximum Available Control Technology (MACT) Standards

As discussed in the "MARAMA Development of Emission Projections for 2009, 2012, 2018, for Non-EGU Point, Area, and Non-Road Sources In the MANE-VU Region", prepared by MACTEC Federal Programs, Inc., dated February 28, 2007 (MACTEC MARAMA Report 2007), it discussed how post-2002 MACT standards were applied on a general scale to all sources with certain SCCs. Every source with a SCC determined to be affected by a post-2002 MACT standard was assigned an incremental percent reduction for the entire applicable MACT standard. Table E2 shows the SCCs affected and the incremental control efficiencies applied for post-2002 MACT standards for New Jersey's point source inventory.

<u>Table E2</u>:
Point Source MACT SCCs

SCC	% Reduction	SCC	% Reduction	SCC	% Reduction	SCC	% Reduction	SCC	% Reduction
2-01-001-01	0.25	3-01-018-92	67.40	3-05-001-43	28	3-20-999-99	35.79	4-02-020-01	53.06
2-01-001-02	40	3-01-018-99	67.40	3-05-001-46	28	4-02-011-03	35.79	4-02-022-01	53.06
2-01-002-01	0.25	3-01-050-01	67.40	3-05-001-50	28	4-02-013-01	35.79	4-02-025-01	73.07
2-01-002-02	40	3-02-019-18	66.15	3-05-001-51	28	4-02-013-05	38.90	4-02-025-03	77
2-01-008-02	40	3-02-019-41	38.69	3-05-001-98	28	4-02-013-20	60.17	4-02-025-37	77
2-02-001-01	0.25	3-02-019-49	38.69	3-05-012-03	28	4-02-013-99	82.05	4-02-025-45	47.93
2-02-001-02	40	3-02-019-50	38.69	3-05-012-04	28	4-02-016-01	82.05	4-02-025-99	47.93
2-02-002-03	0.25	3-04-003-01	38.69	3-05-012-05	74	4-02-016-02	82.05	4-02-026-01	47.93
2-02-002-01	0.25	3-04-003-05	40	3-05-015-06	74	4-02-016-04	66.73	4-02-026-03	47.93
2-02-002-02	40	3-04-003-10	40	3-06-002-01	74	4-02-016-06	66.73	4-02-026-04	47.93
2-02-002-03	0.25	3-04-003-16	40	3-06-009-03	74	4-02-016-07	66.73	4-02-026-06	66.15
2-02-002-04	40	3-04-003-17	40	3-06-009-04	87.40	4-02-016-08	66.73	4-02-026-07	66.15
2-02-007-06	40	3-04-003-19	40	3-06-009-99	65.63	4-02-016-20	66.73	4-03-999-99	66.15
2-02-010-01	40	3-04-003-20	40	3-06-099-03	65.63	4-02-016-21	66.73	5-04-102-16	66.15
2-03-001-01	40	3-04-003-98	40	3-08-001-06	65.63	4-02-016-31	66.73	5-04-103-14	66.15
2-03-001-02	0.25	3-05-001-02	40	3-08-001-07	65.63	4-02-016-99	66.73	5-04-105-30	65.63
2-03-002-03	0.25	3-05-001-05	28	3-08-007-23	47.60	4-02-017-04	66.73	5-04-107-64	50.08
2-03-003-01	40	3-05-001-06	28	3-08-007-99	47.60	4-02-017-21	66.73	5-04-825-99	50.08
3-01-018-37	66.15	3-05-001-16	28	3-14-015-03	70	4-02-017-22	70.83	6-46-310-01	66.15
3-01-018-80	67.40	3-05-001-30	28	3-14-015-11	70	4-02-018-01	70.83		
3-01-018-90	67.40	3-05-001-31	28	3-14-015-14	35.79	4-02-018-02	70.83		
3-01-018-91	67.40	3-05-001-35	28	3-14-015-30	35.79	4-02-018-06	53.06		

Industrial/Commercial/Institutional (ICI) Boilers

Currently, New Jersey ICI boilers are regulated according to size, fuel and boiler type. New Jersey's existing NO_x rules generally apply only to ICI boilers at least 50 MMBtu/hr located at major sources. New Jersey plans to propose amendments to its current ICI boiler rules at N.J.A.C. 7:27-19.7. New Jersey plans on reducing the NO_x emission limits for ICI boilers between 25-100 MMBtu/hr. There are approximately 388 ICI boilers that will see a 50% reduction in NO_x emissions due to the lowering of the emission rate. By 2009, NO_x emission reduction benefits will total approximately 6.8 tons per day.

CAIR

CAIR will replace the existing New Jersey NO_x Budget Program in 2009. Electric generating units (EGUs) that are 25 megawatts (MW) or greater will be subject to CAIR in 2009. The remaining sources will continue to be covered under New Jersey's Nitrogen Oxides Rule N.J.A.C. 7:27-19. CAIR sources will be subject to a base emissions budget of 6656 tons per 5-month season. There are approximately 170 sources that will be subject to CAIR. In 2009 these sources are projected to have NO_x emissions of approximately 108 tons per day (tpd). Their CAIR allowance will limit their emissions to ~44 tpd giving an emission benefit from this program of about 64 tpd of NO_x emissions in 2009.

Administrative Consent Order

Public Service Electric & Gas' (PSEG) Consent Decree applies to Hudson unit 2, Mercer units 1 and 2, and Kearny units 7 and 8. Hudson unit 2 was required to install selective catalytic reduction (SCR) by January 1, 2007 to control NO_x. Emission rates for Mercer had to be in place no later than January 1, 2007 and were required to achieve and maintain their NO_x emission rate of no greater than 0.100 lb/MMBtu, based on a 90-day rolling average emission rate. It also had to continue to operate their SCR at all times. As a result of these controls, 2008 will see a benefit of 48 tons per day of NO_x emissions. Kearny shut down their units 7 and 8 and surrendered all applicable air pollution control permits for those units.

Refinery Enforcement Action

The USEPA's national Petroleum Refinery Initiative was an integrated enforcement and compliance strategy to addresses air emissions from the nation's petroleum refineries. The four refineries located in New Jersey are Valero Refining, Conoco Phillips, Citgo, and Sunoco Coastal Eagle Point. The major refinery sources that were affected by the judicial settlement are FCCUs, flare gas recovery, and equipment leaks. The Fluid Catalytic Cracking Units (FCCUs) or cracking units will reduce NO_x emissions by 60% resulting in an emission benefit of 1.69 tpd for 2009. Flare gas recovery will have a 53% reduction in both VOC and NO_x emissions. The 2009 emission benefits will be 0.74 tpd for VOC and 0.19 tpd for NO_x. Lastly, leak detection and repair will have a 50% control on VOC emissions. This will give a 0.48 tpd emission reduction for 2009. This enforcement action will collectively have NO_x emission reductions of 1.88 tons per day and 1.22 tons per day of VOC reductions.

2.3 Projected Emission Inventory

The projected emissions inventories for the years 2002, 2008 and 2009 for VOCs and NO_x by SCC, for each county, nonattainment area and statewide are included in Attachment 1.

3.0 Area Sources

The New Jersey 2002 baseline inventory used in the RFP calculations[2] has some variations from the modeling inventory.

Residential Wood Burning

The emissions from residential wood burning were calculated using the USEPA guidance, methodology and emission factors as discussed in Attachment 11 of the inventory report.[3] Mid-Atlantic/Northeast Visibility Union (MANE-VU) sponsored a residential wood-burning project to calculate wood burning emissions in the MANE-VU states. The final results of this study are shown in a report titled "Final Report: MANE-VU Residential Wood Combustion Emission Inventory", prepared by E.H. Pechan & Associates, dated June 22, 2004. Version 3 of the modeling inventory was revised to replace the New Jersey Department of Environmental Protection (NJDEP) calculated emissions for woodburning with the MANE-VU Pechan calculated emissions for indoor

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[2] ibid.
[3] ibid.

burning and outdoor burning. However, while the total emissions from most of the pollutants in the MANE-VU inventory are similar to those in the NJDEP inventory, the VOC emissions in the MANE-VU inventory are significantly higher.

An evaluation of this variation revealed that the VOC emission factor in the USEPA air pollutant (AP)-42 guidance for fireplaces does not appear to be correct. The USEPA VOC fireplace emission factor is 332 % higher than that of conventional wood stoves, while the USEPA emission factors for other pollutants range from 7 % lower to 13 % higher. This ratio of emission factors is significantly out of proportion. The USEPA AP-42 rating on this emission factor is a "D" meaning "tests performed using a generally unacceptable method, but the method may provide an order of magnitude value for the source." Table 4-1 in AP-42 for fireplaces, shows an emission factor range of 2.9-184.3 g/kg, quite a wide range. The emission factor testing was performed with a flame ionization detector (FID), which is not a very accurate field instrument and it includes methane (not a VOC) which has to be subtracted out. The AP-42 documentation for woodstoves breaks out the methane as a separate category, while AP-42 for fireplaces does not. The AP-42 narrative is not clear, but it discusses that methane is high in fireplaces and appears to link that to high VOC emissions. These issues were discussed via email correspondence with Roy Huntley and Ron Myer of the USEPA in July of 2006.

VOC emissions from residential woodburning were previously not a significant concern with respect to ozone, because the emissions were not allocated to the ozone season. But due to the high VOC emissions in the MANE-VU Pechan study, even a small allocation in the summer for indoor burning is noticeable, and the MANE-VU Pechan study also included outdoor burning in the summer.

Due to the uncertainties, MANE-VU commissioned another woodburning study. This study evaluated woodburning using different data sources and methodologies. The results of this study are contained in a report titled "Task 6 Technical Memorandum 4 (Final Report) Control Analysis and Documentation for Residential Wood Burning Combustion in the MANE-VU Region", prepared by OMNI Environmental Services, Inc., dated December 19, 2006. The results of this study showed significantly different results from the NJDEP and MANE-VU Pechan estimates. As discussed on page 24 of the OMNI report, OMNI evaluated the USEPA VOC emission factor for fireplaces and the sources that went into it, as well as all of the USEPA emission factors. They also found the VOC emission factor for fireplaces to be in error by a large margin. They concluded that the error was due to a few outliers in the testing used as a basis for the emission factor.

In addition, Pechan used a different ton to cord conversion factor than that used by NJDEP or OMNI, resulting in an estimated increase in emissions. Pechan used 1.8 tons per cord, while NJDEP used 1.42 tons per cord in accordance with USEPA guidance.

A summary of the three estimates, NJDEP, MANE-VU Pechan, and MANE-VU OMNI, are shown below in Table E3. As shown in the table, the NJDEP estimated emissions are very similar to the MANE-VU Pechan emissions for all pollutants except VOC. The OMNI estimated emissions are significantly lower than the NJDEP and the MANE-VU Pechan estimates. The OMNI estimates appear to be more in line with actual monitoring data studies for PM.

