Appendix 4-6:
Onroad 2017 and 2023 Emission Inventories

1.0 Onroad Sources

New Jersey estimated the work weekday summer emission inventories for 2017 and 2023.

The onroad source components of the 2017 and 2023 volatile organic compound (VOC), oxides of nitrogen (NO_x) and carbon monoxide work weekday summer day emission inventories are estimates of exhaust (i.e., tailpipe) and evaporative emissions from all onroad vehicles (gasoline, diesel and natural gas fueled) operating in the New Jersey counties within the nonattainment 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 United States Environmental Protection Agency (USEPA) MOVES (MOtor Vehicle Emission Simulator) computer model (MOVES3.1 Version MOVESdb 20221007 originally released in November of 2022). The MOVES model is run in inventory mode. The proprietary software package (PPSUITE), developed and licensed by AECOM, is used for the counties within the North Jersey Transportation Planning Authority (NJTPA) and South Jersey Transportation Planning Organization (SJTPO) to preprocess and post-process the MOVES input data. PPSUITE applies several adjustments to the TDM outputs, such as average speed, disaggregation of the peak and off-peak volumes to 24-hour volumes, disaggregation of the vehicle types, any off-model VMT credits, reconciliation with HPMS data and several others prior to developing emission estimates. After the inputs are developed, PPSUITE runs MOVES and post-processes the emissions from the MOVES model that includes the generation of reports for the presentation of emission inventory results. For the remaining counties, those within the Delaware Valley Regional Planning Commission (DVRPC), MOVES is used without any preprocessing or postprocessing tools.

Refueling
VOC emissions from refueling of gasoline, diesel and ethanol (E85) were estimated in the onroad inventory. Associated SCCs were removed from New Jersey's onroad inventory and added to the area source inventory.

1.1 Activity Estimates

The vehicle activity estimates used in these emission inventories were calculated with the TDM used by the MPOs that covers the counties of concern in this Ozone attainment demonstration proposed SIP revision.

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 counties in the nonattainment area, there are no areas for which activity is not included. DVMT used for the 2017 and 2023 inventories is included in Attachment 1.

1.1.1 Travel Demand Models

NJTPA

In 2008, NJTPA completed a major upgrade to the region's travel demand model and in 2011, the agency completed a revalidation of the model, which resulted in the North Jersey Regional Transportation Model-Enhanced (NJRTM-E). In 2015, the NJRTM-E was further refined to improve its transit reporting capabilities and ability to estimate external trips entering the NJTPA region. In June 2018, the NJTPA completed a revalidation project for the NJRTM-E including updating the base year to 2015, expanding the zonal system structure and updating some of the model's components. As part of the model validation process, the estimated average weekday VMT at regional level is approximately 95% of the observed VMT for locations where counts are available. The comparison between the estimated and observed average weekday VMT by facility type and area type were within a range of 86% to 115%.

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 a summer work weekday.

The NJRTM-E includes a large buffer area surrounding the NJTPA region; therefore, most of external trips considered were those by truck. However, three external zones were added along the study area border in the 2015 Model Refinement Project, encompassing major highways like the southern New Jersey Turnpike and the western termini of I-78 and I-80. These three zones include both auto and truck trips, aiming to improve estimated volume and travel patterns.

The NJRTM-E contains the following four types of external truck trips 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.
- Intermodal Facility External-Internal truck trips: represents trips that are going between an internal zone and intermodal facility such as a port or an intermodal rail facility.

For trips generated outside the region, a series of external zones were developed that represent entry points into the region. These entry points of "external zones" include major highways at the study area border as well as intermodal terminals located inside the region such as Port Elizabeth/ Newark and the various intermodal rail terminals. The source data used in the model was obtained from the original NJ Statewide Model. The data was updated as part of the 2018 Revalidation Process using the observed truck data provided by Port Authority of New York and New Jersey and NJTPA. The truck trips at the edge of the model 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.

SJTPO

The South Jersey Regional Travel Demand Model (SJTDM) utilizes numerous inputs including demographic information (e.g. population and employment) and transportation networks (e.g. roads and transit lines) to simulate future conditions. In 2015, the model was recalibrated to incorporate the latest available data, setting 2015 as the new model base year. The SJTDM model estimated DVMT is approximately 99.6% of the regional observed DVMT. The comparisons between estimated and observed DVMT by facility type were within a range of 107% (for freeways) to 89% (for ramps).

