The State of New Jersey
Department of Environmental Protection

2011 Periodic Emission Inventory

June 2015

Table of Contents

List of Figures

List of Tables

List of Attachments

* **NOTE:** These attachments are only available electronically

Acronyms and Abbreviations

AADF	Annual Activity Day Factors
AERR	Air Emissions Reporting Requirements
APC	Air Pollution Control
CAMD	Clean Air Markets Division
CE	Control Efficiency
CERR	Consolidated Emissions Reporting Rule
CFR	Code of Federal Regulations
CIF	Centralized Inspection Facility
CMU	Carnegie Mellon University
CMV	Commercial Marine Vessel
CNG	Compressed Natural Gas
CO	Carbon Monoxide
DVMT	Daily Vehicle Miles Traveled
DVRPC	Delaware Valley Regional Planning Commission
EDMS	Emissions and Dispersion Modeling System
ERTAC	Eastern Regional Technical Advisory Committee
FAA	Federal Aviation Agency
GSE	Ground Support Equipment
HPMS	Highway Performance Monitoring System
I/M	Inspection and Maintenance
LPG	Liquefied Petroleum Gas
LTO	Landing and Take-off Operations
MARAMA	Mid-Atlantic Regional Air Management Association
MOVES	Motor Vehicle Emission Simulator
MPO	Metropolitan Planning Organization
MY	Model Year
NH_3	Ammonia
NAAQS	National Ambient Air Quality Standard
NAICS	North American Industry Classification System
NEI	National Emission Inventory
NJDEP	New Jersey Department of Environmental Protection
NJDOT	New Jersey Department of Transportation
NJEMS	New Jersey Emission Management Systems
NJRTM-E	North Jersey Regional Transportation Model Enhanced
NJTPA	North Jersey Transportation Planning Authority
NLEV	National Low Emission Vehicle
NO_x	Nitrogen Oxides
OBD	Onboard Diagnostics
PIF	Private Inspection Facility
$PM_{2.5}$	Particulate Matter less than 2.5 micrometers in diameter
ppm	parts per million
PPSUITE	Performance Evaluation and Emissions Analysis
QA	Quality Assurance
RADIUS	Remote Air Data Input User System
RE	Rule effectiveness
RFG	Reformulated Gasoline
RP	Rule Penetration
RVP	Reid Vapor Pressure
SCC	Source Classification Code
SIP	State Implementation Plan
SJTDM	South Jersey Regional Transportation Model
SJTPO	South Jersey Transportation Planning Organization

Acronyms and Abbreviations (continued)

SO_2	Sulfur Dioxide
SO_x	Oxides of Sulfur
TDM	Travel Demand Model
TPD	tons per day
TPY	tons per year
TSI	Two Speed Idle
USEPA	United States Environmental Protection Agency
VMT	Vehicle Miles Traveled
VOC	Volatile Organic Compound

I. Introduction

A. Statutory and Regulatory Background

The Clean Air Act 42 U.S.C. § 7410(a)(2)(F) (Section 110 (a)(2)(F)) requires the submission by states to the United States Environmental Protection Agency (USEPA) of periodic reports on the nature and amounts of emissions from pollutants with a National Ambient Air Quality Standard (NAAQS criteria pollutant) and emissions related data. The Clean Air Act 42 U.S.C. §§ 7511(a)(1), 7511(a)(3) and 7502(c)(3) (Sections 182(a)1,182(a)(3) and 172(c)(3)) require that states submit periodic emission inventories for marginal and above nonattainment areas in accordance with USEPA guidance.

In 2002, the USEPA promulgated the Consolidated Emission Reporting Rule (CERR), 40 CFR 51, Subpart A that provided inventory requirements including:

- Consolidating the various emissions reporting requirements that already existed into one place in the Code of Federal Regulations;
- Establishing new reporting requirements related to particulate matter less than 2.5 micrometers in diameter ($PM_{2.5}$);
- Establishing new requirements for the statewide reporting of area source and mobile source emissions; and,
- Requiring two types of inventories - annual inventories and three-year cycle inventories.