Table E3:
Residential Woodburning Summary

		2002 ANNUAL EMISSIONS (TONS/YEAR)		
		NJDEP	**MANE-VU V3**	**OMNI**
Indoor	VOC	16,217	43,570	4,425
Outdoor	VOC	*	6,419	
Indoor	NO_x	857	870	374
Outdoor	NO_x	*	73	
Indoor	CO	70,621	67,230	21,541
Outdoor	CO	*	7,081	
Indoor	PM_{10}	9,363	8,931	4,273
Outdoor	PM_{10}	*	970	
Indoor	$PM_{2.5}$	9,363	8,931	4,273
Outdoor	$PM_{2.5}$	*	970	
Indoor	SO_2	122	121	46
Outdoor	SO_2	*	11	
Indoor	NH_3		485	221
Outdoor	NH_3		51	

Notes:
NJDEP = NJDEP 2002 periodic emission inventory dated May 2006
MANE-VU V3 = Version 3 of the 2002 modeling inventory, which was used in NJDEP modeling
* = NJDEP has only one category for all residential woodburning

In summary, the modeling inventory has higher VOC emissions than the NJDEP RFP inventory, which provides a conservative approach for modeling. These higher emissions appear to be in error and are not included in the NJDEP inventory or the RFP analysis.

Composting

MANE-VU sponsored a project to calculate composting emissions. NJDEP elected to use the MANE-VU-sponsored composting inventory for annual and daily VOC and ammonia (NH_3) emissions in the modeling inventory. These emissions are not included in the NJDEP inventory, but are including in the modeling inventory. The total composting emissions are 1113 tons per year of VOC.

3.1 Growth

Growth factors were calculated for area sources utilizing state population projections, USDOE fuel consumption projections, employment projections from the New Jersey Department of Labor, state specific asphalt usage, state specific pesticide usage, state specific lane mileage and inventory landfill model projections.

A summary table which shows the growth factors and growth rate (in percent per year) for each SCC category and the indicators for those growth factors is included as Table 1 in Attachment 2-1.

Population

Projected population is the most appropriate growth indicator to use for certain source categories whose emissions are calculated using population such as architectural coatings, consumer products and graphic arts. It is also the best growth indicator for other categories in which their emissions are calculated using employment but state specific employment projections are not available. State specific employment data for manufacturing in New Jersey (including food and metal parts manufacturing) shows a decrease in manufacturing employment. Therefore, population was used as a growth indicator for those categories such as bakeries, breweries, wineries, and product surface coating operations to be conservative, instead of assuming negative growth. The EGAS 4.0 growth factors for these categories use the constant dollar method for SIC codes that are not state specific and are not SCC code specific. The SIC codes used by EGAS often incorporate industry that is not specific to the SCC category being evaluated. The EGAS growth factors overestimate growth for several of the area sources categories, therefore they were not used.

For transportation planning purposes, New Jersey is divided into three Metropolitan Planning Organizations (MPOs). The three MPOs are the North Jersey Transportation Planning Authority (NJTPA), the South Jersey Transportation Planning Organization (SJTPO) and the Delaware Valley Regional Planning Commission (DVRPC). The MPOs use demographic data in their projection work. The federal transportation conformity rule requires that the MPOs use the most recent planning assumptions. Therefore, the NJDEP used the population projections developed by each of the three MPOs in the State to grow the appropriate categories of the emission inventory.

Population projection data was obtained from the NJTPA, SJTPO, and the DVRPC. The data was combined and straight line interpolation was used to calculate population for the projection years. Statewide growth factors were then calculated using the following equations:

2002-2008 Growth Factor =
2008 Statewide Population / 2002 Statewide Population

2002-2008 Growth Rate (percent per year) =
{[(2002-2008 Growth Factor)^1/y] – 1} * 100 percent

Where: y = the # of years being analyzed (ex: y = 2008-2002 = 6)

The same methodology/equations were used for the rest of the projection years. A summary table of the population data is included as Table 2, in Attachment 2-1.

Fuel Consumption

Projected fuel consumption data was obtained from the USDOE Energy Information Administration (EIA), Annual Energy Outlook Report. The growth factors were calculated in the same manner as the population growth factors, using the same equations, but substituting projected fuel consumption for projected population. A summary table of the fuel consumption data is included as Table 3, in Attachment 2-1.

Employment

Projected employment is the most appropriate growth indicator to use for certain source categories whose emissions are calculated using employment such as autobody refinishing and dry cleaning. It is also the best growth indicator for other categories in which their emissions are calculated using state specific data but state specific data projections are not available, such as construction activities, mining and quarrying and agricultural tilling. The EGAS 4.0 growth factors for these categories use the constant dollar method for SIC codes that are not state specific and are not SCC code specific. The SIC codes used by EGAS often incorporate industry that is not specific to the SCC category being evaluated. The EGAS growth factors overestimate growth for several of the area sources categories, therefore they were not used.

Projected employment data was obtained from the New Jersey Department of Labor website. The growth factors were calculated in the same manner as the population growth factors, using the same equations, but substituting projected employment for projected population. A summary table of the employment data is included as Table 4, in Attachment 2-1.

Product Output

Product output is a direct measure of the amount of product being produced. Product output data was used to calculate growth factors for asphalt usage, pesticide usage and lane mileage. Data was obtained from the Asphalt institute, the NJDEP Bureau of Pesticide Operations and the New Jersey Department of Transportation (NJDOT).

Historical asphalt usage for paving asphalt, cutback asphalt, emulsified asphalt and roofing asphalt was obtained from the Asphalt Institute. A linear trendline was plotted from the historical data for each category and used to project future growth. The historical data for cutback and emulsified asphalt indicates a decreasing trend, greater than negative one percent. The growth rate was capped at negative one percent per year to be conservative. A summary table of the asphalt usage data is included as Table 5, in Attachment 2-1. The linear trendline charts are included as Tables 6 and 7, in Attachment 2-1.

Historical pesticide usage for agricultural, golf, lawn, mosquito and right-of way pesticide use, was obtained from the NJDEP Bureau of Pesticide Operations. A linear trendline was plotted from the historical data for each category and used to project future growth. The historical data for agricultural pesticide use indicates a decreasing trend, greater than negative one percent. The growth rate was capped at negative one percent per year to be conservative. A summary table of the pesticide usage data is included as Table 8, in Attachment 2-1. The linear trendline chart is included as Table 9, in Attachment 2-1.

Historical lane miles were obtained from the NJDOT. A straight line interpolation of historical data was used to project future growth in the traffic paints category. A linear trendline was plotted from the historical data and used to project future growth. A summary table of the lane mileage data is included as Table 10, in Attachment 2-1. The linear trendline chart is included as Tables 11, in Attachment 2-1.

Landfill Model

The USEPA Landfill Air Emissions Estimation Models (Landfil2 and LANDGEMS) were used to calculate projected landfill emissions with and without emission controls, as discussed in the NJDEP 2002 inventory report.[4] The growth factors were calculated in the same manner as the population growth factors, using the same equations, but substituting projected uncontrolled landfill emissions for projected population. A summary table of the landfill data is included as Table 12 in Attachment 2-1.

Residential Wood Combustion

Growth and control of the residential wood combustion is incorporated into one factor, per the USEPA guidance provided to the NJDEP by Marc Houyoux of the USEPA/OAQPS dated September 11, 2006. The factors account for the USEPA rule that sets new source performance standard (NSPS) for woodstoves. The factors are based on estimated turn over of the old stoves to the new stoves. The estimated combined growth and control rates are as follows:

- Fireplaces increase 1%/yr
- Old woodstoves (non-USEPA certified) decrease 2%/yr
- New woodstoves (USEPA certified) increase 2%/yr

Table E4 shows the estimated growth factors by SCC and year.

[4] "The State of New Jersey NJDEP of Environmental Protection 2002 Periodic Emission Inventory May 2006" which was submitted to the USEPA as Appendix D of the "The State of New Jersey NJDEP of Environmental Protection State Implementation Plan (SIP) Revisions for the Attainment and Maintenance of the 8-Hour Carbon Monoxide National Ambient Air Quality Standard, 1-Hour Ozone National Ambient Air Quality Standard, and Fine Particulate Matter National Ambient Air Quality Standard; and the 2002 Periodic Emission Inventory May 2006".

<u>Table E4</u>: Residential Wood Combustion Growth/Control Factors

SCC	SCC Description	Assumptions	Growth and Control Factors			
			2002-2008	2008-2009	2009-2011	2011-2012
2104008000	Total: Woodstoves and Fireplaces	2104008000 total: 1 - 0.01056*(Year-2002) (19.4%fireplaces, 71.6%old woodstoves, 9.1%new woodstoves)	0.937	0.989	0.979	0.989
2104008001	Fireplaces: General	2104008001 fireplaces up 1%/yr: 1 + 0.01*(Year-2002)	1.060	1.010	1.020	1.010
2104008002	Fireplaces: Insert; non-USEPA certified	2104008002 old inserts down 2%/yr: 1 - 0.02*(Year-2002)	0.880	0.980	0.960	0.980
2104008003	Fireplaces: Insert; USEPA certified; non-catalytic	2104008003 new inserts up 2%/yr: 1 + 0.02*(Year-2002)	1.120	1.020	1.040	1.020
2104008004	Fireplaces: Insert; USEPA certified; catalytic	2104008004 new inserts up 2%/yr (same as 2104008003)	1.120	1.020	1.040	1.020
2104008010	Woodstoves: General	2104008010 old woodstoves down 2%/yr (same as 2104008002)	0.880	0.980	0.960	0.980
2104008030	Catalytic Woodstoves: General	2104008030 new woodstoves up 2%/yr (same as 2104008003)	1.120	1.020	1.040	1.020
2104008050	Non-catalytic Woodstoves: EPA certified	2104008050 new woodstoves up 2%/yr (same as 2104008003)	1.120	1.020	1.040	1.020
2104008051	Non-catalytic Woodstoves: Non-USEPA certified	2104008051 old woodstoves down 2%/yr (same as 2104008002)	0.880	0.980	0.960	0.980
2104008052	Non-catalytic Woodstoves: Low Emitting	2104008052 new woodstoves up 2%/yr (same as 2104008003)	1.120	1.020	1.040	1.020
2104008053	Non-catalytic Woodstoves: Pellet Fired	2104008053 new woodstoves up 2%/yr (same as 2104008003)	1.120	1.020	1.040	1.020

<u>No Growth</u>

No growth was projected by EGAS 4.0 for wildfires, managed burning and structural fires. The Department agrees with this assessment. Based on state specific information and regulations, no growth is also projected for incineration, open burning, leaking underground storage tank remediations, agricultural field burning, cigarette smoking and unpaved roads.

<u>Growth Summary</u>

As shown in Table 1 in Attachment 2-1, the statewide overall growth rate for area sources, on average, from 2002 to 2012 is approximately 0.8 percent per year. The statewide average growth rates from 2002 to 2012 vary within the individual SCC categories from approximately negative one percent per year for cutback and emulsified asphalts to 5.6 percent per year for mosquito control pesticides.

Overall, negative growth is projected in categories such as cutback and emulsified asphalts, agricultural pesticides, landfills, industrial residual, distillate, liquefied petroleum gas (LPG) and coal combustion, residential coal combustion and mining.

