Appendix VII
Onroad Inventories

1.0 On-road Sources

The onroad source components of the 2007, 2009 and 2025 fine particle ($PM_{2.5}$), oxides of nitrogen (NO_x) and sulfur dioxide (SO_2) annual emission inventories are estimates of exhaust (i.e., tailpipe) and brake/tire particle emissions from all onroad vehicles (gasoline, diesel and natural gas fueled) operating in the New Jersey counties within the maintenance area. In general, the emissions from this component of the emission inventory are calculated by multiplying activity levels (including vehicle starts, operation times, speeds and miles traveled) by emission factors. Activity estimates are generated by the Metropolitan Planning Organizations (MPO) using their travel demand models (TDM). The emissions are calculated using the latest version of the USEPA MOVES computer model (currently MOVES2010a Version 2010/08/26). The MOVES model is run in the inventory mode. A custom software package (PPSUITE), developed and licensed by AECOM, is used for the counties within the North Jersey Transportation Planning Authority (NJTPA) to preprocess the MOVES input data (including the TDM outputs), run MOVES, and post-process the emissions from the MOVES model including the generation of reports for the presentation of emission inventory results. For the counties within the Delaware Valley Regional Planning Commission (DVRPC), the MOVES County Data Manager are used to set up the MOVES runs and the MOVES summary reports are used to present the MOVES generated emissions.

1.1 Activity Estimates

The vehicle activity estimates used in these emission inventories were calculated with the TDMs used by the MPOs that cover the thirteen counties of concern in this $PM_{2.5}$ maintenance plan. The MPOs are the NJTPA and the DVRPC.

In general, 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 (DVMT). The TDM outputs are 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 (off-model) roadway traffic. Since the highway networks cover all thirteen counties in the two maintenance areas, there are no areas for which activity is not included. Attachment 1 presents the DVMT used for the 2007, 2009 and 2025 inventories.

1.1.1 NJTPA

The current North Jersey Regional Transportation Model Enhanced (NJRTM-E) was revalidated for the year 2008. The NJRTM-E estimated DVMT is approximately 101% of the regional observed DVMT. The comparisons between estimated and observed DVMT by facility type were within a range of 92% to 119%.

For the purpose of emissions analyses, Highway Performance Monitoring System (HPMS) adjustment files were created to account for the DVMT taking place on the non-modeled roads

within the MPO region. The HPMS adjustment files account for the differences between the model DVMT and the regional DVMT data collected by the HPMS.

The NJRTM-E DVMT was developed for each month. The monthly adjustment factors were developed by first comparing model DVMT with the DVMT values from the HPMS 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. The annual $PM_{2.5}$, NO_x and SO_2 inventories are calculated as the sum of emissions for all twelve months.

The NJRTM-E includes a large buffer area surrounding the NJTPA region; therefore, the only external trips considered were those by truck. The NJRTM-E contains three types of external truck trips (External-External, External-Internal, and External-Internal-External) used to estimate activity moving into and out of the NJTPA region.

- External-External truck trips: have both origin and destination outside of the modeled region and are commonly referred to as “pass-through” trips.
- External-Internal truck trips: have one trip “end” inside the model region while the other trip “end” is outside of the region.
- External-Internal-External truck trips: similar to external-external trips except they are routed through an intermediate truck terminal.

The truck trips at the edge of the respective Metropolitan Planning Organization models were estimated using observed counts and classification data 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.

1.1.2 DVRPC

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 the 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 demand model is segregated into separate peak, midday, and evening time periods. This segregation begins during trip generation when 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 DVRPC 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 includes trips that pass through the DVPRC region. Trip distribution is the process whereby the trip ends

established during 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 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 2008 for 2005 conditions. This validation included a comparison of simulated and counted traffic volumes at 480 locations that crossed a series of 15 screenlines and an outer cordon. As part of the validation exercise, simulated transit ridership was also compared to passenger counts. The total differences were 3.2 percent for highways and 4.4 percent for transit.

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.

2.0 MOVES Model Inputs

The NJDEP used the USEPA's recently released MOVES2010a (MOtor Vehicle Emission Simulator) to estimate air pollution emissions from onroad mobile sources including buses, cars, trucks and motorcycles. MOVES2010a replaces MOBILE6.2, the previous mobile source model. MOVES input files are somewhat more detailed than the MOBILE6.2 input files. To assist in the transition to the new model, USEPA developed software tools to convert MOBILE6.2 inputs for MOVES. In addition, the MOVES model includes a preprocessing tool called the County Data Manager (CDM) to convert spreadsheet-based information to tables in a MySQL database required by MOVES.