On December 17, 2008[1], the USEPA amended the CERR and renamed it the Air Emissions Reporting Requirements (AERR). The AERR amendments included:

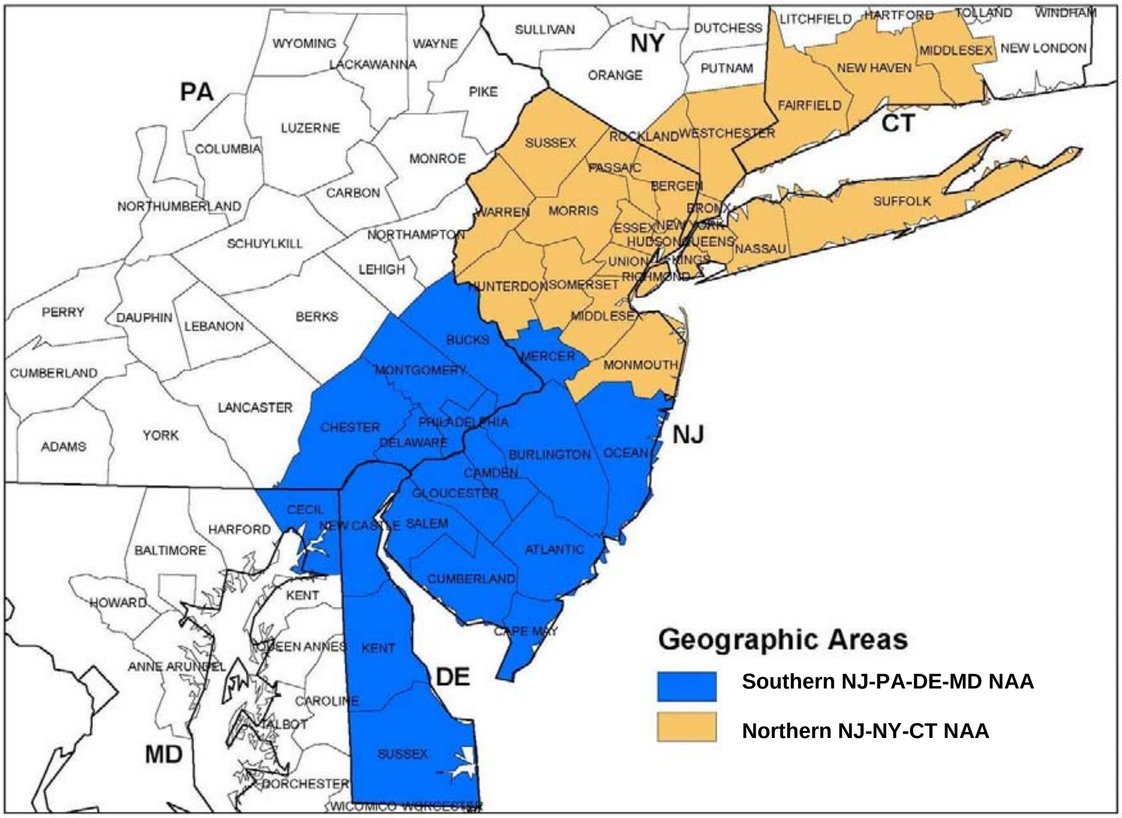
- Shortening the timeline for reporting data;
- Eliminating the emissions reporting requirement for biogenic emissions; and
- Requiring state and local agencies to adopt the definition of a “point source” as specified under Title V of the Clean Air Act.

Several amendments were proposed to the AERR on June 6, 2013. These revisions were not finalized as of the date of this report.

The following map represents New Jersey’s nonattainment areas for 8-hour ozone (Figure 1).

[1] 73 FR76539 (December 17, 2008)

Figure 1:
New Jersey 8-Hour Ozone Nonattainment Areas



B. Emission Inventory Overview

This 2011 Periodic Emission Inventory is a compilation of the emissions from sources of anthropogenic (human-made) and biogenic (natural) VOC, NO_x, CO, particulate matter less than 2.5 micrometers and 10 micrometers in diameter ($PM_{2.5}$ and PM_{10}), sulfur dioxide (SO_2) and ammonia (NH_3) in the outdoor air.[2] The sources are divided into five sectors and each making up one component of the inventory: point sources (large stationary), area sources (small stationary), onroad mobile sources, nonroad mobile sources and biogenic (naturally occurring) sources.

This report includes the 2011 emission inventory for the pollutants listed in Table 1.

Table 1: 2011 Inventories Prepared

	Summer Day	Annual
VOC	√	√
NO_x	√	√
CO	√	√
$PM_{2.5}$		√
PM_{10}		√
SO_2		√
NH_3		√

C. Emission Inventory

A summary of the 2011 Periodic Emission Inventory for New Jersey is presented in Table 2 by pollutant and source sector. Table 3 presents the inventory data by pollutant, source sector, and county.

[2] SO_2 has been reported in the inventory instead of SO_x because the USEPA MOBILE and NONROAD models and the majority of USEPA guidance on emission factors is based on SO_2, not SO_x. In addition, the USEPA National Emission Inventory (NEI) reports SO_2.