Overall, no growth is projected in categories such as incineration, open burning, leaking underground storage tank remediations, agricultural field burning, wildfires, managed burning, structural fires, cigarette smoking and unpaved roads.

Overall, positive growth from zero to one percent is projected in categories such as residential distillate oil combustion, traffic paints, road construction, gasoline storage and refueling categories, marine vessel loading and transport of crude oil and gasoline, bakeries, breweries, wineries, distilleries, architectural surface coatings, factory surface coatings, degreasing, graphic arts, industrial adhesives, consumer products, industrial treatment works, publicly owned treatment works, restaurant operations, vehicle fires, commercial distillate, natural gas and LPG combustion and marine vessel loading and transport of distillate oil.

Overall, one to two percent growth is projected for categories such as construction, autobody refinishing, residential LPG combustion, commercial coal combustion, dry cleaning, lawn pesticides and industrial natural gas combustion.

Overall, two to six percent growth is projected for categories such as paving and roofing asphalts, commercial residual oil combustion, residential kerosene combustion, marine vessel loading and transport of kerosene, mosquito, golf course and right-of way pesticides, agricultural tilling and aircraft refueling.

3.2 Controls

<u>Overview</u>

New Jersey and the USEPA have developed and will develop rules that require control measures to reduce area source emissions of air pollutants. In developing the 2002 emissions inventory, control efficiency factors for the NJDEP pre-2002 rules were applied to the 2002 uncontrolled emissions inventory in order to calculate the 2002 "actual" or controlled emissions inventory. In a similar fashion, incremental control efficiency factors (CEs) reflecting post-2002 rules, relative to existing rules, were applied to the grown emissions inventories, and incremental emission reduction benefits were calculated. The incremental CEs were applied to the grown inventory, to determine emission reduction benefits from the New Jersey rules, relative to the existing rules. These benefits grow in future years in direct relation to the growth factor for the respective emission categories. The equation that was used to project emissions in a future year, y, incorporating growth and the application of new control measures between year x and year y is:

$$E_{yr\,y\,c} = E_{yr\,x\,c} * GF_{x-y} * [1 - (CE * RE * RP)_{x-y}]$$

where: E_{yryc} = Controlled emissions in year y
E_{yrxc} = Controlled emissions in year x
GF_{x-y} = Growth factor used to grow emissions from year x to year y

CE = Incremental control efficiency factor for a control measure implemented between years X and Y
RE = Rule Effectiveness Factor
RP = Rule Penetration Factor

As required by the USEPA, a default RE value of 80 percent was used for all categories. The rule penetration factors were assumed to be 100 percent.

The adopted control measures (on the books) and control measures anticipated to be adopted (beyond on the way), which affect the area source sector are shown in Table E5.

<u>Table E5</u>: Area Source Control Measures

Control Measures	Sector	Pollutant	Area Source Category
Pre-2002 with benefits achieved Post-2002, Federal, On the Books			
Residential Woodstove NSPS	Area	VOC, NO_x, CO	Residential Wood Combustion
Post-2002 New Jersey On the Books			
Consumer Products 2005	Area	VOC	Consumer Products
Architectural Coatings 2005	Area	VOC	Architectural coatings, Traffic paints, High performance maintenance coatings, Other special purpose coatings
Portable Fuel Containers 2005	Area and Nonroad	VOC	Portable Fuel Containers
Mobile Equipment Repair and Refinishing	Area	VOC	Auto Body Refinishing
Solvent Cleaning	Point and Area	VOC	Degreasing
NO_x RACT rule 2005	Point and Area	NO_x	Industrial and Commercial Fuel Combustion
Stage I and Stage II (Gasoline Transfer Operations)	Area	VOC	Balanced submerged filling
Post-2002, New Jersey, Beyond on the Way			
Consumer Products 2009	Area	VOC	Consumer Products
Portable Fuel Container Amendments	Area and Nonroad	VOC	Portable Fuel Containers
Cutback and Emulsified Asphalt	Area	VOC	Cutback and Emulsified Asphalts
Adhesives and Sealants	Area and Point	VOC	Industrial Adhesives
Petroleum Storage Tanks	Point and Area	VOC	All reductions incorporated in point sources

A more detailed discussion of each of the control measures is included in Chapter 4. A discussion of the control measure control factors is included below.

Control Factors

Residential Woodstove NSPS

See Residential Wood Combustion discussion above under Growth.

Consumer Products

As discussed in the NJDEP rule proposal at 35 N.J.R. 4241(b), and two reports referenced in the rule proposal, "Control Measure Development Support Analysis of Ozone Transport Commission Model Rules", prepared by E.H. Pechan & Associates, dated March 31, 2001 (Pechan Report 2001), and the NJDEP report "Estimated VOC Emission Reductions and Economic Impact Analysis for Proposed Amendments to Chemically Formulated Consumer Products" dated July 3, 2003, it is estimated that the NJDEP 2005 consumer products rule will achieve an overall 14.2 percent VOC emission reduction of the total consumer products VOC emission inventory, beyond the current USEPA national rule. This is a reduction of approximately 32 percent for the categories being regulated, however, the entire consumer products inventory is not being regulated.

A CE of 0.142 has been applied to the 2008 grown emissions inventory for commercial and consumer solvent use. As required by the USEPA, a default RE value of 80 percent was used for all categories. The rule penetration factors were assumed to be 100 percent.

As discussed in the "MARAMA Development of Emission Projections for 2009, 2012, 2018, for Non-EGU Point, Area, and Non-Road Sources In the MANE-VU Region", prepared by MACTEC Federal Programs, Inc., dated February 28, 2007 (MACTEC Mid-Atlantic Regional Air Management Association (MARAMA) Report 2007), it is estimated that the NJDEP anticipated 2009 amendments to the consumer products rule will achieve an additional overall 2.0 percent VOC emission reduction of the total consumer products VOC emission inventory, beyond the current USEPA national rule and NJDEP 2005 rule.

A CE of 0.02 has been applied to the 2009 grown emissions inventory for commercial and consumer solvent use. As required by the USEPA, a default RE value of 80 percent was used for all categories. The rule penetration factors were assumed to be 100 percent.

Architectural Coatings (Architectural Coatings, Traffic Paints, High Performance Maintenance Coatings, Other Special Purpose Coatings)

As discussed in the rule proposal at 35 N.J.R. 2983(a), and two reports referenced in the rule proposal, the Pechan Report 2001 and the NJDEP report "Estimated VOC Emission Reductions and Economic Impact Analysis for Proposed Amendments to Architectural Coatings" dated June 12, 2003, it is estimated that the New Jersey architectural coatings rule will achieve an overall 31 percent VOC emission reduction, beyond the current USEPA national rule. The area source categories included in the calculations are:

architectural surface coatings, traffic paints, high performance maintenance coatings and other special purpose coatings.

A CE of 0.31 has been applied to the 2008 grown emissions inventory for architectural surface coatings, traffic paints, high performance maintenance coatings and other special purpose coatings. As required by the USEPA, a default RE value of 80 percent was used for all categories. The rule penetration factors were assumed to be 100 percent.

Portable Fuel Containers (PFCs)

Emissions from portable fuel containers are generated from the area source sector and the nonroad sector. As discussed in the rule proposal at 35 N.J.R. 4241(b), and two reports referenced in the rule proposal, the Pechan Report 2001 and the NJDEP report "Estimated VOC Emission Reductions and Economic Impact Analysis for Proposed Portable Fuel Containers Rule" dated July 3, 2003, it was estimated that VOC emissions from the NJDEP 2005 portable fuel containers rule will be reduced by approximately 73 percent of total uncontrolled emissions, once the new rule is fully effective. Based on new data discussed in the "California Air Resources Board Staff Report Initial Statement of Reasons for Proposed Amendments to the Portable Fuel Container Regulations", dated July 29, 2005, the estimated reduction has been reduced to 65 percent. As discussed in the MACTEC MARAMA Report 2007, the anticipated amendments to the portable fuel container rule are anticipated to achieve an additional 58 percent reduction, once the amendments are fully effective. It is estimated that it will take 10 years to turnover the portable fuel containers population.

The incremental CE for each range of projection years was calculated as follows:

PFC Rule 2005:

CE x-y = [1-(0.65 * (year x - 2005)/10)] - [1-(0.65 * (year y- 2005)/10)] /
[1-(0.65 * (year x- 2005)/10)]

where: CE = Incremental control efficiency factor for a control
measure implemented between years X and Y

Anticipated PFC rule amendments:

CE x-y = [1-(0.58 * (year x - 2008)/10)] - [1-(0.65 * (year y- 2008)/10)] /
[1-(0.65 * (year x- 2008)/10)]

where: CE = Incremental control efficiency factor for a control
measure implemented between years X and Y

Total Control Efficiency:

CE x-y = [100-((100-(100*CE1))-(100-(100*CE1)))*CE2)]/100 where: CE = Incremental control efficiency factor for a control measure implemented between years X and Y

As required by the USEPA, a default RE value of 80 percent was used for all categories. The rule penetration factors were assumed to be 100 percent.

Mobile Equipment Repair and Refinishing (Autobody refinishing)

According to the Pechan Report 2001, it is estimated that the new rule will achieve a 38 percent reduction in VOC emissions. This estimate includes a 35 percent reduction from the use of high transfer efficiency spray guns or equivalent equipment and another 3 percent from the use of enclosed spray gun cleaners.

A CE of 0.35 has been applied to the 2008 grown emissions inventory for painting operations and 0.03 for cleaning operations. As required by the USEPA, a default RE value of 80 percent was used for all categories. The rule penetration factors were assumed to be 100 percent.

Solvent Cleaning (Degreasing)

According to the Pechan Report 2001, it is estimated that the new rule will achieve a 66 percent VOC emission reduction. New Jersey's previous solvent cleaning operations rule achieves a 60 percent reduction of solvent cleaning operations VOC emissions. Therefore, the new rule will achieve an additional 6 percent VOC emission reduction, from the uncontrolled level, or an additional 16.7 percent emission reduction of the existing controlled emissions in New Jersey.

A CE of 0.167 has been applied to the 2008 grown emissions inventory for degreasing operations. As required by the USEPA, a default RE value of 80 percent was used for all categories. The rule penetration factors were assumed to be 100 percent.

Gasoline Transfer Operations
Balanced Submerged Filling (Stage I Vapor Recovery)

The CE was calculated for balanced submerged filling (or Stage I) as shown below and as discussed in the rule proposal support document, “NJDEP Economic Impact Analysis and Estimated VOC Emission reductions for Proposed amendments to the Gasoline Transfer Operation Provisions at New Jersey Administrative Code (N.J.A.C.) 7:27-16.3” dated March 28, 2002.