The MOVES input files that contain local (non-default) data are included in Attachment 2 and include:

- I/M Coverage
- Early NLEVs and MYLEVS Tables
- AgeDistribution
- AverageSpeedDistribution
- FuelSupply
- FuelFormulation
- MeteorologyData
- RampFraction
- RoadTypeDistribution
- SourceTypePopulation

- HPMSVTypeYear
- MonthVMTFraction
- DayVMTFraction
- HourVMTFraction

The development of each of these MOVES inputs is discussed in subsequent subsections.

2.1 I/M Coverage

General

- As a first step, all rows of data in the MOVES default tables for New Jersey counties for a given year need to be copied into the IMCoverage file and designated "N" in the "useIMyn" column. If this is not done MOVES will not run; error messages will be generated.
- It is necessary to develop a unique I/M input representation for each analysis year because the model years (MYs) that certain programs cover are a function of analysis year.
- The pollutant processes assumed to be covered by I/M from the MOVES default tables for New Jersey counties were used.
- The MOVES defaults included representations for both fuel type 1 (gasoline) and fuel type 5 (ethanol –anything greater than E10). In case appreciable amounts of E85 are assumed to be consumed in NJ in future years, the IM program representations for fuel type 1 were copied (added) for fuel type 5 for the 2013, 2014, 2015, 2017, 2020, and 2025 representations.
- No adjustments of the compliance factors for portions of vehicle types (such as certain vehicle weight ranges) that are exempt from I/M because this is not a significant factor for New Jersey. In some cases vehicles over 8500 lbs are subject to an idle test instead of the more stringent TSI or OBD test but MOVES does not allow the specification of more than one test for a given vehicle type/model year/pollutant process. Therefore, the most accurate MOVES input representation is to assume that, for a given model year range, the entire vehicle class receives the test that is administered to the majority of the vehicles in that class.
- The new vehicle exemption is 4 years for the 2007 and 2009 representations and 5 years for the 2013, 2014, 2015, 2017, 2020, and 2025 representations.

- IM Program ID's were established as summarized in the following table.
  TestStandardID can be found in the MOVES Users Guide
  D = IMProgramID used in MOVES default table (not used to avoid confusion)
  X = IMProgramID not currently used
  endModelYearID for 2007, 2009, 2013, 2014, 2015, 2017, 2020 and 2025 I/M programs shown

Table 1
IM Program ID's Used in the New Jersey MOVES Runs

IMProgramID	InspectFreq	testStandardsID	begModelYearID	endModelYearID
1	D	D	D	D
2	2	11 (idle)	1970	2003, 2005, 2008, 2009, 2010, 2012, 2015, 2020
3	2	11	1970	2007, 2009, 2013, 2014, 2015, 2017, 2020, 2025
4	2	22 (5015)	1981	1995
5	D	D	D	D
6	2	41 (gas cap)	1970	2007, 2009, 2013, 2014, 2015, 2017, 2020, 2025
7	D	D	D	D
8	D	D	D	D
9	2	51 (exhOBD)	1996	2003, 2005, 2008, 2009, 2010, 2012, 2015, 2020
10	D	D	D	D
11	2	12 (TSI)	1981	1995
12	1	41	1970	1995
13	1	45 (GC/evOBD)	1996	2007, 2009, 2013, 2014, 2015, 2017, 2020, 2025
14	1	22	1981	1995
15	2	41	1970	1995
16	1	51	1996	2007, 2009, 2013, 2014, 2015, 2017, 2020, 2025
17	2	41	1970	2003, 2005, 2008, 2009, 2010, 2012, 2015, 2020
18	2	45	1996	2003, 2005, 2008, 2009, 2010, 2012, 2015, 2020
19	1	12	1981	1995
20	1	11	1970	2007, 2009, 2013, 2014, 2015, 2017, 2020, 2025
21	2	41	1970	1995
22	2	45	1996	2000
23	2	43 (evOBD)	2001	2003, 2005, 2008, 2009, 2010, 2012, 2015, 2020
24	1	41	1970	1995
25	1	45	1996	2000
26	1	43	2001	2007, 2009, 2013, 2014, 2015, 2017, 2020, 2025
27	1	41	1970	2000

2007 and 2009 IM Representations

- Compliance Factor inputs were calculated as follows:
  First the overall effectiveness of the NJ I/M program was calculated assuming an 80/20 CIF/PIF split and that PIFs are 80% as effective as CIFs: 0.8(1.0) + 0.2(0.8) = 0.96.
  Then, based on recent data, the waiver rate is either 0.01% for exhaust OBD and ASM 5015 tests or 0.0% for the other exhaust and all evaporative tests.
  Also, based on recent data, the compliance rate is currently about 96%.
  Therefore the overall compliance factors are:
  0.96 X 0.9999 X 0.96 = 0.9215 for programs with a waiver and
  0.96 X 1.0000 X 0.96 = 0.9216 for programs without a waiver.