Table 2: 2011 Statewide Emission Inventory by Source Sector and Pollutant

VOC					
Source Sector	**Tons per Summer Day**	**Tons per Year**	**% of Total Annual Inventory**	**% of Anthropogenic Summer Day Inventory**	**% of Anthropogenic Annual Inventory**
Point	40	7,320	3%	7%	4%
Area	274	93,726	32%	50%	51%
Onroad	101	40,206	14%	18%	22%
Nonroad	139	40,938	14%	25%	22%
Biogenic*	293	107,054	37%	NA	NA
Total in State	847	289,244	100%	NA	NA
Total Anthropogenic	554	182,190	NA	100%	100%

NOx					
Source Sector	**Tons per Summer Day**	**Tons per Year**	**% of Total Annual Inventory**	**% of Anthropogenic Summer Day Inventory**	**% of Anthropogenic Annual Inventory**
Point	129	14,793	8%	22%	8%
Area	32	24,157	13%	6%	13%
Onroad	260	92,356	50%	45%	51%
Nonroad	160	50,834	28%	28%	28%
Biogenic*	4	1,482	1%	NA	NA
Total in State	585	183,622	100%	NA	NA
Total Anthropogenic	581	182,140	NA	100%	100%

CO					
Source Sector	**Tons per Summer Day**	**Tons per Year**	**% of Total Annual Inventory**	**% of Anthropogenic Summer Day Inventory**	**% of Anthropogenic Annual Inventory**
Point	67	7,055	1%	2%	1%
Area	47	76,341	8%	2%	8%
Onroad**	1,109	455,683	48%	41%	48%
Nonroad	1,477	401,977	42%	55%	43%
Biogenic*	39	14,066	1%	1%	NA
Total in State	2,739	955,122	100%	NA	NA
Total Anthropogenic	2,700	941,056	NA	100%	100%

* The USEPA estimated biogenic emissions in tons per year, therefore, 2011 tons per day values were estimated by dividing the annual value by 365. Biogenic emissions are from USEPA 2011 NEI v2 dated February 2015. **Onroad Annual CO is from USEPA 2011 NEI v2 dated February 2015.

Table 2 (continued):
2011 Statewide Emission Inventory by Source Sector and Pollutant

Source Sector	PM2.5**			Source Sector	PM10**		
	Tons per Year	% of Total Inventory	% of Anthropogenic Annual Inventory		Tons per Year	% of Total Inventory	% of Anthropogenic Annual Inventory
Point	2,710	11%	11%	Point	3,611	10%	10%
Area	14,420	59%	59%	Area	22,072	63%	63%
Onroad	3,557	15%	15%	Onroad	5,328	15%	15%
Nonroad	3,567	15%	15%	Nonroad	3,757	11%	11%
Biogenic	NA	NA	NA	Biogenic	NA	NA	NA
Total in State	24,254	100%	NA	**Total in State**	34,768	100%	NA
Total Anthropogenic	24,254	NA	100%	**Total Anthropogenic**	34,768	NA	100%

Source Sector	SO_2			Source Sector	Ammonia		
	Tons per Year	% of Total Inventory	% of Anthropogenic Annual Inventory		Tons per Year	% of Total Inventory	% of Anthropogenic Annual Inventory
Point	6,415	38%	38%	Point	1,021	5%	10%
Area	6,669	40%	40%	Area	6,997	36%	66%
Onroad	879	5%	5%	Onroad	2,506	13%	24%
Nonroad	2,836	17%	17%	Nonroad***	43	0%	0%
Biogenic	NA	NA	NA	Biogenic*	9,032	46%	NA
Total in State	16,799	100%	NA	**Total in State**	19,599	100%	NA
Total Anthropogenic	16,799	NA	100%	**Total Anthropogenic**	10,567	NA	100%

* The USEPA estimated biogenic emissions in tons per year, therefore, 2011 tons per day values were estimated by dividing the annual value by 365. Biogenic emissions are from USEPA 2011 NEI v2 dated February 2015.
** These totals include adjusted emissions from fugitive dust categories in the area source inventory.
*** Nonroad ammonia is from USEPA 2011 NEI v2 dated February 2015.