The adopted 2003 amendments increase the efficiency of the Stage I vapor recovery system from 90% to 98%. Using 7.6 lbs/1000 gallons for uncontrolled conditions (California Air Regulations Board (CARB) Enhanced Vapor Recovery Initial Statement of Reasons for Proposed Amendments to the Vapor Recovery Certification and Test

Procedures for Gasoline Loading and Motor Vehicle Gasoline Refueling at Service Stations, Appendix D, February 4, 2000), the emission factors are calculated as follows:

At 90% efficiency: (7.6 lb/1000 gal) x (1.00 - 0.90) = 0.76 lbs/1000 gallons

At 98% efficiency: (7.6 lb/1000 gal) x (1.00 - 0.98) = 0.152 lbs/1000 gallons

Therefore, the emission reduction is: ((0.76-0.152)/0.76)*100= 80%

And the CE = 0.80

As required by the USEPA, a default RE value of 80 percent was used for all categories. The rule penetration factors were assumed to be 100 percent.

Gasoline Transfer Operations
Gasoline Refueling (Stage II Vapor Recovery)

The emissions and benefits from gasoline refueling or Stage II vapor recovery were calculated using the USEPA MOBILE6 model. For the New Jersey 2002 inventory, the emissions and benefits are included in the onroad sector of the inventory, although previously were included in the area sector. For the New Jersey modeling inventory, the emissions are included in the area sector. The control efficiencies used in the model are as discussed in the rule proposal support document, “NJDEP Economic Impact Analysis and Estimated VOC Emission reductions for Proposed amendments to the Gasoline Transfer Operation Provisions at N.J.A.C. 7:27-16.3” dated March 28, 2002. They are as follows: 86 % with annual inspections; 62% less frequent inspections; in accordance with the “EPA Technical Guidance-Stage II Vapor Recovery Systems for Control of Vehicle Refueling Emissions at Gasoline Dispensing Facilities, Volume I, page 4-50”.

Therefore, an efficiency of 62% was used for 2002 emissions, prior to the rule amendments and an efficiency of 86% was used in the MOBILE6 model for future year emissions after the rule amendments adopted in 2003.

NO_x RACT Rule 2006

Estimated emission reductions from the New Jersey 2005 amendments to Subchapter 19 “Additional NO_x controls” were calculated as shown in the March 31, 2001 “Control Measure Development Support Analysis of Ozone Transport Commission Model Rules” prepared by E.H. Pechan. Also, additional reductions were estimated from annual tune-ups for boilers, as discussed in the New Jersey rule proposal dated September 20, 2004. Emission reductions used in the modeling for these tune-ups are shown in the February 28, 2007 “OTC Identification and Evaluation of Candidate Control Measures Final Technical Support Document” prepared by MACTEC. The New Jersey rule proposal estimated a 25 percent reduction to the area source inventory as a result of the tune-up for boilers. The MACTEC OTC Report 2007 applied this reduction to the area source inventory to estimate area source reductions from the rule.

Therefore, a CE of 0.25 has been applied to the 2008 grown emissions inventory for industrial and commercial fuel combustion. As required by the USEPA, a default RE value of 80 percent was used for all categories. The rule penetration factors were assumed to be 100 percent.

Asphalt Paving (Cutback and Emulsified Asphalt)

As discussed in the "OTC Identification and Evaluation of Candidate Control Measures Final Technical Support Document," prepared by MACTEC, dated February 28, 2007, (MACTECH OTC Report 2007) it is estimated that the NJDEP anticipated amendments to the cutback and emulsified asphalt rule will achieve a 100 percent reduction of the cutback asphalt VOC emissions inventory and a 97 percent reduction of the emulsified asphalt VOC emissions inventory. The baseline VOC content used for emulsified asphalt in the NJDEP 2002 emissions inventory is 8 percent. The anticipated rule proposal will require approximately 0.25 percent.

A CE of 1.0 has been applied to the 2009 grown emissions inventory for cutback asphalt. A CE of 0.97 has been applied to the 2009 grown emissions inventory for emulsified asphalt. As required by the USEPA, a default RE value of 80 percent was used for all categories. The rule penetration factors were assumed to be 100 percent.

Adhesives and Sealants

As discussed in the MACTEC MARAMA Report 2007, it is estimated that the NJDEP anticipated rule for adhesives and sealants will achieve a 64.4 percent reduction of the adhesives and sealants VOC emissions inventory. The estimates are based on calculations done by CARB in their "Determination of Reasonably Available Control Technology (RACT) and Best Available Retrofit Control technology (BARCT) for Adhesives and Sealants" dated December 1998. As shown in the NJDEP 2002 Periodic Emission inventory dated May 2006, [5] NJDEP used CARB assumptions to calculate estimated emissions, in order to be consistent with the CARB data.

A CE of 0.64 has been applied to the 2009 grown emissions inventory for adhesives and sealants. As required by the USEPA, a default RE value of 80 percent was used for all categories. The rule penetration factors were assumed to be 100 percent.

3.3 Projected Emission Inventory

The projected emissions inventories for the years 2002, 2008 and 2009 for VOCs and NO_x by SCC, for each county, nonattainment area and statewide are included in Attachments 2-2 and 2-3, respectively. The gasoline refueling (Stage II) emissions are included in the onroad section.

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[5] ibid.

4.0 Nonroad Sources

The nonroad source component of the 2002, 2008 and 2009 emission inventories are estimates of emissions from all engines used in construction, commerce, maintenance, and transportation equipment that do not operate on roads. This inventory is divided into four subcomponents: nonroad modeled sector, aircraft, locomotives and commercial marine vessels. The methodologies used to calculate these inventories are described below.

A. Nonroad Emissions Equipment Model (NNEM) Nonroad Equipment Sector

The Nonroad Emissions Equipment Model (NNEM), Version 2005c, March 21, 2006 was used to calculate past and future emission inventories for all nonroad equipment categories except commercial marine vessels, locomotives, and aircraft. The NNEM includes more than eighty basic and two hundred sixty specific types of nonroad equipment, which are categorized by equipment types, horsepower rating and fuel. Fuel types include gasoline, diesel, compressed natural gas, and liquefied petroleum gas (LPG). This categorization allows the NNEM to determine the phase-in of new emission standards and other aspects of emissions including allocations by application, fuel type or power level.

The NNEM incorporates exhaust and evaporative standards for recreational equipment and large spark ignition (SI) engines that were published in the Federal Register in November 2002. Additionally, it includes the benefits of the 2004 Nonroad Diesel Rule and the benefits of small gasoline engine standards through Phase 2. A detailed description of nonroad measures is provided in Chapter 4.

i. Human Population Data

The NNEM contains default human population data; however, the NJDEP utilized user-inputted state- specific 2002 human population data for New Jersey. The human population data is the same as those used by the metropolitan planning organizations in their travel demand models to calculate onroad sector emissions. For certain SCCs, human population is used in the NNEM to estimate equipment activity levels.

Parameters inputted into the NNEM model to calculate the nonroad emissions inventories for a typical summer weekday are shown in Table E5.

Table E5: Scenario Specific Parameters Used in the NNEM

	2002 Controls (Used for 2002 run and 2008/9 runs with 2002 controls)	2008/9 Controls
Fuel RVP (psi)(1)	6.77	6.77
Fuel Oxygen weight %	2.12(1)	3.5(2)
Gasoline Sulfur %	0.0103(1)	0.0043(3)
Diesel Sulfur %	0.308(4)	0.0330(5)
Marine Diesel Sulfur %(5)	0.2918	0.0445
CNG/LPG Sulfur %(1)	0.003	0.003
Minimum Temperature(6)	66.3	66.3
Maximum Temperature(6)	82.9	82.9
Average Ambient Temperature(6)	74.90	74.90
Altitude of Region	LOW	LOW
Stage II Control	0.0	0.0

(1) Gasoline parameters for the summer reid vapor pressure (RVP), oxygen and sulfur levels were obtained from the USEPA survey data for New Jersey.
(2) User's Guide to MOBILE6.1 and MOBILE6.2, Mobile Source Emission Factor Model, EPA420-R-03-010, Section 2.8.10.4, Oxygenated Fuels Program, pg 158, USEPA, August 2003
(3) Technical Guidance on the Use of MOBILE6.2 for Emission Inventory Preparation, EPA420-R-04-013, Section 5.5.3, page 64, August 2004
(4) Diesel sulfur for nonroad fuel was obtained from: "Draft Regulatory Impact Analysis: Control of Emissions from Non-road Diesel Engines' Section 7.1.4.2 (USEPA 420-R-03-008 April 2003). The average value for Petroleum Administration for Defense District 1 (3384 parts per million (ppm)) was combined with a 10 % contribution for the spillover of highway diesel fuel (340 ppm) to nonroad equipment.
(5) Diesel sulfur for nonroad fuel was obtained from: Final Regulatory Analysis: Control of Emissions from Non-Road Diesel Engines, EPA420-R-04-007, May 2004, pg 7-78, Table 7.1.6-6, Annual Distillate Fuel Demand and Sulfur Content: Final NRLM Rule: U.S. minus AK and HI (million gallons and ppm). The average value with consideration of highway spillover and small refiner fuel and the final Nonroad Locomotive and Marine Rule for the U.S. minus Alaska and Hawaii is represented as 330 ppm for 2008 and 2009.
(6) Normal daily max/min temperatures and normal dry bulb temperatures were obtained from the National Oceanic and Atmospheric Administration, Local Climatological Data for 2002. Values from airports in Newark, Allentown PA, Philadelphia PA, and Atlantic City were used to represent the counties within the respective air quality areas. Statewide values were the averages for the 21 counties.

The NNEM contains default equipment population data. The default equipment population values were used except for the population of airport ground support equipment (GSE).

ii. Airport Ground Support Equipment (GSE) Population

An actual population inventory of GSE for Newark Liberty International Airport (NLIA) was used to estimate projected emissions from nonroad GSE statewide. The equipment population was used to generate emissions values using the NNEM. Use of this approach is believed to enhance the accuracy of the inventory since it is based upon an actual equipment count for the largest airport operation within the state. Although 2002 ground support equipment population data were requested, the Port Authority of New York and New Jersey (Port Authority) submitted population data for 2003. The Port Authority indicated that any differences between the 2002 and 2003 population were minimal.

The NLIA GSE inventory was also used to calculate GSE population for other airports in the state. In order to estimate the amount of ground support equipment at other major New Jersey airports, for which the NJDEP lacks specific data, scaling factors were calculated. The scaling factors were calculated by comparing the number of air carrier (commercial) and air taxi aircraft landing and take-off operation (LTOs) for NLIA, as reported by the Federal Aviation Administration, to the number of these aircraft LTOs for each major airport in Atlantic, Essex, Burlington, Mercer, Bergen and Morris counties. These LTOs are shown in Table E7 below. The scaling factor for each airport was then applied to the NLIA GSE population data and the resultant new population data for each airport was combined with the NLIA data to determine the total statewide GSE population. The statewide GSE population was input into the NNEM model to generate statewide emissions. The GSE population for both the NLIA and the entire State are presented in Table E6 stratified by NNEM equipment types, horsepower rating and fuel.