Table 2
2007 and 2009 Exhaust I/M Programs

MOVES use type	Description	MY Range	Test Type	Freq	New Vehicle Exemption?
21. Passenger Car		1981 - 1995 1996 – 2003/5	ASM 5015 init exhOBD	2 2	NA Yes
31. Passenger Truck	Minivans, pickups, SUVs and other 2-axle / 4-tire trucks used primarily for personal transportation	1981 - 1995 1996 – 2003/5	ASM 5015 init exhOBD	2 2	NA Yes
32. Light Commercial Truck	Minivans, pickups, SUVs and other trucks 2-axle / 4-tire trucks used primarily for commercial applications. Expected to differ from passenger trucks in terms of annual mileage, operation by time of day	1981 - 1995 1996 – 2003/5	ASM 5015 init exhOBD	2 2	NA Yes
51. Refuse Truck	Garbage and recycling trucks Expected to differ from other single unit trucks in terms of drive schedule, roadway type distributions, operation by time of day	NA	None – fleet is assumed to be all diesel	NA	NA
52. Single-Unit Short-Haul Truck	Single-unit trucks with majority of operation within 200 miles of home base	1970 – 2007/9	idle	2	No
53. Single-Unit Long-Haul Truck	Single-unit trucks with majority of operation outside of 200 miles of home base	1970 – 2007/9	idle	2	No
54. Motor Home		1970 – 2003/5	idle	2	Yes
41. Intercity Bus	Buses which are not transit buses or school buses, e.g. those used primarily by commercial carriers for city-to-city transport.	NA	None – fleet is assumed to be all diesel	NA	NA
42. Transit Bus	Buses used for public transit.	NA	None – fleet is assumed to be all diesel	NA	NA
43. School Bus	School and church buses.	1981 - 1995 1996 – 2007/9	ASM 5015 init exhOBD	1 1	NA No
61. Combination Short-Haul Truck	Combination trucks with majority of operation within 200 miles of home base	NA	None – fleet is assumed to be all diesel	NA	NA
62. Combination Long-Haul Truck	Combination trucks with majority of operation outside of 200 miles of home base	NA	None – fleet is assumed to be all diesel	NA	NA
11. Motorcycle		NA	None	NA	NA

Table 3
2007 and 2009 Evaporative I/M Programs

MOVES use type	Description	MY Range	Test Type	Freq	New Vehicle Exemption?
21. Passenger Car		1970 - 1995 1996 – 2003/5	Gascap Gascap/evpOBD	2 2	NA Yes
31. Passenger Truck	Minivans, pickups, SUVs and other 2-axle / 4-tire trucks used primarily for personal transportation	1970 - 1995 1996 – 2003/5	Gascap Gascap/evpOBD	2 2	NA Yes
32. Light Commercial Truck	Minivans, pickups, SUVs and other trucks 2-axle / 4-tire trucks used primarily for commercial applications. Expected to differ from passenger trucks in terms of annual mileage, operation by time of day	1970 - 1995 1996 – 2003/5	Gascap Gascap/evpOBD	2 2	NA Yes
51. Refuse Truck	Garbage and recycling trucks Expected to differ from other single unit trucks in terms of drive schedule, roadway type distributions, operation by time of day	NA	None – fleet is assumed to be all diesel	NA	NA
52. Single-Unit Short-Haul Truck	Single-unit trucks with majority of operation within 200 miles of home base	1970 – 2007/9	Gascap	2	No
53. Single-Unit Long-Haul Truck	Single-unit trucks with majority of operation outside of 200 miles of home base	1970 – 2007/9	Gascap	2	No
54. Motor Home		1970 – 2003/5	Gascap	2	Yes
41. Intercity Bus	Buses which are not transit buses or school buses, e.g. those used primarily by commercial carriers for city-to-city transport.	NA	None – fleet is assumed to be all diesel	NA	NA
42. Transit Bus	Buses used for public transit.	NA	None – fleet is assumed to be all diesel	NA	NA
43. School Bus	School and church buses.	1970 - 1995 1996 – 2007/9	Gascap Gascap/evpOBD	1 1	NA No
61. Combination Short-Haul Truck	Combination trucks with majority of operation within 200 miles of home base	NA	None – fleet is assumed to be all diesel	NA	NA
62. Combination Long-Haul Truck	Combination trucks with majority of operation outside of 200 miles of home base	NA	None – fleet is assumed to be all diesel	NA	NA
11. Motorcycle		NA	None	NA	NA

2013, 2014, 2015, 2017, 2020 and 2025 IM Representations

- Compliance Factor inputs were calculated as follows:
  First the overall effectiveness of the NJ I/M program was calculated assuming an 80/20 CIF/PIF split and that PIFs are 95.9% as effective as CIFs: 0.8(1.0) + 0.2(0.959) = 0.9918.