Table 3: 2011 Statewide Emission Inventory by County and Source Sector

County	VOC Tons Per Summer Day						
	Point Sources	Area Sources	Onroad Sources	Nonroad Sources	Biogenic*	Total	Total Anthropogenic
Atlantic	0.16	9.12	3.73	8.04	29.10	50.15493	21.05
Bergen	1.46	25.45	11.17	14.41	5.75	58.24126	52.49
Burlington	0.92	14.32	6.52	7.48	35.47	64.70849	29.24
Camden	0.74	14.27	6.53	5.12	11.22	37.8777	26.66
Cape May	0.26	3.71	1.5	10.4	10.88	26.7549	15.87
Cumberland	0.33	7.29	1.68	2.9	22.19	34.38778	12.2
Essex	2.65	21.95	6.48	6.43	4.85	42.35622	37.51
Gloucester	4.29	16.12	3.86	4.54	12.09	40.90479	28.81
Hudson	3.11	15.87	3.82	3.96	0.94	27.7006	26.76
Hunterdon	0.16	4.37	2.04	3.09	11.43	21.08866	9.66
Mercer	0.54	11.32	5.06	4.54	8.71	30.16764	21.46
Middlesex	16.86	25.45	9.03	9.19	9.09	69.61989	60.53
Monmouth	0.43	19.33	7.79	9.6	18.60	55.74633	37.15
Morris	0.58	15.94	6.22	9.08	15.95	47.76877	31.82
Ocean	0.31	15.9	6.46	14.29	29.17	66.12575	36.96
Passaic	0.9	14.55	4.71	5.07	9.65	34.8837	25.23
Salem	0.78	3.09	1.13	1.84	11.44	18.28389	6.84
Somerset	0.96	10.52	3.87	6.21	9.76	31.31614	21.56
Sussex	0.14	4.52	1.93	4.07	20.64	31.30052	10.66
Union	3.7	17.15	5.99	5.96	4.61	37.41099	32.8
Warren	0.41	4.04	1.6	2.32	9.60	17.97	8.37
Total in State	**39.68**	**274.3**	**101.13**	**138.54**	**291.14**	**844.79**	**553.65**

* The USEPA estimated biogenic emissions in tons per year, therefore, 2011 tons per day values were estimated by dividing the annual value by 365. Biogenic emissions are from USEPA 2011 NEI v2 dated February 2015.

Table 3 (continued): 2011 Statewide Emission Inventory by County and Source Sector

County	VOC Tons per Year						
	Point Sources	Area Sources	Onroad Sources	Nonroad Sources	Biogenic	Total	Total Anthropogenic
Atlantic	58	3,437	1,278	2,472	10,623	17,868	7,245
Bergen	321	8,408	4,512	4,209	2,099	19,549	17,450
Burlington	226	4,995	2,382	2,174	12,946	22,723	9,777
Camden	218	5,134	2,349	1,484	4,094	13,279	9,185
Cape May	16	1,397	505	3,142	3,973	9,033	5,060
Cumberland	64	2,627	621	928	8,099	12,339	4,240
Essex	483	7,341	2,686	1,982	1,769	14,261	12,492
Gloucester	1,008	5,261	1,424	1,308	4,415	13,416	9,001
Hudson	722	5,504	1,585	1,244	343	9,398	9,055
Hunterdon	31	1,463	854	876	4,171	7,395	3,224
Mercer	126	4,343	1,877	1,286	3,178	10,810	7,632
Middlesex	1,891	8,539	3,711	2,617	3,318	20,076	16,758
Monmouth	117	6,442	3,241	2,790	6,788	19,378	12,590
Morris	133	5,257	2,561	2,570	5,821	16,342	10,521
Ocean	68	5,576	2,708	4,507	10,646	23,505	12,859
Passaic	113	4,708	1,952	1,488	3,524	11,785	8,261
Salem	197	1,036	414	565	4,177	6,389	2,212
Somerset	236	3,533	1,589	1,701	3,561	10,620	7,059
Sussex	48	1,517	835	1,197	7,534	11,131	3,597
Union	1,143	5,666	2,450	1,723	1,683	12,665	10,982
Warren	102	1,541	672	673	4,293	7,281	2,988
Total in State	**7,320**	**93,726**	**40,206**	**40,938**	**107,054**	**289,244**	**182,190**

Table 3 (continued): 2011 Statewide Emission Inventory by County and Source Sector

County	NO_x Tons per Summer Day						
	Point Sources	Area Sources	Onroad Sources	Nonroad Sources	Biogenic*	Total	Total Anthropogenic
Atlantic	0.95	1.05	14.2	5.91	0.20	22.31	22.11
Bergen	3.64	3.48	27.43	14.54	0.06	49.15	49.09
Burlington	8.92	1.79	17.78	8.79	0.39	37.67	37.28
Camden	1.53	1.79	16.89	6.84	0.12	27.17	27.05
Cape May	13.77	0.37	5.66	5.88	0.07	25.75	25.68
Cumberland	4.57	0.57	5.07	4.4	0.31	14.92	14.61
Essex	12.07	2.81	15.74	15.28	0.04	45.94	45.9
Gloucester	6.83	0.93	10.57	7.21	0.29	25.83	25.54
Hudson	16.98	2.07	8.4	14.29	0.02	41.76	41.74
Hunterdon	6.23	0.49	7	3.52	0.38	17.62	17.24
Mercer	6.49	1.64	14.2	5.62	0.20	28.15	27.95
Middlesex	19.08	3.03	23.95	12.65	0.13	58.84	58.71
Monmouth	0.58	2.15	14.64	11.54	0.22	29.13	28.91
Morris	0.98	2.2	15.86	7.27	0.12	26.43	26.31
Ocean	3.15	1.59	11.41	8.62	0.18	24.95	24.77
Passaic	0.27	1.62	9.55	4.89	0.06	16.39	16.33
Salem	10.36	0.25	5.89	1.61	0.47	18.58	18.11
Somerset	1.45	1.36	10.8	5.85	0.18	19.64	19.46
Sussex	0.15	0.54	3.12	2.19	0.27	6.27	6
Union	9.01	1.91	16.01	11.77	0.04	38.74	38.7
Warren	1.78	0.41	6.09	1.56	0.29	10.13	9.84
Total in State	**128.78**	**32.06**	**260.25**	**160.23**	**4.06**	**585.38**	**581.32**