Table E6: GSE Population for NLIA and the State of New Jersey

SCC CODE	Fuel	Max Horse Power	NLIA Population	NJ Population
2265008005	4-Stroke Gasoline	16	60	83
2265008005	4-Stroke Gasoline	75	320	441
2265008005	4-Stroke Gasoline	100	40	55
2265008005	4-Stroke Gasoline	175	1690	2327
2267008005	Liquid Petroleum Gas	75	80	110
2267008005	Liquid Petroleum Gas	175	30	41
2270008005	Diesel	16	300	413
2270008005	Diesel	75	10	14
2270008005	Diesel	100	274	377
2270008005	Diesel	175	436	600
2270008005	Diesel	300	140	193
2270008005	Diesel	600	200	275
2270008005	Diesel	750	150	207
TOTAL NUMBER OF GSE			**3,730**	**5,136**

The emissions generated from the state level GSE population included in the table above were allocated to the county level by inputting LTOs into the NMEM model for each of the six counties shown in Table E7.

<u>Table E7</u>: County Level LTOs Used in the NNEM

COUNTY	AIR CARRIERS	AIR TAXI	TOTAL LTO's
ATLANTIC	7,038	4,364	11,402
BERGEN	3	39,571	39,574
BURLINGTON(1)	2,396	5,694	8,090
ESSEX	141,374	88,052	229,426
MERCER	5	3,547	3,552
MORRIS	0	5,500	5,500
OCEAN(1)	0	18,341	18,341
TOTAL STATE	**150,816**	**165,069**	**315,885**

(1) The air taxi category constitutes military aircraft LTO for Burlington County from McGuire Air Force Base and for Ocean County from the Naval Air Station at Lakehurst.

B. Locomotive Emissions

Locomotive emissions are based on the estimated fuel consumption of individual railroad systems operating in New Jersey. The NJDEP received specific fuel use data from many short line freight and commuter railroads. An estimation of fuel consumption based on gross tons-miles (tons of freight multiplied by the miles traveled) and a fuel consumption index (gross ton-miles per gallon of fuel) was prepared for those railroads that did not submit statewide fuel data. For example, the larger freight haul operations, i.e., CSX and Norfolk Southern, reported nationwide fuel use and national and statewide gross ton miles from which a state fuel index was obtained to calculate state and county level fuel use. Specifics on the equations used for the calculation of these emissions, other assumptions, and references for data can be found in the calculation sheet for locomotives included in the 2002 Periodic Emission Inventory.

C. Commercial Marine Vessel Emissions

Commercial Marine Vessel emissions were taken from the Commercial Marine Vessel Emissions Inventory Report prepared by the Starcrest Consulting Group, LLC (Starcrest Report).[6] This inventory was prepared as a part of the New York Harbor Deepening Project. The Starcrest Report relied on actual operational data, to the extent such information was available, and then used local activity parameters to extend emission estimates to those portions not directly inventoried. Actual operational data were obtained from extensive interviews with vessel operators, crew, pilots, and the United States Coast Guard's vessel traffic system that tracks oceangoing commercial marine vessels from points of origin and destination. From this information emission estimates were prepared based on estimated horsepower demand.

Commercial marine vessel emissions for the southern New Jersey area were estimated using fuel purchases for diesel and residual fuels and the number of trips of self propelled

[6] StarCrest. The New York, Northern New Jersey, Long Island Nonattainment Area Commercial Marine Vessel Emissions Inventory, Volume 1-Report. StarCrest Consulting Group, LLC, April 2003.

vessels along the Delaware River. Emissions on the Delaware River were split between Pennsylvania and New Jersey by assuming that all northbound emissions were in New Jersey and all southbound emissions in Pennsylvania. This allocation process was agreed to by the two states as part of the 1990 emission inventory submittal. This fuel-based approach tends to overestimate commercial marine vessel emissions because some of the fuel purchased was used outside of the Delaware River. However, NJDEP did not have comprehensive information similar to the Starcrest Report for the Delaware River. Specifics on the equations used for the calculation of these emissions, other assumptions, and references for data can be found in the calculation sheet for Commercial Marine Vessel Emissions included in the 2002 Periodic Emission Inventory.

D. Aircraft Emissions

Aircraft emissions were calculated based on the number of landing and take-off operations (LTO) at each aircraft. The five major airports in New Jersey: Newark Liberty International, Teterboro, Morris Municipal, Mercer County and Atlantic City, and the two military airports: McGuire Air Force Base (AFB) and Naval Air Station (NAS) Lakehurst, supplied the NJDEP with their number of LTOs for each aircraft type and category. Aircraft type corresponded to a specific aircraft model and engine. In addition every aircraft type was categorized as either commercial air carrier, military, general aviation, or air taxi.

The LTO counts for each specific aircraft type were inputted into the Federal Aviation Agency (FAA) modeling tool called the Emissions and Dispersion Modeling System (EDMS) tool. This tool generated annual emissions for each of the five major airports for each aircraft category. However for McGuire AFB, the United States Air Force (USAF) supplied us with specific emission factors and activity data to determine their aircraft emissions at this base.[7]

USEPA default emission factors were applied to total LTO counts for all the other airports that operate in New Jersey including heliports. These airports did not submit any LTO activity data on specific aircraft types. NJDEP used the flight operations database that is maintained by the FAA on more then 3,000 US airports. A flight operation is defined as either a landing or a takeoff. Flight operations are converted to LTO by division by two. Once converted to LTOs, USEPA default emission factors were applied to estimate emissions generated at each of the small airports for each of the four aircraft categories. Specifics on the equations used for the calculation of these emissions, other assumptions, and references for data can be found in the calculation sheet for Aircraft Emissions included in the 2002 Periodic Emission Inventory.

E. Evaporative Spillage

Emissions from portable fuel containers are generated from the area source sector and the nonroad sector. Emission reductions were estimated for the New Jersey 2005 portable

[7] Air Emissions Inventory Guidance Document for Mobile Sources at Air Force Installations, US Air Force IERA, January 2002.

fuel containers rule using the methodology used by Pechan in their “Control Measure Development Support Analysis of Ozone Transport Commission Model Rules,” prepared by E.H. Pechan & Associates, and dated March 31, 2001. The emissions generated from portable fuel containers in the nonroad sector were calculated by first extracting the spillage and volume displacement emissions from the NMEN sector nonroad equipment that match the SCC codes in the methodology in the 2001 Pechan Report. Those applicable nonroad equipment types are expected to be fully or partially refueled utilizing portable fuel containers as indicated in the Pechan report. The anticipated percent of refueling by portable fuel containers is applied to the emissions, to result in a total emissions associated with portable fuel containers from the nonroad sector.

The rule control efficiency with a rule effectiveness factor of 80 % is then applied to the emissions. Control efficiencies used in the calculations are discussed above in the area source Attachment 2-3 of this appendix. The calculated benefits that resulted from this application for the 2009 projection year are: 1.33 tons per summer day VOC in the Northern New Jersey/New York/Connecticut nonattainment area and 0.54 tons per summer day VOC in the Southern New Jersey/Philadelphia nonattainment area.

The emission reductions for the anticipated portable fuel container amendments were obtained from the February 28, 2007 “OTC Identification and Evaluation of Candidate Control Measures Final Technical Support Document” prepared by MACTEC. The MACTEC report estimated statewide emission reductions of 0.3 tons per summer day VOC. Based on the New Jersey nonattainment area ratios calculated for the 2005 PFC rule, this would equate to approximately 0.2 tons per summer day VOC in the Northern New Jersey/New York/Connecticut nonattainment area and 0.1 tons per summer day in the Southern New Jersey/Philadelphia nonattainment area.

F. NNEM Growth

The NNEM model contains growth factors, which are based on the historical trends in nonroad equipment activity. Specifically, in developing this model, the USEPA analyzed historical engine population trends for many categories from the 2003 version of the Power Systems Research Parts Link database (PSR). This analysis consisted of calculating the total market sector populations, segregated by fuel type, for each year from 1996 through 2000. Extrapolating from a simple linear regression of these historical populations, the USEPA could project average annual growth factors for each market sector population and fuel type and incorporate this information into the model. The market sectors in this analysis were: airport service, construction, farm, industrial, lawn and garden, light commercial, logging, railway and recreational.

In some cases, however, the USEPA has used population data from a source other than PSR when such a source is available and found to be more accurate than the PSR data. For some types of equipment (e.g., all-terrain-vehicles (ATVs) and snowmobiles) NNEM uses equipment sales or population data from industry sources or state registration data.

The NNEM model grows nonroad equipment emissions to a specified episode year with all phased-in nonroad control measures applied to the end of the episode year unless the user specifies that a different year be used as the technology year to end all control measure phase-ins. This is an important feature of the updated 2005 version of the model because nonroad control measures usually phase-in over a certain number of years. This is unlike point and area sector control measures which are generally effective on a particular date.

Five projection runs with phased-in controls applied to the same episode year or other specified technology year have been conducted. Table E8 includes a description and the total emissions generated from these five runs (Runs 1-5) and the prior NNEM version 2003b run (Run A) conducted for the 2002 emission inventory.

TableE8: NNEM Runs Nonroad Equipment Sector
Summer Day Average Statewide Emissions – tons per day (tpd)

Run #	**File name**	**Episode Year** (Yr emissions grown)	**Technology Year** (Yr control measure phase-in ends)	**VOC**	**NO_x**
A		2002	2002	215.0	176.76
1	nj_counties_08c.xls	2008	2008	164.35	129.38
2	nj_counties_08nc.xls	2008	2002	233.05	156.18
3	nj_counties_09c.xls	2009	2009	154.91	124.32
4	nj_counties_09nc.xls	2009	2002	234.58	158.63
5	nj_counties_nnc09.xls	2009	2008	155.11	124.58

The entire outputs generated for each New Jersey county for the NMEN Runs # 1-5 are produced in Attachment 3-1 to this appendix in the five (5) files named in Table E8 above.

Two of the above five projection runs have a technology year of 2002 (Runs 2 and 4). These runs were conducted to demonstrate the effect of growth, if no new controls were applied after 2002, for the projection years 2008 (Run 2) and 2009 (Run 4). For example, the projected NMEN run nonroad sector VOC emissions would increase from 215.0 tpd in 2002 (Run A) to 234.58 tpd in 2009 (Run 4). Regarding NO_x emissions for this same period with no controls, there is an emission decrease from 176.76 to 158.63 tpd. The reason for this apparent negative growth in NO_x emissions is that the nonroad sector is associated with equipment that is used for many years. The slow turnover rate of some equipment results in a reduction in NO_x emissions because the fleet average emission rates are decreasing when 2002 technology equipment replaces pre-2002 equipment between 2002 and 2008/9.

Two of the above five projection runs have the same technology and episode years (Runs 1 and 3). These runs were conducted to determine controlled emissions from the phase-in of federal control measures from the base year 2002 (Run A) to the projection years 2008 (Run 1) and 2009 (Run 3). To accomplish this task, the NNEM technology year input was left unaltered so that control measure phase-ins would be effective to the conclusion of each projection year. This is in contrast to the uncontrolled NNEM Runs 2 and 4 discussed above. A technology year input of 2002 prevented the phase-in of new federal control measures for these runs.