The waiver rate is now 0%.
The compliance rate is 96%.
Therefore the overall compliance factors are:
0.96 X 1.0 X 0.9918 = 0.9521 for all programs

Table 4
2013, 2014, 2015, 2017, 2020 and 2025 Exhaust I/M Programs

MOVES use type	Description	MY Range	Test Type	Freq	New Vehicle Exemption?
21. Passenger Car		1981 - 1995 1996 - Pres	TSI exhOBD	2 2	NA Yes
31. Passenger Truck	Minivans, pickups, SUVs and other 2-axle / 4-tire trucks used primarily for personal transportation	1981 - 1995 1996 - Pres	TSI exhOBD	2 2	NA Yes
32. Light Commercial Truck	Minivans, pickups, SUVs and other trucks 2-axle / 4-tire trucks used primarily for commercial applications. Expected to differ from passenger trucks in terms of annual mileage, operation by time of day	1981 - 1995 1996 - Pres	TSI exhOBD	1 1	NA No
51. Refuse Truck	Garbage and recycling trucks Expected to differ from other single unit trucks in terms of drive schedule, roadway type distributions, operation by time of day	NA	None – fleet is assumed to be all diesel	NA	NA
52. Single-Unit Short-Haul Truck	Single-unit trucks with majority of operation within 200 miles of home base	1970 - Pres	idle	1	No
53. Single-Unit Long-Haul Truck	Single-unit trucks with majority of operation outside of 200 miles of home base	1970 - Pres	idle	1	No
54. Motor Home		1970 - Pres	idle	2	Yes
41. Intercity Bus	Buses which are not transit buses or school buses, e.g. those used primarily by commercial carriers for city-to-city transport.	NA	None – fleet is assumed to be all diesel	NA	NA
42. Transit Bus	Buses used for public transit.	NA	None – fleet is assumed to be all diesel	NA	NA
43. School Bus	School and church buses.	1981 - 1995 1996 - Pres	TSI exhOBD	1 1	NA No
61. Combination Short-Haul Truck	Combination trucks with majority of operation within 200 miles of home base	NA	None – fleet is assumed to be all diesel	NA	NA
62. Combination Long-Haul Truck	Combination trucks with majority of operation outside of 200 miles of home base	NA	None – fleet is assumed to be all diesel	NA	NA
11. Motorcycle		NA	None	NA	NA

Table 5
2013, 2014, 2015, 2017, 2020 and 2025 Evaporative I/M Programs

MOVES use type	Description	MY Range	Test Type	Freq	New Vehicle Exemption?
21. Passenger Car		1970 - 1995 1996 - 2000 2001 - Pres	Gascap Gascap/evOBD evOBD	2 2 2	NA NA Yes
31. Passenger Truck	Minivans, pickups, SUVs and other 2-axle / 4-tire trucks used primarily for personal transportation	1970 - 1995 1996 - 2000 2001 - Pres	Gascap Gascap/evOBD evOBD	2 2 2	NA NA Yes
32. Light Commercial Truck	Minivans, pickups, SUVs and other trucks 2-axle / 4-tire trucks used primarily for commercial applications. Expected to differ from passenger trucks in terms of annual mileage, operation by time of day	1970 - 1995 1996 - 2000 2001 - Pres	Gascap Gascap/evOBD evOBD	1 1 1	NA NA No
51. Refuse Truck	Garbage and recycling trucks Expected to differ from other single unit trucks in terms of drive schedule, roadway type distributions, operation by time of day	NA	None – fleet is assumed to be all diesel	NA	NA
52. Single-Unit Short-Haul Truck	Single-unit trucks with majority of operation within 200 miles of home base	1970 - 2000	Gascap	1	No
53. Single-Unit Long-Haul Truck	Single-unit trucks with majority of operation outside of 200 miles of home base	1970 - 2000	Gascap	1	No
54. Motor Home		1970 - Pres	Gascap	2	Yes
41. Intercity Bus	Buses which are not transit buses or school buses, e.g. those used primarily by commercial carriers for city-to-city transport.	NA	None – fleet is assumed to be all diesel	NA	NA
42. Transit Bus	Buses used for public transit.	NA	None – fleet is assumed to be all diesel	NA	NA
43. School Bus	School and church buses.	1970 - 1995 1996 - 2000 2001 - Pres	Gascap Gascap/evOBD evOBD	1 1 1	NA NA No
61. Combination Short-Haul Truck	Combination trucks with majority of operation within 200 miles of home base	NA	None – fleet is assumed to be all diesel	NA	NA
62. Combination Long-Haul Truck	Combination trucks with majority of operation outside of 200 miles of home base	NA	None – fleet is assumed to be all diesel	NA	NA
11. Motorcycle		NA	None	NA	NA