* The USEPA estimated biogenic emissions in tons per year, therefore, 2011 tons per day values were estimated by dividing the annual value by 365. Biogenic emissions are from USEPA 2011 NEI v2 dated September 2014.

Table 3 (continued): 2011 Statewide Emission Inventory by County and Source Sector

County	NOx Tons Per Year						
	Point Sources	Area Sources	Onroad Sources	Nonroad Sources	Biogenic	Total	Total Anthropogenic
Atlantic	110	807	3,926	1,909	72	6,824	6,752
Bergen	714	2,570	9,852	4,539	21	17,696	17,675
Burlington	266	1,309	5,952	2,765	143	10,435	10,292
Camden	433	1,408	5,463	2,216	45	9,565	9,520
Cape May	600	288	1,500	1,988	27	4,403	4,376
Cumberland	721	437	1,418	1,460	114	4,150	4,036
Essex	1,470	2,107	5,934	5,138	13	14,662	14,649
Gloucester	1,765	732	3,618	2,364	107	8,586	8,479
Hudson	1,087	1,605	3,152	4,731	9	10,584	10,575
Hunterdon	181	366	2,663	1,026	138	4,374	4,236
Mercer	634	1,194	4,661	1,593	73	8,155	8,082
Middlesex	1,647	2,217	9,045	3,826	46	16,781	16,735
Monmouth	151	1,665	5,570	3,586	82	11,054	10,972
Morris	122	1,556	6,046	2,160	45	9,929	9,884
Ocean	252	1,413	4,430	2,778	65	8,938	8,873
Passaic	48	1,210	3,566	1,500	23	6,347	6,324
Salem	1,540	182	1,952	476	172	4,322	4,150
Somerset	168	969	4,102	1,721	67	7,027	6,960
Sussex	39	395	1,203	634	100	2,371	2,271
Union	2,532	1,405	5,984	3,979	14	13,914	13,900
Warren	314	322	2,317	443	106	3,502	3,396
Total in State	**14,793**	**24,157**	**92,356**	**50,834**	**1,482**	**183,622**	**182,140**

Table 3 (continued): 2011 Statewide Emission Inventory by County and Source Sector

County	CO Tons per Summer Day						
	Point Sources	Area Sources	Onroad Sources	Nonroad Sources	Biogenic*	Total	Total Anthropogenic
Atlantic	0.92	1.91	47.16	47.81	3.90	101.70	97.80
Bergen	1.49	3.47	128.03	198.37	0.76	332.12	331.36
Burlington	2.67	6.88	68.9	79.73	4.97	163.15	158.18
Camden	0.47	3.17	64.63	62.04	1.44	131.75	130.31
Cape May	1.14	0.66	18.15	45.18	1.55	66.68	65.13
Cumberland	2.25	1.42	15.97	20.16	3.11	42.91	39.80
Essex	12.05	2.96	70.99	84.87	0.49	171.36	170.87
Gloucester	2.14	1.34	41.11	51.26	1.60	97.45	95.85
Hudson	6.64	2.21	38.46	41.16	0.16	88.63	88.47
Hunterdon	2.18	1	22.08	37.27	1.85	64.38	62.53
Mercer	1.22	2.2	52.97	58.14	1.21	115.74	114.53
Middlesex	22.29	3.59	108.77	132.73	1.12	268.50	267.38
Monmouth	0.8	2.45	83.9	114.31	2.19	203.65	201.46
Morris	0.42	2.28	72.86	121.29	1.70	198.55	196.85
Ocean	2.48	3.95	63.68	88.62	4.22	162.95	158.73
Passaic	0.17	1.74	52.36	62.2	0.93	117.40	116.47
Salem	3.08	0.6	15.16	11.73	1.81	32.38	30.57
Somerset	0.79	1.46	42.25	90.37	1.32	136.19	134.87
Sussex	0.4	0.85	17.85	28.7	2.15	49.95	47.80
Union	2.85	2.05	67.43	81.39	0.43	154.15	153.72
Warren	0.74	1.04	16.55	19.42	1.62	39.37	37.75
Total in State	**67.20**	**47.23**	**1,109.26**	**1476.75**	**38.54**	**2,738.97**	**2,700.44**

* The USEPA estimated biogenic emissions in tons per year, therefore, 2011 tons per day values were estimated by dividing the annual value by 365. Biogenic emissions are from USEPA 2011 NEI v2 dated February 2015.