Regarding controlled NO_x emissions, the NNEM generated 129.38 tpd for projection year 2008 (Run 1) and 124.32 tpd for projection year 2009 (Run 3) as indicated in Table 4 above. These controlled projection year emissions are subtracted from the uncontrolled NO_x emissions of 154.09 tpd for the projection year 2008 (Run 2) and 156.51 tpd for the projection year 2009 (Run 4). The NO_x emission benefits from the phase-in of all federal control measures are 24.09 tpd for the projection year 2008 and 32.19 tpd for the projection year 2009. The state control measure for PFCs was not considered since this measure only applies to VOC emissions. Regarding VOC emissions, the same approach was applied except that the state control measure for PFCs was considered. VOC emission benefits achieved from the phase-in of all federal and state control measures were 68.68 tpd for the year 2008 and 81.37 tpd for the projection year 2009.

The total nonroad projected emissions and control measure benefits achieved from the implementation of federal and state rules from the base year 2002 to the projection years 2008 and 2009 for Statewide, the New Jersey Portion of the Northern New Jersey/New York/Connecticut and the Southern New Jersey/Philadelphia nonattainment area are included respectively in Tables 6.1, 6.2 and 6.3 in the main document. These emissions and benefits also incorporate those achieved for the three (3) nonroad sources not included in the NNEM model (commercial marine vessels, locomotives and aircraft). A discussion of how these emissions were grown and benefits estimated is included in the following sections.

G. Aircraft Growth

LTO aircraft emission growth factors except for McGuire AFB and Lakehurst NAS were based on the FAA projected number of operations (operation is defined as either a take-off or landing at a particular facility.[8] The two military bases supplied their projected LTO counts for 2008 and 2009.[9,10] No control measures with any measurable emission reductions were identified for this category.

Specifics on the equations used for the calculation of these growth factors, other assumptions, and references for data can be found in Attachment 3-2 to this appendix.

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[8] FAA. APO Terminal Area Forecast Detail Report, Forecast Issued February 2006, Federal Aviation Administration (FAA), apo.data.faa.gov.

[9] Environmental Assessment East Coast Basing of C-17 Aircraft, Page 2-2, Table 2-1, Airfield Operations, NAES Lakehurst Landing Zone Alternative, October 2004.

[10] Personal email from Kimberlee McDonald, McGuire AFB, to Jim Koroniades, NJDEP, containing the spreadsheet, MAFB_Aircraft Ops_2005.xls, June 6, 2006.

H. Locomotive Growth

Locomotive emission growth is based on the annual quantity of fuel consumed by locomotives from the base year 2002 to the projection years 2008 and 2009.[11] On this basis emissions grew 9.2 % from the base year 2002 to the projection year 2009.

Locomotive emission control efficiencies were derived from fleet average emission factors for all locomotives.[12] These emission factors are based on the federal locomotive and locomotive engine rules discussed in Chapter 4. The control efficiencies developed from these emission factors are provided in Table E9.

Table E9: Locomotive Control Efficiencies Derived from USEPA Emission Factors

YEAR	VOC	NO_x
2002 to 2008	10.28 %	30.67 %
2008 to 2009	2.08 %	2.43 %

These control efficiencies were applied to uncontrolled locomotive emissions with a rule effectiveness factor of 80 percent. The calculated benefits that resulted from this application are included in Table E10.

Table E10: Locomotive Statewide Emission Benefits - Summer Day Average tons per day (tpd)

YEAR	VOC	NO_x
2002 to 2008	0.041	3.44
2002 to 2009	0.049	3.70

Specifics on the equations used for the calculation of these benefit emissions and growth factors, other assumptions, and references for data can be found in Attachment 3-3 to this appendix.

I. Commercial Marine Vessels (CMV)

Federal CMV rules were implemented in 1999 for two categories of commercial marine engines and a third category in 2004. These three categories encompass most commercial marine engines. From reference documents and conversations with the USEPA a general description of these three categories are as follows:

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[11] USEPA. Final Regulatory Analysis: Control of Emissions from Nonroad Diesel Engines, EPA420-R-04-007. USEPA, Office of Transportation and Air Quality (OTAG), Chapter 3: Emission Inventory, page 3-20, Table 3.1-6b, Baseline (50 State) Fuel Sulfur Levels, SO_2, Sulfate PM, and $PM_{2.5}$ Emissions for Locomotives and Commercial Marine Diesel Vessels.
[12] Emission Factors for Locomotives, EPA420-F-97-051, December 1997, Table 9, page 5.

Category 1: Harbor craft consisting of: 56 % assist tugs, 20 % tow boats, ferry and excursion vessels except for the Staten Island ferry and government vessels and category 2 auxiliary engines.[13,14,15]

Category 2: Harbor craft consisting of: 44 % assist tugs, 80 % tow boats and the Staten Island Ferry and category 3 auxiliary engines.[5, 6, 7]

Category 3: Ocean going vessel (OGV) comprising mainly bulk, car carrier, container, cruise vessels, ro-ro, tanker and miscellaneous vessels.[6, 7]

The rules themselves use a different system of categorization than indicated above. These rules base emission standards on engine cylinder displacement ratings. These ratings, however, do not correspond to the inventories developed for CMV emissions as described in this report. Therefore, the above general categorization was used to develop future projections of the 2002 emission inventories and the benefits achieved from the federal CMV rules. A more detailed discussion of the engine displacement ratings CMV categorizations and the rules themselves are provided in Chapter 4.

As part of the regulatory impact analysis (RIA) and results of benefit calculations for its CMV engine rules, the USEPA projected both future controlled and uncontrolled emissions for the three (3) different categories of CMV engines.[16,17]

The highest growth occurred for OGV category 3 engines emissions, which grow approximately 3 % every year for VOC and 2.7 % every year for NO_x emissions from the base year 2002 to the projection year 2009. Harbor craft category 1 and 2 engines experienced an annua1 growth of approximately 1 % during this same period.

The benefits achieved from the federal CMV implementation rules as determined from the RIA and the results of benefit of calculations as presented in Table E11.

[13] ICF. Current Methodologies and Best Practices in Preparing Port Emission Inventories, Final Report, page 26, Table 2-13: Average Engine Horsepower and Annual Hours of Operation (Port Of Los Angeles), ICF Consulting, January 5, 2006.

[14] Personal communication: Phone conversation with Penny Carey of USEPA confirming indicated categorization of Harbor craft and OGV, February 15, 2007.

[15] Starcrest. The New York, Northern New Jersey, Long Island Nonattainment Area Commercial Marine Vessel Emissions Inventory, Volume 3 – Appendices F&G. The Port Authority of New York and New Jersey, Starcrest Consulting Group, LLC, April 2003.

[16] Personal communication: Fax from David Brzezinski, Results of Benefit Calculations for the 1999 RIA Commercial Marine Inventories, February 3, 2007.

[17]USEPA. Final Regulatory Impact Analysis: Control of Emissions from Marine Diesel Engines, EPA420-R-03-004, Table 7.2-1, Projected Emission Inventories from Category 3 Marine Diesel Engines in Port Areas (short tons). United States Environmental Protection Agency, January 2003.

Table E11: CMV Statewide Emission Benefits - Summer Day Average Emissions – tons per day (tpd)

YEAR	VOC	NO_x
2002 to 2008	0.018	1.47
2002 to 2009	0.022	1.86

Specifics on the equations used for the calculation of these benefit emissions and growth factors, other assumptions, and references for data can be found in the calculation sheet for commercial Marine Vessel Projection Emissions included in Attachment 3-4.

4.1 Projected Emission Inventory

The projected emissions inventories for the years 2002, 2008 and 2009 for VOCs and NO_x by SCC, for each county, nonattainment area and statewide are included in Attachments 3-5 and 3-6.

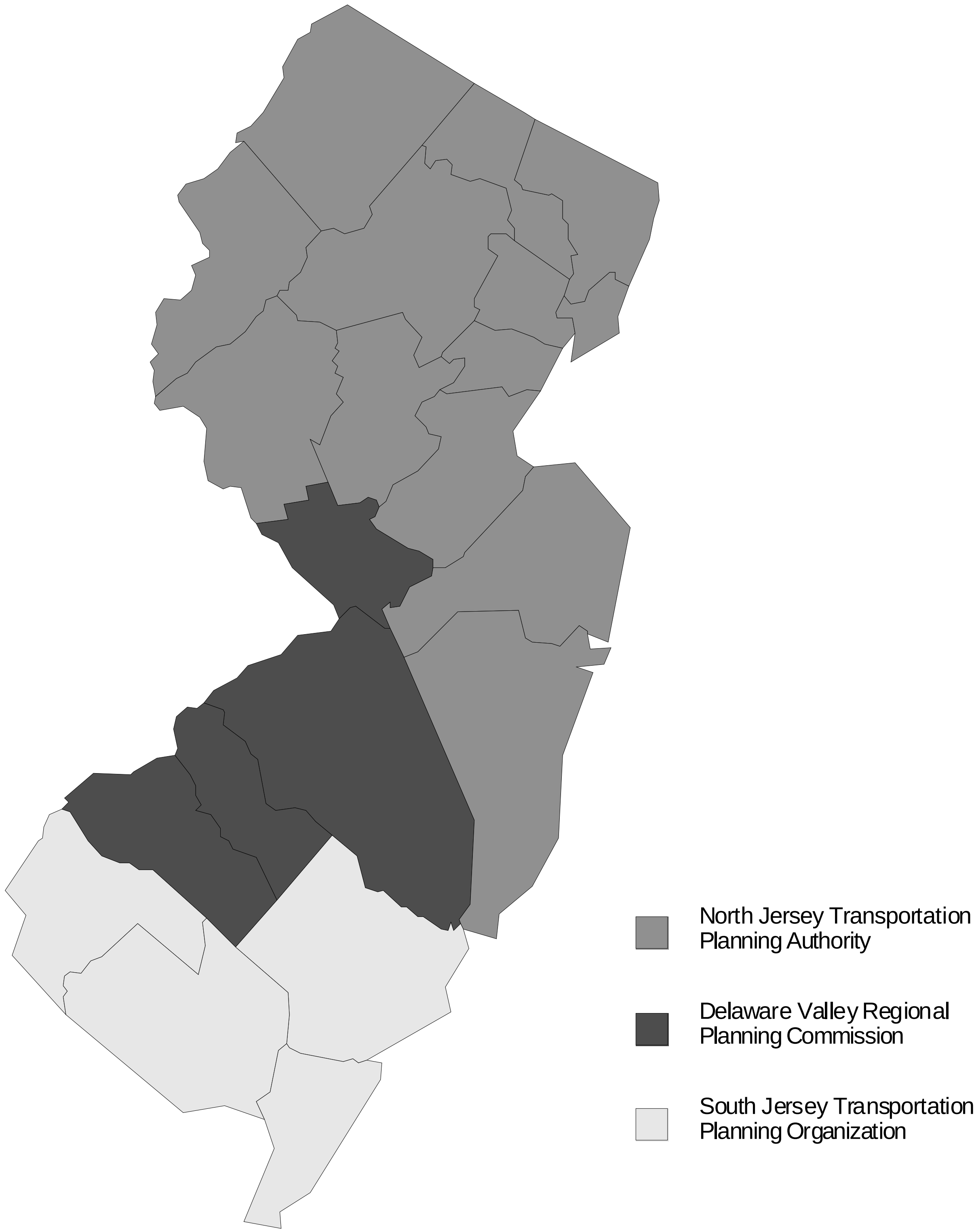
5.0 Onroad Sources

The onroad source component of the 2002, 2008 and 2009 emission inventories are estimates of exhaust (i.e., tailpipe) emissions and fuel evaporative emissions from all vehicles (both gasoline and diesel-fueled) operating on New Jersey roadways. In general, the emissions from this component of the inventories are calculated by multiplying an activity level by an emission factor. In the case of onroad mobile sources, the activity level is daily vehicle miles traveled (DVMT). The emission factors are calculated using the latest version of the USEPA MOBILE computer model.