2.2 Early NLEVs and MYLEVS Tables

The MOVES inputs to represent New Jersey's participation in the National Low Emitting Vehicle (NLEV) and New Jersey Low Emission Vehicle (adoption of the California Low Emission Vehicle (LEV) program) programs were developed pursuant to the USEPA instructions at http://www.epa.gov/otaq/models/moves/tools.htm . The USEPA instructions are for using California Low Emission Vehicle (LEV) inputs, Zero Emission Vehicle (ZEV) inputs, and National Low Emitting Vehicle (NLEV) inputs in certain northeast states in MOVES. The USEPA provided these inputs in the form of two databases and one spreadsheet file. The emission rates in these files are for use only in states other than California that adopted California LEV standards, and states in the Ozone Transport Commission (OTC) that received early implementation of NLEV standards. The New Jersey inputs were developed to represent it's early participation in the NLEV program and the implementation of the California LEV program starting with the 2009 model year. The two databases are provided electronically in Attachment 2.

2.3 Age Distribution

The age distribution factors for each MOVES vehicle type have been estimated for the New Jersey fleet using a combination of: New Jersey vehicle registration data, MOVES default data, and converted MOBILE6 data. The age distribution factors for 2007 were primarily based on New Jersey vehicle registration data for 2007. For 2008 the data from the various sources were used to estimate the coefficients of a polynomial that represented a best fit of the data based on maximizing the R-squared for the curve fitting process. The values from the polynomial were then used for each year for the age distribution fractions. This resulted in a smooth curve of the age distribution factors; as expected by the steady real-world retirement of vehicles as they age. For year zero the actual age fractions were used, instead of the values from the curve, because for the first year represents a partial year of vehicle sales. Age distributions were determined for 2007 and 2008. The 2008 age distributions were used for all years following 2008 because new vehicle data after 2008 was atypical because it was impacted by the significant effects of the recession. Use of atypical age distributions for future years would result in poor projections of the likely nature of future vehicle age distributions. Further details regarding the establishment of the age distribution factors for the New Jersey fleet are provided electronically in Attachment 2.

2.4 Average Speed Distribution

The average speed distributions are based on outputs from the NJTPA and DVRPC regional transportation models.

2.5 Fuel Supply and Fuel Formulation

The MOVES inputs for gasoline formulations were consolidated from reformulated gasoline (RFG) survey data received by New Jersey from the USEPA (via email from Robert Anderson of the USEPA dated 6/21/2011). The RFG data was combined to form three gasoline types: summer gasoline representing the months of May, June, July, August, and September; winter gasoline representing the months of December, January and February; and shoulder gasoline representing the months of March, April, October, and November. Separate gasoline types were developed for 12 northern NJ counties (County ID's: 3, 13, 17, 19, 23, 25, 27, 31, 35, 37, 39 and 41) and 9 southern NJ counties (County ID's: 1, 5, 7, 9, 11, 15, 21, 29 and 33). These county groups correspond to the ozone nonattainment area boundaries. Gasoline types were developed for years 2007, 2008, 2009, and 2010. The projected gasoline types for 2011 and

2012 were assumed to be the same as 2010. The MOVES model assumes that the fuel parameters for any years beyond 2012 are the same as the inputs for 2012. Gasoline parameters were estimated to be the average of all available sampling data for each year/period/area. The only data missing from the USEPA RFG data, but required as a MOVES input, is the RVP for the non-summer months; data for this parameter were based on the MOVES defaults for NJ (note that this is generally not critical because RVP affects only VOCs emissions which are an ozone precursor concern during the summer months). The 2012 RVP MOVES defaults for the winter and shoulder fuels were used for 2010, 2011 and 2012 fuels.

Diesel sulfur levels are based on USEPA survey data for Petroleum Administration for Defense District 1 (PADD 1) received from the USEPA on July 14, 2009 which indicated actual average sulfur levels of 32 ppm for 2007 and 15 ppm for 2008. A sulfur level of 11 ppm was assumed for 2009+ based on USEPA guidance (EPA420-R-04-013, August 2004, Technical Guidance on the Use of MOBILE6.2 for Emission Inventory Preparation, pg 64). Partial PADD 1 survey data for 2009 from the USEPA was less than 11ppm.

2.6 Meteorology Data

The meteorology data required by MOVES are hourly values for temperature and relative humidity. The meteorology data for the $PM_{2.5}$ and $PM_{2.5}$ precursor annual inventories was average monthly values based on historical averages. The MOVES meteorology file is provided electronically in Attachment 2.

2.7 Ramp Fraction

For the NJTPA counties the fraction of travel that occurs on highway ramps is generated by the PPSUITE software based on outputs from the NJTPA regional transportation model. For the DVRPC counties the MOVES default value of 8% is used.