Table 3 (continued): 2011 Statewide Emission Inventory by County and Source Sector

County	CO Tons per Year						
	Point Sources	Area Sources	Onroad Sources ***	Nonroad Sources	Biogenic	Total	Total Anthropogenic
Atlantic	179	4,493	13,740	13,553	1,425	33,390	31,965
Bergen	278	4,861	53,500	53,631	277	112,547	112,270
Burlington	356	6,734	27,653	21,635	1,813	58,190	56,378
Camden	140	6,243	23,922	16,981	525	47,811	47,286
Cape May	61	1,607	6,039	13,250	564	21,521	20,957
Cumberland	234	3,198	6,729	5,989	1,137	17,287	16,150
Essex	630	4,616	32,647	25,006	178	63,077	62,899
Gloucester	510	2,436	16,487	13,377	586	33,396	32,810
Hudson	334	4,083	18,606	12,513	57	35,593	35,536
Hunterdon	50	1,209	9,367	9,523	676	20,825	20,149
Mercer	183	5,374	21,211	15,090	441	42,298	41,858
Middlesex	1,753	4,707	45,777	35,120	409	87,766	87,357
Monmouth	239	4,351	36,065	30,219	800	71,675	70,874
Morris	84	3,194	31,289	31,670	622	66,859	66,237
Ocean	534	7,500	26,667	26,043	1,539	62,284	60,744
Passaic	32	2,343	21,629	17,169	341	41,513	41,173
Salem	554	774	4,001	3,378	662	9,369	8,707
Somerset	104	1,976	17,650	22,599	481	42,811	42,329
Sussex	74	1,216	7,745	8,038	784	17,857	17,073
Union	576	3,318	27,597	21,827	158	53,476	53,318
Warren	150	2,110	7,362	5,369	592	15,583	14,991
Total in State	**7,055**	**76,341**	**455,683**	**401,977**	**14,066**	**955,122**	**941,056**

*** Onroad Annual CO is from 2011 USEPA NEI v2 dated February 2015

Table 3 (continued): 2011 Statewide Emission Inventory by County and Source Sector

County	PM2.5** Tons per Year						
	Point Sources	Area Sources	Onroad Sources	Nonroad Sources	Biogenic	Total	Total Anthropogenic
Atlantic	13	694	144	133	NA	984	984
Bergen	143	992	416	362	NA	1,913	1,913
Burlington	39	1,166	230	176	NA	1,611	1,611
Camden	41	976	211	144	NA	1,372	1,372
Cape May	139	307	52	154	NA	652	652
Cumberland	200	542	52	82	NA	876	876
Essex	185	898	231	227	NA	1,541	1,541
Gloucester	330	542	138	142	NA	1,152	1,152
Hudson	100	765	127	239	NA	1,231	1,231
Hunterdon	16	319	98	87	NA	520	520
Mercer	102	856	189	152	NA	1,299	1,299
Middlesex	411	1,010	356	305	NA	2,082	2,082
Monmouth	37	972	194	271	NA	1,474	1,474
Morris	18	641	221	209	NA	1,089	1,089
Ocean	45	1,230	155	214	NA	1,644	1,644
Passaic	2	499	143	124	NA	768	768
Salem	219	199	80	36	NA	534	534
Somerset	18	428	152	160	NA	758	758
Sussex	13	300	44	70	NA	427	427
Union	600	688	240	236	NA	1,764	1,764
Warren	39	398	83	45	NA	565	565
Total in State	**2,710**	**14,420**	**3,557**	**3,567**	**NA**	**24,254**	**24,254**

** These totals include adjusted emissions from fugitive dust categories in the area source inventory.

Table 3 (continued): 2011 Statewide Emission Inventory by County and Source Sector