A. Daily Vehicle Miles Traveled

The DVMT used in the emission inventories were calculated with the travel demand models (TDMs) used by the three Metropolitan Planning Organizations (MPOs) in the State. Metropolitan Planning Organizations are charged with developing transportation plans and programs that promote the safe and efficient management, operation, and development of transportation systems while minimizing fuel consumption and air pollution. The three MPOs with jurisdiction in New Jersey are the North Jersey Transportation Planning Authority (NJTPA), the Delaware Valley Regional Planning Commission (DVRPC) and the South Jersey Transportation Planning Organization (SJTPO). Figure E1 is a map showing the counties included in each of the three Metropolitan Planning Organizations.

<u>Figure E1</u>: Metropolitan Planning Organizations in New Jersey



In general, the TDMs use demographic data, such as population, employment, housing density, and shopping patterns, to estimate the demand for travel in the modeled area. This travel demand is then distributed throughout the available roadways and transit routes, referred to as links. The model is based on an algorithm which takes into account factors such as transit fares, tolls, traffic volume, and time of day to estimate how many people travel from one point to another on any given link. The number of vehicles traveling on each link is then used to estimate the speed of travel and the total number of vehicle miles traveled in a day. The TDM output is adjusted for any vehicle miles traveled that are not accounted for in the model, such as reductions due to transportation control measures or increases due to local roadway traffic.

B. SJTPO and NJTPA DVMT Calculations

The current South Jersey Travel Demand Model (SJTDM) was validated for the year 2000. The comparisons between estimated and observed DVMT by facility type were within a range of 104 %-157%.

The North Jersey Model is currently being updated. The model is validated for the year 2000. All major tasks that were required for the development of the new model, the North Jersey Regional Transportation Model Enhanced (NJRTME), have been completed. However there is still an on-going effort to perform minor refinements in order to improve the validation results. In the most current version of NJRTME available at the time this report was prepared, the model estimated DVMT was approximately 99.6 % of the regional observed DVMT. The comparisons between estimated and observed DVMT by major facility types (major arterials and higher) were approximately within a range of 90% to 115%.

For the purpose of emissions analyses, Highway Performance Monitoring System (HPMS) adjustment files for 2002 were created to account for DVMT of the non-modeled roads within the MPO region. The HPMS adjustment files simply offset the difference between model DVMT and the regional DVMT data collected by the HPMS.

Traffic at the South Jersey Transportation Planning Organization and North Jersey Transportation Planning Authority boundaries was established via observed count data for the validation year. Since each Metropolitan Planning Organization utilizes the same New Jersey Department of Transportation database for traffic counts to set boundary volumes, these estimates should be generally consistent. A minor variation in estimates could occur if an observed count was not available at the exact “border” link between two models.

The SJTDM chain contains a “temporal” module that factors the validated model analysis day to the desired summer analysis day for emissions purposes. The factors are based on month-to-month as well as day-to-day variations for each trip purpose. The factors were calculated from traffic counts and household travel surveys.

The NJRTM DVMT for emission analysis was adjusted into two seasons (summer and winter). The adjustment factors were developed by first comparing model DVMT with the DVMT values from the Highway Performance Management System database, thus correcting for any variation between the annual average daily traffic volumes. A second adjustment addresses seasonal variation using seasonal factors by both facility and county. This results in two seasonal adjustment files (winter and summer) that are used in the emissions forecasting process.

The emission estimates include all DVMT within the model region, including local "off-model" roadways. The entire State of New Jersey is covered by the summation of three Metropolitan Planning Organization models, so that the DVMT from the entire state is covered as part of the "modeled" DVMT.

The SJTDM contains two types of external trips (External-External, External-Internal) used to estimate DVMT from vehicles moving into and out of the Metropolitan Planning Organization regions. The external-external purpose represents trips that have both origin and destination outside of the modeled region. These trips are referred to as "*pass-through*" trips. The External-Internal trip purpose includes trips for which one of its trip "ends" is inside the model region while the other is outside of the region. The new NJRTME does not have an external trip model component, instead it extends the model coverage to include surrounding counties that serve as buffer to the NJTPA Region. The trips from these buffer counties to the NJTPA region are considered as the external trips to the region. The external trips can be External-to-External (E-E), External-to-Internal (E-I), or Internal-to-External (I-E) trips. The estimated and observed vehicle trips at major locations on the edge to the NJTPA boundaries (proxy for external trips) were compared. The vehicle trips at the edge of the respective Metropolitan Planning Organization models are obtained from observed counts provided by the New Jersey Department of Transportation and other agencies such as the Port Authority of New York and New Jersey, to help ensure traffic volume consistency at the boundaries between the Metropolitan Planning Organizations.

C. DVRPC DVMT Calculations

The DVRPC's travel demand model follows the traditional steps of trip generation, trip distribution, modal split, and traffic assignment. However, an iterative feedback loop is employed from traffic assignment to the trip distribution step. The feedback loop ensures that the congestion levels used by the model when determining trip origins and destinations are equivalent to those that result from the traffic assignment step. Additionally, the iterative model structure allows trip-making patterns to change in response to changes in traffic volumes, congestion levels, and improvements to the transportation system.

The DVRPC travel simulation process uses the Evans Algorithm to iterate the model. Evans re-executes trip distribution and modal split based on updated highway speeds after each iteration of highway assignment. This algorithm converges rapidly to the equilibrium solution on highway travel speeds and congestion levels. After equilibrium is achieved, the transit trip tables are assigned to the transit networks to produce link and route passenger volumes.

The DVRPC travel simulation models are segregated into separate peak, midday, and evening time periods. This segregation begins in trip generation where factors are used to separate daily trips into time-period specific travel. The enhanced process then utilizes separate model chains for peak, midday, and evening travel simulation runs. Time of day sensitive inputs to the models such as highway capacities and transit service levels are segregated to be reflective of time-period specific conditions. Capacity factors are used to allocate daily highway capacity to each time period.

The first step in the DVRPC modeling process involves generating the number of trips that are produced by, and destined for, each traffic zone and cordon station throughout the nine-county region. Internal trip generation is based on estimates of demographic and employment data, while external trips are derived from cordon line traffic counts. The latter also include trips that pass through the Delaware Valley region. Trip distribution is the process whereby the trip ends established in trip generation are linked together to form origin-destination patterns in trip table format. Peak, midday, and evening trip ends are distributed separately. The modal split model is also run separately for the peak, midday, and evening time periods. The modal split model calculates the fraction of each person-trip interchange in the trip table, which should be allocated to transit, and then assigns the residual to the highway side. The choice between highway and transit usage is made on the basis of comparative cost, travel time, frequency of service, and auto ownership. For highway trips, the final step in the focused simulation process is the assignment of current or future vehicle trips to the highway network. The assignment model is "capacity restrained" in that congestion levels are considered when determining the best route. After equilibrium is achieved, the transit trip tables are assigned to the transit network to produce link and route passenger volumes.

The DVRPC’s travel demand model was validated in 2000 for the 1997 base year and again in 2005 for 2000 conditions. Both of these validations included a comparison of simulated and counted traffic volumes at 355 locations that cross a series of 14 screenlines. For 1997 conditions, the simulated traffic volumes were 1.4 percent higher than the counted volumes, with an overall R^2 of 0.83, an acceptable correspondence. As part of the validation exercise, simulated transit ridership is also compared to passenger counts. These differences for the 1997 and 2000 validations were 6.1 percent and 4.0 percent, respectively.

DVMT estimates are output from the highway traffic assignment step of the model. The travel model's highway network includes all facilities with federal functional class of collector or higher. Some local roads are included in the highway network, but DVMT outputs must be adjusted to account for the local facilities that are not included. This adjustment is done at the county level based on the mileage of local roads that are missing and the average daily traffic volume of local roads in that county determined from available traffic counts.

Traffic volumes crossing the travel demand model boundary, or cordon, are controlled through an extensive traffic counting program. The DVRPC generally counts traffic at all of its cordon crossings every five years. Future year traffic volumes at cordon stations are projected by first extrapolating historical trends and then adjusting these trends to account for the long range population and employment forecasts in the counties surrounding the DVPRC region.

The DVRPC develops monthly and seasonal traffic variation factors that are derived from the Pennsylvania and New Jersey Departments of Transportation continuous traffic counting stations. These stations produce traffic volumes for every day of the year and are used to calculate monthly and seasonal factors by federal functional class. For emission modeling purposes, the 12 federal functional classes must be combined into the four functional classes used by MOBILE6. The DVRPC does this at the county level using a weighted average based upon county-level vehicle miles traveled by functional class from the Highway Performance Modeling System data.

D. MOBILE Model and Model Inputs

The USEPA MOBILE computer model estimates vehicle emission factors for ozone precursors. Over time, there have been several versions of the MOBILE model developed and released by the USEPA for use by the states in estimating emissions from onroad sources. The NJDEP used version MOBILE6.2.03 (hereafter referred to as MOBILE6) dated September 24, 2003 and officially released on May 19, 2004 (69 Fed. Reg. 28830 (May 19, 2004)) in developing the RFP inventories. A summary of the inputs used for MOBILE6 is provided in Table E12.