2.8 Road Type Distribution

For the NJTPA counties the fraction of travel that occurs on each road type is generated by the PPSUITE software based on outputs from the NJTPA regional transportation model and VMT aggregation by facility type. For the DVRPC counties, a postprocessor tabulates the fraction of travel that occurs on each road type based on outputs from the DVRPC regional travel model at the county-level.

2.9 Source Type Population

Source type population (VPOP) is used by MOVES to calculate start and evaporative emissions. Emissions estimated by MOVES are related to the population of vehicles in an area in addition to the VMT for those vehicles and therefore local data must be developed for this input.

The MOVES model characterizes vehicles into 13 source types, which are subsets of the 6 HPMS MOVES vehicle types. The USEPA believes that states should be able to develop population data for many of these source type categories from state motor vehicle registration data (for motorcycles, passenger cars, passenger trucks and light commercial trucks), transit agencies, school districts, bus companies, and refuse haulers (for intercity, transit, school buses and refuse trucks, respectively). The population for other source types may be based on the application of local VMT to national default travel rates.

New Jersey motor vehicle registration was assembled and aggregated by NJDEP. It was collected for years 2007, 2008, 2009, 2010 and 2011 and arranged in MOVES input format for each individual county. Growth factors were applied to create MOVES VPOP inputs for future years. The growth factors were the VMT growth factors from the New Jersey travel demand model (TDM) outputs. The TDM VMT growth factors reflect projected local economic growth. VPOP growth rates were assumed to follow the same trend as the VMT growth rates. When the travel model results were missing for any of the future years the data were interpolated from the travel model outputs for the nearest years.

If accurate local vehicle population data are not available for a particular source type, the USEPA recommends applying a national default travel rate to local VMT in order to estimate VPOP (Technical Guidance on the Use of MOVES2010 for Emission Inventory Preparation in State Implementation Plans and Transportation Conformity, USEPA, April 2010, page 21). Local VMT multiplied by the ratio of MOVES default population to MOVES default VMT provides an estimate of local population.

During several technical meetings with NJDOT, NJDEP, and the MPOs, it was decided to use motor vehicle registration data for all vehicle types except for the long and short haul trucks. VMT-based data were used for short and long haul trucks (source types 52, 53, 61 and 62). New Jersey believes that registration data are the most accurate data currently available for all source type populations except for the short and long haul trucks. The VMT based population developed pursuant to USEPA guidance was used for these source types since the registration numbers are not as representative of actual time spent in each county for these types of vehicles. MOVES runs with national default data were conducted and VMT/Population ratios (daily miles) were estimated for each source type. This ratio was applied during the PPSUITE network analysis to create VPOP input for each county in the analysis year from the travel model generated VMT. For the DVRPC counties the estimation of VPOPs for the short and long haul trucks is included in Attachment 2.

In summary, for the New Jersey emissions analyses, MOVES source type population inputs were developed using a combination of vehicle registration and VMT-based methods as summarized below.

Table 6
Vehicle Population Sources for the MOVES Source Types

MOVES Source Type		Population Source
11	Motorcycle	Registration
21	Passenger Car	Registration
31	Passenger Truck	Registration
32	Light Commercial Truck	Registration
41	Intercity Bus	Registration
42	Transit Bus	Registration
43	School Bus	Registration
51	Refuse Truck	Registration
52	Single Unit Short-Haul Truck	VMT-Based
53	Single Unit Long-Haul Truck	VMT-Based
54	Motor Home	Registration
61	Combination Short-haul Truck	VMT-Based
62	Combination Long-haul Truck	VMT-Based

2.10 HPMS VType Year

The VMT by vehicle type is based on the HPMS VMT data from the New Jersey Department of Transportation. Growth factors for future years are from the NJTPA and DVRPC regional transportation models.

2.11 Month VMT Fraction

The VMT monthly fractions are based on the HPMS VMT seasonal factors provided by the New Jersey Department of Transportation.

2.12 Day VMT Fraction

The VMT daily fractions are based on MOVES default values and/or outputs from the TDMs. DVRPC VMT daily fractions are based on day-of-the-week and month-of-the-year factors from similar counties. DVRPC assumes each month has weekdays and weekends in a 5/2 proportion.

2.13 Hour VMT Fraction

The VMT hourly fractions are based on MOVES default values and/or post-processing of outputs from the TDMs.

3.0 Summary of On-road Inventory Data

Tables 7 through 12 present the onroad source emission inventories by county and nonattainment area. Attachment 1 contains the emission inventories by MOVES vehicle type.