A number of traffic data sources were used for model calibration and validation. NJDOT supplies traffic counts for most major regional roadways, including all state highways and many county roadways. Additional traffic counts were supplied by the New Jersey Turnpike Authority, the South Jersey Transportation Authority, and several counties. In the SJTDM two types of external trips (External-External, External-Internal) are used to estimate DVMT from vehicles moving into and out of the Metropolitan Planning Organization region. The external-external purpose represents trips that have both origin and destination outside of the modeled region. The External-Internal trip purpose includes trips for which one of its trips “ends” is inside the model region while the other is outside of the region.

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 (AM and PM), 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 model 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 DVRPC 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. Vehicle trips are separated into autos and trucks and assigned to the roadway network separately. 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 extensively validated against numerous data sources to ensure that it accurately represents current travel behavior in the DVRPC region. The extensive validation performed on the model ensures that all significant trends are captured and reproduced. Fall 2019 pre-Covid conditions were used for model validation. The DVRPC Travel Demand Model estimated DVMT is approximately 98.26% of the regional observed DVMT for the New Jersey counties in the area. The comparisons between estimated and observed DVMT by facility type were within a range of –3.60 to -0.15% for the New Jersey portion of the area.

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 New Jersey Department of Environmental Protection (NJDEP) used the USEPA MOVES3.1 model to estimate air pollution emissions from onroad mobile sources including buses, cars, trucks and motorcycles. 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
- Age Distribution
- Average Speed Distribution
- Fuel Tables
- Meteorology Data
- Road Type Distribution
- Source Type Population
- HPMS VMT by Vehicle Type
- Month VMT Fraction
- Day VMT Fraction
- Hour VMT Fraction
- Hoteling Activity Tables
- Retrofit Data

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 were copied into the IMCoverage file and designated “N” in the “useIMyn” column.
- 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.
- To account for the use of E85, the IM program representations for fuel type 1 (gasoline) were copied (added) for fuel type 5 (ethanol –anything greater than E10).

I/M Modeling Assumptions

Table 1 presents New Jersey’s enhanced I/M program design used for both the 2017 and 2023 modeling runs.

Table 1
NJ Enhanced I/M Program Design

Program Element	New Jersey's Enhanced I/M Program
Compliance Rate	96%
Waiver Rate	0%
Regulatory Class Coverage for Sourcetypes 21, 31 and 32	21: 100% 31: 98.9% 32: 92.9%
Overall I/M Program Effectiveness for Sourcetypes 21, 31 and 32	21: 96.00% 31: 94.90% 32: 89.10%
Program Start Date	1974
Test Frequency	Biennial except annual for commercial vehicles
New Vehicle Exemption	5 Years
Model Year (MY) Coverage	1996 and later MY
Vehicle Type Coverage	All gasoline-fueled vehicles and trucks except non-OBD equipped vehicles greater than 8,500 lbs. GVWR
Exhaust Emission Test	OBD - 1996 and later MY
Evaporative System Function Checks	None

Compliance Factor Calculations
MOVES uses the compliance factor input (complianceFactor) to account for I/M program compliance rates, waiver rates, and adjustments needed to account for the fraction of vehicles within a source type that are covered by the I/M program. The last component is referred to as the regulatory class coverage adjustment (RCCA). The compliance factor is entered as a number from 0 to 100 and represents the percentage of vehicles within a source type that receive the benefits of the program. A unique compliance factor should be calculated for each IMProgramID. The compliance factor entered in MOVES is calculated as:

NJ's IM program assumes a 0.96 compliance rate, 0 waiver rate and 0 failure rate. Details about how NJ calculates the Regulatory class coverage adjustment are below.

Regulatory Class Coverage Adjustment
I/M programs entered in MOVES are applied to source types. However, this association of I/M programs and source type may be inconsistent with state I/M program regulations that define I/M programs by the vehicle weight classes. MOVES source types are composed of several vehicle weight classes and, therefore, applying I/M benefits to the entire MOVES source type may be inappropriate.
EPA's mobile source emissions model, MOVES3.1 added an I/M program benefit for Class 2b and 3 gasoline trucks with a gross vehicle weight rating of between 8,500 and 14,000 pounds (Regulatory Class 41). With this minor revision, these trucks will now receive the same proportional I/M benefit for exhaust emissions as lower classification gasoline trucks. This benefit was missing in previous versions of MOVES.