County	PM10** Tons per Year						
	Point Sources	Area Sources	Onroad Sources	Nonroad Sources	Biogenic	Total	Total Anthropogenic
Atlantic	22	929	189	140	NA	1,280	1,280
Bergen	152	1,328	647	381	NA	2,508	2,508
Burlington	78	1,573	352	185	NA	2,188	2,188
Camden	571	1,111	325	152	NA	2,159	2,159
Cape May	156	586	69	164	NA	975	975
Cumberland	226	1,055	70	86	NA	1,437	1,437
Essex	191	1,158	339	236	NA	1,924	1,924
Gloucester	332	1,109	210	149	NA	1,801	1,801
Hudson	103	965	189	250	NA	1,507	1,507
Hunterdon	16	829	137	92	NA	1,074	1,074
Mercer	113	1,091	291	159	NA	1,654	1,654
Middlesex	486	1,585	522	321	NA	2,913	2,913
Monmouth	42	1,763	321	286	NA	2,412	2,412
Morris	47	935	330	221	NA	1,533	1,533
Ocean	50	2,023	260	226	NA	2,559	2,559
Passaic	3	633	219	130	NA	985	985
Salem	241	436	98	39	NA	814	814
Somerset	40	705	226	170	NA	1,140	1,140
Sussex	23	599	75	75	NA	772	772
Union	667	926	349	248	NA	2,191	2,191
Warren	53	733	111	47	NA	944	944
Total in State	**3,611**	**22,072**	**5,328**	**3,757**	**NA**	**34,768**	**34,768**

** These totals include adjusted emissions from fugitive dust categories in the area source inventory

Table 3 (continued): 2011 Statewide Emission Inventory by County and Source Sector

County	SO_2 Tons per Year						
	Point Sources	Area Sources	Onroad Sources	Nonroad Sources	Biogenic	Total	Total Anthropogenic
Atlantic	107	276	29	61	NA	473	473
Bergen	67	503	103	50	NA	723	723
Burlington	87	318	55	143	NA	603	603
Camden	48	299	50	219	NA	616	616
Cape May	1,295	89	10	40	NA	1,434	1,434
Cumberland	348	287	9	31	NA	675	675
Essex	248	498	57	386	NA	1,189	1,189
Gloucester	742	206	33	391	NA	1,372	1,372
Hudson	1,083	300	28	435	NA	1,846	1,846
Hunterdon	3	304	21	6	NA	334	334
Mercer	624	280	43	10	NA	957	957
Middlesex	235	406	88	73	NA	802	802
Monmouth	31	334	71	264	NA	700	700
Morris	4	579	62	77	NA	722	722
Ocean	26	374	53	42	NA	495	495
Passaic	13	257	37	5	NA	312	312
Salem	1,256	106	10	8	NA	1,380	1,380
Somerset	12	189	38	9	NA	248	248
Sussex	11	474	14	3	NA	502	502
Union	123	332	54	577	NA	1,086	1,086
Warren	52	259	16	3	NA	330	330
Total in State	**6,415**	**6,669**	**879**	**2,836**	**NA**	**16,799**	**16,799**

Table 3 (continued): 2011 Statewide Emission Inventory by County and Source Sector

County	Ammonia Tons per Year						
	Point Sources	Area Sources	Onroad Sources	Nonroad Sources ***	Biogenic	Total	Total Anthropogenic
Atlantic	14	194	90	NA	329	NA	NA
Bergen	372	380	282	NA	863	NA	NA
Burlington	39	471	141	NA	520	NA	NA
Camden	20	246	127	NA	518	NA	NA
Cape May	3	75	31	NA	130	NA	NA
Cumberland	30	404	26	NA	203	NA	NA
Essex	41	322	170	NA	762	NA	NA
Gloucester	16	324	86	NA	274	NA	NA
Hudson	26	230	80	NA	572	NA	NA
Hunterdon	2	417	61	NA	164	NA	NA
Mercer	10	216	108	NA	347	NA	NA
Middlesex	162	370	262	NA	746	NA	NA
Monmouth	47	616	213	NA	651	NA	NA
Morris	3	230	185	NA	544	NA	NA
Ocean	41	209	155	NA	616	NA	NA
Passaic	1	182	105	NA	505	NA	NA
Salem	59	644	29	NA	89	NA	NA
Somerset	2	228	111	NA	309	NA	NA
Sussex	0	321	38	NA	235	NA	NA
Union	127	226	161	NA	501	NA	NA
Warren	6	694	46	NA	153	NA	NA
Total in State	**1,021**	**6,997**	**2,506**	**43**	**9,032**	**19,605**	**10,567**

*** Nonroad ammonia is from USEPA 2011 NEI v2 dated February 2015

II. Point Sources

For the purposes of this 2011 emission inventory, a point source is defined as a stationary facility that emits or has the potential to emit at or above any of the following thresholds:

- 10 tons per year of VOC
- 25 tons per year of NO_x
- 100 tons per year of carbon monoxide, $PM_{2.5}$, PM_{10}, $SO_{2,}$ ammonia

The remaining stationary sources are included in the area source emission inventory.