Table 7
2007 On-road Annual Emission Inventories by County (Northern NAA)

	Area	VMT	Exhaust PM	ECARBON	OCARBON	SO4	BRAKE	TIRE	Total PM2.5	SO2	NOx
		Annual (million)	Tons/Yr	Tons/Yr	Tons/Yr	Tons /Yr	Tons /Yr	Tons /Yr	Tons/Yr	Tons /Yr	Tons/Yr
2007	County										
	Bergen	7,866.2	622.6	326.5	294.2	2.0	68.5	15.2	706	110	16,459
	Essex	4,879.1	352.7	202.6	148.9	1.2	27.6	8.7	389	58	9,629
	Hudson	2,290.0	208.0	119.9	87.4	0.7	17.1	4.4	229	30	5,357
	Mercer	3,565.9	310.9	203.4	106.3	1.2	21.9	6.5	339	50	8,503
	Middlesex	7,795.0	545.4	315.4	228.1	1.9	38.6	13.5	597	90	15,111
	Monmouth	6,315.6	231.9	98.7	132.4	0.8	29.1	10.5	272	62	8,140
	Morris	5,529.8	298.8	161.2	136.5	1.1	25.1	9.3	333	60	9,288
	Passaic	2,913.7	184.7	94.1	90.1	0.6	17.4	5.3	207	34	5,310
	Somerset	3,230.7	195.9	111.9	83.3	0.8	15.9	5.7	218	36	6,083
	Union	4,619.0	350.7	206.5	142.9	1.2	27.0	8.3	386	55	9,505
	Totals:	49,004.9	3,301.6	1,840.3	1,450.1	11.2	288.2	87.3	3,677	586	93,385

Table 8
2009 On-road Annual Emission Inventories by County (Northern NAA)

	Area	VMT	Exhaust PM	ECARBON	OCARBON	SO4	BRAKE	TIRE	Total PM2.5	SO2	NOx
		annual (million)	Tons/Yr	Tons/Yr	Tons/Yr	Tons /Yr	Tons /Yr	Tons /Yr	Tons/Yr	Tons /Yr	Tons/Yr
2009	County										
	Bergen	7,485.3	493.5	253.4	239.2	0.9	64.8	14.4	573	81	12,983
	Essex	4,651.5	276.1	156.5	119.1	0.5	25.4	8.2	310	42	7,474
	Hudson	2,170.9	155.0	87.2	67.6	0.3	15.8	4.1	175	21	4,021
	Mercer	3,414.0	197.3	112.7	84.1	0.4	19.9	6.1	223	33	5,834
	Middlesex	7,494.6	417.9	234.4	182.8	0.8	36.9	12.9	468	65	11,589
	Monmouth	6,175.4	189.7	78.9	110.4	0.4	28.5	10.2	228	50	6,492
	Morris	5,302.4	255.0	136.4	118.2	0.5	25.0	9.0	289	46	7,597
	Passaic	2,904.9	159.3	78.8	80.3	0.3	18.2	5.3	183	27	4,405
	Somerset	3,198.5	175.4	101.1	73.9	0.4	16.3	5.7	197	27	5,298
	Union	4,456.4	279.1	158.7	119.9	0.5	25.4	7.9	312	40	7,413
	Totals:	47,253.8	2,598.3	1,398.1	1,195.3	4.8	276.1	83.9	2,958	433	73,106

Table 9
2025 On-road Annual Emission Inventories by County (Northern NAA)

	Area	VMT	Exhaust PM	ECARBON	OCARBON	SO4	BRAKE	TIRE	Total PM2.5	SO2	NOx
		annual (million)	Tons/Yr	Tons/Yr	Tons/Yr	Tons /Yr	Tons /Yr	Tons /Yr	Tons/Yr	Tons /Yr	Tons/Yr
2025	County										
	Bergen	8,091.8	149.5	32.8	115.7	1.0	71.9	15.6	237	98	3,624
	Essex	5,063.5	78.4	19.1	58.7	0.5	29.3	9.0	117	51	1,967
	Hudson	2,446.5	45.0	11.2	33.4	0.3	19.4	4.8	69	27	1,147
	Mercer	4,139.3	58.8	12.7	45.7	0.4	23.7	7.4	90	40	1,920
	Middlesex	8,465.9	124.6	29.0	94.8	0.9	46.7	15.0	186	83	3,201
	Monmouth	6,749.4	83.7	18.4	64.8	0.5	33.3	11.4	128	63	1,905
	Morris	5,913.0	80.2	18.2	61.6	0.5	27.9	10.0	118	56	2,033
	Passaic	3,263.9	56.5	13.1	43.1	0.3	21.2	5.9	84	35	1,253
	Somerset	3,700.5	48.7	11.7	36.6	0.4	20.1	6.7	75	36	1,448
	Union	4,792.8	75.3	18.0	56.8	0.5	29.5	8.6	113	48	2,047
	Totals:	52,626.6	800.6	184.1	611.1	5.4	322.8	94.3	1,218	539	20,546