New Jersey's IM program covers these class 2b and class 3 vehicles using the OBD test, starting with the 2008 model year. OBD was required for 2b and 3 class vehicles starting in 2001, but pre model year 2008 class 2b and 3 vehicles are not OBD tested in NJ's program. This means the vehicles in those classes between 2001 and 2008 need to be removed in the adjustment factor estimate as they are not being inspected under NJ's IM program. Using the data available NJ calculated RCCA adjustment factors.

2022 Class 2b and 3 vehicle counts
Total – 307,994
MY 2008 and newer - 206,075
Pre-MY 2001 – 18,502
MY 2001 and newer – 289,492
Between 2001 and 2008 – 83,417

Using the above data, NJ determined the fraction of vehicles that need to be removed to properly estimate a new RCCA.
2001 thru 2007 vehicles / 2001 and newer vehicles
83,417/ 289,492 = 0.288

Class 2b and class 3 vehicles fall in the passenger truck (31) and light commercial truck (32) MOVES source type descriptions. Table A-1 MOVES Gasoline Regulatory class distributions by source type present in the MOVES technical guidance document includes a breakdown of moves regulatory class descriptions within the MOVES source type IDs. The table shows class 3b and 3 trucks fractions as 0.0388 and 0.2474 for the passenger truck and light commercial truck source types respectively. Multiplying the above fraction with the fractions from Table A-1 yields the fraction of vehicles in the 31 and 32 MOVES source types that are not captured by the NJ IM program.
Removal Fraction for 31s: 0.288 x 0.0388 = 0.011
Removal Fraction for 32s: 0.288 x 0.2474 = 0.071

The adjusted RCCA then becomes one minus the calculated removal fractions.
RCCA for 31s: 0.989
RCCA for 32s: 0.929

Using the new RCCAs for the 31 and 32 moves source type vehicles yield new compliance factors for those classes
CF for 31: 0.949
CF for 32: 0.891

The remainder of this section discusses in detail the various New Jersey program parameters used to model the enhanced I/M program.

1. Network Type:

New Jersey's enhanced I/M program is comprised of a hybrid network of both centralized test-only facilities (CIFs) and decentralized test-and-repair facilities (PIFs). In 2014 the USEPA issued guidance that stated that the difference in the effectiveness between centralized and decentralized programs has become insignificant[1]. The compliance factors for the I/M program were not reduced due to the CIF/PIF split.

2. Test Frequency and New Vehicle Exemption Periods:

The test frequency of New Jersey's enhanced I/M program is biennial (vehicle inspections are required once every two years). The exception of this applies to certain classes of commercial vehicles, limousines, taxis and jitneys that receive annual (more frequent) inspections. The exemption period for new vehicles is 5 years for I/M programs. Commercial vehicles do not have a new vehicle exemption period.

3. Model Year, Vehicle Type Coverage and Test Types:

New Jersey's light duty I/M program consists of OBD inspections only.

4. IM Program ID's and other parameters were established as summarized in the following table:

Table 2
I/M Program ID's Used in the New Jersey MOVES Runs

IMProgramID	InspectFreq	testStandardsID	begModelYearID	endModelYearID
9	2	51 (exh OBD)	1996	Present
16	1	51	1996	Present
23	2	43 (ev OBD)	1996	Present
26	1	43	1996	Present

[1] Performance Standard Modeling for New and Existing Vehicle Inspection and Maintenance (I/M) Programs Using the MOVES Mobile Source Emissions Model. EPA-420-B-14-006. January 2014.

2017 and 2023 IM Representations:

Table 3
Exhaust I/M Programs

MOVES use type	Description	MY Range	Test Type	Freq	New Vehicle Exemption?
21. Passenger Car		1981 - 1995 1996 - Pres	None exhOBD	NA 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	None exhOBD	NA 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	None exhOBD	NA 1	NA No

Table 4
Evaporative I/M Programs

MOVES use type	Description	MY Range	Test Type	Freq	New Vehicle Exemption?
21. Passenger Car		1970 - 1995 1996 - Pres	None evOBD	NA 2	NA Yes
31. Passenger Truck	Minivans, pickups, SUVs and other 2-axle / 4-tire trucks used primarily for personal transportation	1970 - 1995 1996 - Pres	None evOBD	NA 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 - Pres	None evOBD	NA 1	NA No

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 fractions (factors) for each MOVES vehicle type have been estimated for the New Jersey fleet using a combination of: NJ Motor Vehicle Registration Database, International Registration Plan Data for apportioned vehicle types (41,53,62), and VIN decode data. The age distribution factors for 2017 were primarily based on New Jersey vehicle registration data for 2017. For light duty vehicle types (21,31,32) age distributions were developed based on a representative county scheme. The 2023 age distribution was estimated by using EPA's MOVES3 age distribution projection tool on New Jersey's 2022 age distribution. The 2022 age distribution was estimated using the same methodology as the 2017 age distribution, but with 2022 data. 2022 was used as the base year for the projection tool as it was the latest available dataset at the time that could reflect the fleet after the dip in new car sales due to the COVID-19 pandemic. 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 MPO's regional transportation models.