<u>Table E12</u>: MOBILE6 Run Setups for RFP

Measure	2002	2008	2009
New Vehicle Program	Northeast Low Emission Vehicle Program (NLEV)	NLEV	NJLEV without the Zero Emission Vehicle Program
Gasoline Oxygenate	Summer: 100% Methyl Tertiary Butyl Ether (MTBE) at 2.1%Oxygen Winter: 70% MTBE at 1.5%Oxygen and 30% Ethanol at 3.5%Oxygen	Summer and Winter: 100% Ethanol at 3.5%Oxygen	Summer and Winter: 100% Ethanol at 3.5%Oxygen
Gasoline Sulfur	Summer: 129ppm ave. and 1,000ppm max. Winter: 279ppm ave. and 1,000ppm max.	Summer and Winter: 30ppm ave. and 80ppm max.	Summer and Winter: 30ppm ave. and 80ppm max.
Gasoline Vapor Pressure[1] (RVP)	Summer: 6.7pounds per square inch (psi) Winter: 15psi	Summer: 6.8psi Winter: 15psi	Summer: 6.8psi Winter: 15psi
Stage 2 Refueling Effectiveness[2]	62%	86%	86%
Diesel Sulfur	340ppm	15ppm	15ppm
HDDV Rebuild Effectiveness[3]	14% (based on actual USEPA data)	90% (USEPA MOBILE6 Default)	90% (USEPA MOBILE6 Default)
Inspection and Maintenance Program	• Pre-81 LDGVs and all HDGVs idle test (no waiver) • 81 and newer LDGVs ASM exhaust test with initial cutpoints; 0.4% waiver • tech training • 71 and newer gas cap test • ATP: 75 and newer: - catalytic converter check - fuel inlet restrictor check - gas cap integrity check • biennial cycle • 98% compliance rate • I/M effectiveness: 94.6% for VOCs, 93.83% for CO and 85.4% for NO_x. (2002 actuals)	• Pre-81 LDGVs and all HDGVs idle test (no waiver) • 96 and newer LDGVs OBD exhaust and evap. test; 3% waiver • 81-95 LDGVs ASM exhaust test with initial cutpoints • tech training • 71 and newer gas cap test • ATP testing is same as 2002. • biennial cycle with 4 year grace period for new vehicles • 98% compliance rate • I/M effectiveness: 94% (100% for centralized (70%) and 80% for decentralized (30%))	• Same as 2008

1. No actual data for RVP winter gasoline in New Jersey could be found so this value was set at the maximum specification of 15 psi.
2. The MOBILE6 inputs for Stage 2 effectiveness has been set based on calculations performed pursuant to New Jersey rule amendments involving Stage 2 controls.
3. The 2002 inventory was developed using a MOBILE6 Rebuild Program effectiveness rate of 14% to reduce heavy-duty diesel vehicle NO_x off-cycle emissions. Recent national data on the actual numbers of chip reflashes being performed during engine rebuilds has indicated that the effectiveness of this program has been significantly less than the default MOBILE6 value of 90%. New Jersey has used an effectiveness rate of 14% for 2002 based on the USEPA program summary data reported as of March 31, 2003.

The emission factors calculated by the MOBILE6 model are dependent on a variety of data, including temperature, humidity, distribution of travel speeds, fuel type, vehicle age distribution, type of inspection and maintenance (I/M) program, and roadway type. The model is designed so that the user can input state-specific data for many of the variables that affect vehicle emissions. If state-specific data are unavailable, default values are also available for many of the inputs required for the model. The inputs are shown in the calculation files included in Attachment 4 to this Appendix. The model will estimate emission factors for any calendar year between 1952 and 2050, inclusive. The 25 most recent vehicle model years are considered to be in operation in each calendar year.

With regard to the State's I/M program, the NJDEP assumed for the 2002 inventory that New Jersey's I/M program consisted of seventy-four percent centralized facilities and twenty-six percent decentralized facilities in 2002. This assumption is based on data from the NJDEP's I/M program database. A detailed description of many of the specific I/M program inputs used for the 2002 inventory are documented in the November 2002 Revised Performance Standard Modeling State Implementation (SIP) Revision.[18] In addition, the NJDEP adjusted the I/M effectiveness values for VOC and NO_x from the performance standard values to account for the fact that ten percent of New Jersey's vehicles (i.e., those with non-switchable four wheel-drive or non-switchable traction control) receive a 2500 RPM exhaust emission test instead of an ASM5015 exhaust emission test. By adjusting the I/M effectiveness values to match the performance standard emission factors for the entire fleet (accounting for both the vehicles receiving the ASM 5015 test and the vehicles receiving the 2500 RPM test), the New Jersey I/M program was represented by one model run instead of a combination of two model runs. Also, an updated version of the vehicle registration information was used to develop the RFP inventories.

Maximum and minimum temperatures for specific counties were compiled from normal maximum/minimum temperatures reported for the Newark, Allentown, Philadelphia, and Atlantic City airports in the National Oceanic and Atmospheric Administration Local

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[18] NJDEP. Enhanced Inspection and Maintenance (I/M) Program for the State of New Jersey, Revised Performance Standard Modeling, SIP Revision. The State of New Jersey, Department of Environmental Protection, November 27, 2002.

Climatological Data for 2002. The calculation file from the USEPA MOBILE6 website was used to calculate absolute humidity using the normal dry bulb temperature, the average normal relative humidity and the average mean station pressure. The validity of the calculated absolute humidity was then checked by computing the corresponding relative humidity at the minimum temperature. If the resulting relative humidity exceeded 100% the absolute humidity was reduced until the relative humidity no longer exceeded 100% at the minimum temperature. Temperatures and absolute humidities were established for the average summer (June, July, and August) periods for use in the MOBILE6 runs to generate the RFP inventories.

E. South Jersey Transportation Planning Organization and North Jersey Transportation Planning Authority Emission Calculations

Both the South Jersey Transportation Planning Organization and the North Jersey Transportation Planning Authority use a computer model called PPSUITE to estimate emissions from onroad sources. PPSUITE is a group of computer programs that modifies and converts output data from the TDMs, generates MOBILE6 input files, and summarizes MOBILE6 output files, including the calculation of emission inventories using DVMT and emission factors. PPSUITE Version 5 was designed to be compatible with MOBILE6 and was the version used to develop the RFP emission inventories.

PPSUITE allows the user to perform adjustments to the raw outputs from the TDMs. In addition, PPSUITE calculates link capacities and speed distributions for each hour. Speeds are adjusted when roadways experience overcapacity situations (i.e., traffic jams). PPSUITE then combines the adjusted traffic activity data with the non-traffic-activity MOBILE6 input parameters (such as the I/M program description) to generate a MOBILE6 input file (this file is called M6input.in). A separate MOBILE6 run is performed for each county with separate scenarios for each roadway type. After MOBILE6 is run, PPSUITE multiples vehicle miles traveled by the MOBILE6 emission factors to produce emission inventory results. To accomplish this, PPSUITE uses the composite MOBILE6 emission factors from the MOBILE6 descriptive output.

The files used to generate the onroad source emission inventories for the North Jersey Transportation Planning Authority and the South Jersey Transportation Planning Organization are contained in Attachments 4-1 and 4-2, respectively.

F. Delaware Valley Regional Planning Commission Emission Calculations

The Delaware Valley Regional Planning Commission uses a slightly different process to calculate onroad emissions. First, the TDM is used to determine the highway/transit volumes and the resultant vehicle miles traveled inventory. Output from the TDM is input into a postprocessor along with speed curve data to generate MOBILE6 input files. The MOBILE6 input files consist of speed distribution files (*.sp files), vehicle miles traveled by facility files (*.fc files), and hourly vehicle miles traveled files (*.hr files) for each county. MOBILE6 is then run with each scenario representing a different county. Composite emission factors from the MOBILE6 descriptive output are combined with vehicle miles traveled data in a spreadsheet to calculate emission inventories by county. The files used to generate the 2002 onroad source emission inventory for the Delaware Valley Regional Planning Commission are contained in Attachment 4-3.

Emission Benefit Calculations

Emission benefits by nonattainment area were calculated for the following control measures: Federal Control measures in the latest MOBILE6 model, New Jersey Stage 2 controls since 2002, New Jersey gasoline vehicle I/M program changes since 2002 and the New Jersey Low Emission Vehicle program that begins with the 2009 model year.

Federal Control Measures for Onroad Vehicles

In order to calculate benefits for the Federal control measures since the 2002 base year it was necessary to generate an emissions estimate for the hypothetical case of 2002 controls and vehicle fleet with 2008/9 activity (vehicle miles traveled (VMT), speeds, etc.). This was accomplished by specifying 2002 as the calendar year in the MOBILE6 input along with all of the other 2002 inputs including I/M program, gasoline characteristics, vehicle age distributions, etc. except that the 2008/2009 activity levels (VMT, speeds, etc.) were used. The results of this run represent the "uncontrolled" onroad emissions that reflect solely the effect of growth from 2002. The emission benefits for the Federal and State control measures were calculated as the difference between the "uncontrolled" run and controlled run. The emission benefits for the Federal control measures were determined by subtracting the benefits of the State measures from the Federal/State emission benefit sum. This methodology was followed for both 2008 and 2009.

Gasoline Transfer Operations
Gasoline Refueling (Stage II Vapor Recovery)

The emissions and benefits from gasoline refueling or Stage II vapor recovery were calculated using the USEPA MOBILE6 model. For the New Jersey 2002 and subsequent year inventories, the emissions and benefits are included in the onroad sector of the inventory, although previously were included in the area sector. For the New Jersey modeling inventory, the emissions are included in the area sector. The control efficiencies used in the model are as discussed in the rule proposal support document, "NJDEP Economic Impact Analysis and Estimated VOC Emission reductions for Proposed amendments to the Gasoline Transfer Operation Provisions at N.J.A.C. 7:27-16.3" dated March 28, 2002. They are as follows: 86 % with annual inspections; 62% less frequent inspections; in accordance with the "EPA Technical Guidance-Stage II Vapor Recovery Systems for Control of Vehicle Refueling Emissions at Gasoline Dispensing Facilities, Volume I, page 4-50".

Therefore, an efficiency of 62% was used for 2002 emissions, prior to the rule amendments and an efficiency of 86% was used in the MOBILE6 model for future year emissions after the rule amendments were adopted in 2003.

New Jersey Gasoline I/M Program

The primary changes to the New Jersey I/M program for gasoline vehicles between 2002 and 2008/9 were the replacement of the ASM exhaust test with the on-board diagnostic (OBD) test for light duty gasoline vehicles and the addition of a four year grace period. The emission benefits for the changes to the New Jersey I/M program for gasoline vehicles between 2002 and 2008/9 were estimated by performing 2008/9 MOBILE6 runs with the 2002 I/M program. The difference between the emissions from these runs and the 2008/9 controlled runs represented the emission benefits for the New Jersey gasoline I/M program since 2002.

New Jersey Low Emission Vehicle (NJLEV) Program

The NJLEV program is projected to begin with the 2009 model year. According to direction from the USEPA, the NJDEP is allowed to claim SIP credit for the NJLEV program with the exception of the Zero Emission Vehicle (ZEV) component of the California program. In addition, emission benefits from the so-called “greenhouse gas amendments” to the California program, that have also been adopted by New Jersey, are not included in the emission benefits calculated here for the NJLEV program. The emission benefits for the NJLEV program were estimated by performing 2009 MOBILE6 runs without the NJLEV program (Federal Tier 2 only). The difference between the emissions from these runs and the 2009 controlled runs represented the emission benefits for the NJLEV program.

Summary of Onroad Inventory Data

Attachment 4-4 contains the detailed onroad emission inventory by county and SCC (vehicle type). This attachment also contains the emission benefits by nonattainment area for the following control measures: Federal Control measures in the MOBILE6 model, New Jersey Stage 2 controls since 2002, New Jersey gasoline vehicle I/M program changes since 2002 and the New Jersey Low Emission Vehicle program that begins with the 2009 model year.