Table 10
2007 On-road Annual Emission Inventories by County (Southern NAA)

	Area	VMT	Exhaust PM	ECARBON	OCARBON	SO4	BRAKE	TIRE	Total PM2.5	SO2	NOx
		annual (million)	Tons/Yr	Tons/Yr	Tons/Yr	Tons /Yr	Tons /Yr	Tons /Yr	Tons/Yr	Tons /Yr	Tons/Yr
2007	County										
	Burlington	4,703.8	378.5	247.3	129.8	1.4	27.9	8.6	415	64	10,615
	Camden	4,089.8	355.6	226.8	127.4	1.3	31.3	7.9	395	59	9,834
	Gloucester	2,722.4	225.8	149.4	75.6	0.9	14.3	4.8	245	38	6,543
	Totals:	11,515.9	959.9	623.6	332.7	3.6	73.5	21.3	1,055	161	26,992

Table 11
2009 On-road Annual Emission Inventories by County (Southern NAA)

	Area	VMT	Exhaust PM	ECARBON	OCARBON	SO4	BRAKE	TIRE	Total PM2.5	SO2	NOx
		annual (million)	Tons/Yr	Tons/Yr	Tons/Yr	Tons /Yr	Tons /Yr	Tons /Yr	Tons/Yr	Tons /Yr	Tons/Yr
2009	County										
	Burlington	4,508.8	238.8	133.3	105.1	0.5	26.4	8.1	273	43	7,320
	Camden	3,905.4	215.3	120.3	94.6	0.4	24.7	7.1	247	38	6,556
	Gloucester	2,658.9	140.0	78.0	61.7	0.3	14.4	4.7	159	25	4,378
	Totals:	11,073.1	594.1	331.5	261.3	1.2	65.6	19.9	680	107	18,253

Table 12
2025 On-road Annual Emission Inventories by County (Southern NAA)

	Area	VMT	Exhaust PM	ECARBON	OCARBON	SO4	BRAKE	TIRE	Total PM2.5	SO2	NOx
		annual (million)	Tons/Yr	Tons/Yr	Tons/Yr	Tons /Yr	Tons /Yr	Tons /Yr	Tons/Yr	Tons /Yr	Tons/Yr
2025	County										
	Burlington	5,559.2	71.7	15.3	55.9	0.6	32.9	10.1	115	54	2,505
	Camden	4,363.2	58.5	12.7	45.4	0.5	27.3	7.9	94	43	2,028
	Gloucester	3,409.3	44.9	9.7	34.9	0.3	18.8	6.0	70	33	1,563
	Totals:	13,331.7	175.2	37.6	136.2	1.4	79.0	24.0	278	130	6,095

4.0 Control Measure Emission Benefits

Emission benefits accrue from numerous existing control measures including: Federal Control measures in the MOVES model, New Jersey gasoline vehicle I/M program and the New Jersey Low Emission Vehicle program that began with the 2009 model year. A complete summary of the control measures included in the emission inventories is summarized in Section 5.4 of this SIP.

Emission benefits by nonattainment area were estimated by calculating the difference between the base year emissions (2007) and the last year of the maintenance period emissions (2025). Emisson benefits are summarized in the following tables:

Table 13
On-road Annual Emission Benefits by County (Northern NAA)

Area	Total PM2.5	SO2	NOx
2007/2025 Difference	Tons/Yr	Tons/Yr	Tons/Yr
County			
Bergen	469	12	12,835
Essex	272	7	7,662
Hudson	160	3	4,210
Mercer	249	10	6,583
Middlesex	411	7	11,910
Monmouth	143	-1	6,235
Morris	215	4	7,254
Passaic	124	-1	4,057
Somerset	142	0	4,635
Union	273	7	7,457
Totals:	2,459	47	72,840

Table 14
On-road Annual Emission Benefits by County (Southern NAA)

Area	Total PM2.5	SO2	NOx
2007/2025 Difference	Tons/Yr	Tons/Yr	Tons/Yr
County			
Burlington	300	10	8,110
Camden	301	16	7,806
Gloucester	175	5	4,981
Totals:	776	31	20,896

5.0. Quality Assurance

The primary quality assurance activities for the on-road emission estimates were the performance of parallel MOVES runs by NJDEP staff on NJDEP computers and the MPO representatives on their computers. This so-called “benchmarking” activity is performed whenever transportation conformity budgets are being developed. It is necessary that the MPOs are able to exactly reproduce the MOVES inputs, MOVES methodologies, and MOVES outputs because the on-road emission inventories are being used to establish budgets that will need to stay under when performing their subsequent transportation conformity determinations.