2.5 Fuel Tables

The MOVES defaults were used for the 2017 and 2023 fuel tables.

2.6 Meteorology Data

The meteorology data required by MOVES are hourly values for temperature and relative humidity. The meteorology data for the 2017 and 2023 summer daily inventories were average monthly values based on historical averages. The MOVES meteorology file is provided electronically in Attachment 2.

2.7 Road Type Distribution

For the NJTPA and SJTPO counties the fraction of travel that occurs on each road type is generated by the PPSUITE software based on outputs from each MPO's regional transportation model and VMT aggregation by facility type. The DVRPC road type distribution is generated similarly, however PPSUITE is not used.

2.8 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 vehicle types. New Jersey motor vehicle registration data (VIN decodes and other associated registration data) were assembled and aggregated by NJDEP. The data were collected and arranged in MOVES input format for each individual county. VPOPs for motorcycles, passenger cars, passenger trucks, light duty commercial trucks and school buses were allocated to counties by using their registration addresses. VPOPs for transit and intercity buses were allocated to counties based on census population data. The vehicle registration data was used along with the NJDEP solid waste haulers permitting database to identify the populations of refuse trucks. Then the VPOPs for refuse trucks were allocated to counties based on census household data. The vehicle registration data for heavy duty trucks and buses was used to separate these vehicles into apportioned and conventional commercially registered groups. The apportioned vehicles were assumed to be long-haul trucks and inter-city buses.

MOVES VPOP inputs for 2017 were developed using 2017 data and the inputs for 2023 were developed using 2022 data projected to 2023. The source type population for sources 41 (intercity bus), 53 (single unit long-haul truck) and 62 (combination long-haul trucks) was generated by applying the national VMT and VPOP ratio for each source and county to the relevant VMT. Further details regarding the establishment of the source type populations for the New Jersey fleet are provided electronically in Attachment 2.

2.9 HPMS VMT by Vehicle Type

The VMT by vehicle type is based on the HPMS VMT data from the New Jersey Department of Transportation. Growth factors for future years (2023) are from the MPO's regional transportation models.

2.10 Month VMT Fraction

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

2.11 Day VMT Fraction

The VMT daily fractions are based on MOVES default values and/or outputs from the MPO's TDMs.

2.12 Hour VMT Fraction

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

2.13 Hoteling Activity Tables

The MOVES defaults were used for the 2017 and 2023 hoteling activity tables.

2.14 Retrofit

The Retrofit Data Tab in MOVES allows users to enter retrofit program data that apply adjustments to vehicle emission rates. New Jersey created a retrofit input to reflect the New Jersey Diesel Retrofit Law established in 2005 to clean up emissions for certain diesel-powered vehicles through the use of PM emissions control technology.

3.0 Onroad Inventories

New Jersey's 2017 and 2023 summer work weekday onroad source emission inventories by county for New Jersey's nonattainment areas are summarized in Tables 5 through 8 and included in Attachment 1.

Table 5
2017 On-road Summer Work Weekday Emission Inventories by County (Northern NAA)

	Area	VMT	VOC	NOx	Carbon Monoxide
		Daily (Thousand)	Tons/Day	Tons/Day	Tons/Day
2017	County				
	Bergen	22,094	7.22	15.80	99.39
	Essex	15,495	4.91	11.96	67.25
	Hudson	6,931	2.76	6.64	31.97
	Hunterdon	5,852	1.51	5.12	21.86
	Middlesex	26,390	6.43	19.92	97.12
	Monmouth	19,427	5.15	8.71	74.78
	Morris	14,507	3.87	9.03	55.11
	Passaic	8,795	3.21	5.60	40.64
	Somerset	9,674	2.54	6.81	36.65
	Sussex	3,574	1.25	1.83	15.49
	Union	13,229	3.88	10.10	52.14
	Warren	5,290	1.32	5.10	19.40
	Totals:	151,261	44.04	106.62	611.79

Table 6
2017 On-road Summer Work Weekday Emission Inventories by County (Southern NAA)

	Area	VMT	VOC	NOx	Carbon Monoxide
		Daily (Thousand)	Tons/Day	Tons/Day	Tons/Day
2017	County				
	Atlantic	9,351	2.47	6.96	37.41
	Burlington	15,371	4.09	9.26	55.14
	Camden	12,072	3.88	7.74	49.56
	Cape May	3,657	1.09	3.07	16.02
	Cumberland	3,690	1.29	3.27	16.59
	Gloucester	9,056	2.48	5.64	33.95
	Mercer	10,772	3.10	7.13	41.96
	Ocean	14,340	4.76	7.54	63.85
	Salem	2,412	0.64	1.58	9.66
	Totals:	80,725	23.80	52.19	324.15

Table 7
2023 On-road Summer Work Weekday Emission Inventories by County (Northern NAA)

	Area	VMT	VOC	NOx	Carbon Monoxide
		Daily (Thousand)	Tons/Day	Tons/Day	Tons/Day
2023	County				
	Bergen	22,860	5.03	8.94	73.01
	Essex	14,876	3.26	6.54	47.67
	Hudson	7,342	1.97	4.40	25.25
	Hunterdon	5,823	1.03	3.06	16.44
	Middlesex	26,223	4.35	12.14	73.95
	Monmouth	22,000	3.75	5.13	62.14
	Morris	14,673	2.62	4.95	41.07
	Passaic	8,812	2.18	2.91	29.05
	Somerset	9,936	1.72	3.87	27.83
	Sussex	3,489	0.84	0.91	10.70
	Union	12,755	2.69	5.96	38.95
	Warren	5,177	0.86	3.02	14.38
	Totals:	153,971	30.30	61.83	460.44

Table 8
2023 On-road Summer Work Weekday Emission Inventories by County (Southern NAA)

	Area	VMT	VOC	NOx	Carbon Monoxide
		Daily (Thousand)	Tons/Day	Tons/Day	Tons/Day
2023	County				
	Atlantic	9,419	1.73	3.68	27.37
	Burlington	15,627	2.91	5.06	40.99
	Camden	11,994	2.78	4.15	36.22
	Cape May	3,756	0.73	1.49	11.48
	Cumberland	3,883	0.92	1.84	12.54
	Gloucester	9,200	1.76	3.07	25.15
	Mercer	10,896	2.19	3.84	30.96
	Ocean	16,389	3.64	4.40	51.45
	Salem	2,442	0.46	0.83	7.04
	Totals:	83,611	17.13	28.36	243.21

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 Chapter 3 of this SIP.

Emission benefits by nonattainment area were estimated by calculating the emission differences between the base year (2017) and the attainment year (2023). Emisson benefits are summarized in the following tables:

Table 9
On-road Summer Emission Benefits by County (Northern NAA)

Area	VOC	NOx	Carbon Monoxide
	Tons/Day	Tons/Day	Tons/Day
Difference	2017 - 2023	2017-2023	2017-2023
County			
Bergen	2.19	6.86	26.38
Essex	1.65	5.42	19.59
Hudson	0.79	2.24	6.72
Hunterdon	0.48	2.06	5.43
Middlesex	2.08	7.78	23.16
Monmouth	1.40	3.58	12.64
Morris	1.24	4.09	14.04
Passaic	1.04	2.69	11.58
Somerset	0.82	2.94	8.82
Sussex	0.41	0.93	4.78
Union	1.19	4.14	13.19
Warren	0.46	2.07	5.02
Totals:	13.74	44.79	151.35

Table 10
On-road Summer Emission Benefits by County (Southern NAA)

Area	VOC	NOx	Carbon Monoxide
	Tons/Day	Tons/Day	Tons/Day
Difference	2017 - 2023	2017-2023	2017-2023
County			
Atlantic	0.74	3.28	10.04
Burlington	1.18	4.20	14.16
Camden	1.10	3.59	13.34
Cape May	0.36	1.58	4.54
Cumberland	0.37	1.43	4.05
Gloucester	0.71	2.57	8.80
Mercer	0.90	3.29	10.99
Ocean	1.13	3.14	12.39
Salem	0.18	0.75	2.62
Totals:	6.67	23.84	80.94

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 (NJTPA) 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 transportation conformity budgets that will be used by the MPOs when performing their subsequent transportation conformity determinations.