A. VOC, NO_x, Carbon Monoxide, Ammonia, $SO_{2,}$ PM_{10}, and $PM_{2.5}$ Emissions From Emission Statements

The 2011 point source inventories for VOC, NO_x, carbon monoxide, ammonia, SO_2, PM_{10}, and $PM_{2.5}$ were developed using data reported by facilities to the NJDEP through the Emission Statement Program. Facilities are required to prepare an annual accounting of air emissions for each pollutant source at the facility and to report those emissions by submitting an Emission Statement to the NJDEP in accordance with N.J.A.C. 7:27-21. A total of 532 facilities, including power plants with units that report to the Clean Air Markets Division (CAMD), were identified in New Jersey as meeting one of the required criteria in 2011.

Emission Statement data are submitted through NJDEP's data entry software, known as Remote Air Data Input Users System (RADIUS). Table 4 provides a brief description of the Emission Statement information collected.

Table 4: Emission Statement Information

Screen Name	Description of Emission Statement Data
Facility Profile (General)	Plant level data (Facility Information)
Facility Profile (Planning)	Estimates of plant activities for planning purposes
Non-Source Fugitive Emissions	Fugitive emissions
Insignificant Source Emissions	List of sources not requiring permits
Equipment Inventory	List of permitted sources
Control Device Inventory	List of control devices
Emission Point Inventory	List of emission points (stacks) for the permitted sources
Emission Unit/Batch Process Inventory	List of emission units and batch processes containing the permitted sources
Subject Item Group Inventory	List of sources grouped for various permitting purposes
Emission Statement	Process and emission data for all sources, including control efficiency and source details

The certified RADIUS file containing the emission statement data was imported into the New Jersey Emission Management System (NJEMS) database. After the data was quality assured (see Section VII(A)), the data was submitted to the USEPA's NEI database.

B. Rule Effectiveness

Per the USEPA's guidance,[3] [4] a rule effectiveness factor was applied to all applicable sources for the emission inventories. The purpose of the rule effectiveness factor is to account for noncompliance with existing rules, pollution control equipment failures and control equipment downtime. The USEPA guidance requires states to apply a default rule effectiveness factor of eighty percent unless other, state-specific data exist to justify the use of a different value. New Jersey has chosen to apply state-specific rule effectiveness factors to point sources in the 2011 inventory if the overall control efficiency is not reported to the Emission Statement Program. All remaining sources had the eighty percent rule effectiveness applied in accordance with USEPA guidance.

C. Point Source Inventory Data

Tables 2 and 3 present the 2011 point source emission inventory by county. Attachment 1 contains the detailed point source emission inventories for VOC, NO_x, carbon monoxide, ammonia, PM_{10}, $PM_{2.5}$, and SO_2, respectively. These attachments are only available electronically.

III. Area Sources

The area source component of the 2011 emission inventory includes emissions from numerous facilities or activities that individually release small amounts of a given pollutant, but collectively they can release significant amounts of a pollutant. This includes small stationary sources that fall below required emission reporting thresholds by the Emission Statement Program. Area sources are small and numerous and have emissions which are not readily associated with a single point or a small set of points. Some of the stationary sources in this sector are sometimes referred to as minor point sources.

A. VOC, NO_x, CO, SO_2, $PM_{2.5}$, and PM_{10} Emission Calculation Procedures

The VOC, NO_x, CO, SO_2, $PM_{2.5}$, and PM_{10} emissions from area source categories were calculated, for the most part, by multiplying a USEPA published emission factor by a known indicator of activity for each source category, such as employment, population and fuel usage. The emissions were first calculated on an annual basis since most activity data was provided on an annual basis. The annual emission estimates were allocated to each season, based on seasonal adjustment factors. A calculation methodology sheet was created to document the data used to estimate the emissions from each area source category. In general, the calculation methodology sheets document the calculation methodology selected, the process used to estimate the emissions, all assumptions required to calculate the emissions, and all sources of data. A complete set of calculation methodology sheets is included in Attachment 2.

The following sections describe how the area source emission inventory was developed.

i. Annual Emissions

Most USEPA emission factors are in pounds of pollutant emitted per unit of activity. The general calculation methodology to estimate tons of pollutant emitted per year can be expressed as:

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[3] USEPA, "Guidelines for Estimating and Applying Rule Effectiveness for Ozone/CO State Implementation Plan Base Year Inventories", November 1992. Hereafter cited as Rule Effectiveness Guidance.

[4] USEPA, "Emissions Inventory Guidance for Implementation of Ozone and Particulate Matter National Ambient Air Quality Standards (NAAQS) and Regional Haze Regulations", June 2003.

$$\text{Emissions}_{\text{Annual}} = \text{EF} \times \text{AL/CF} \qquad (1)$$

where:
$\text{Emissions}_{\text{Annual}}$ = Annual pollutant emissions in tons per year
EF = Annual emission factor
AL = Annual activity level
CF = Factor to convert pounds to tons

ii. Daily Emissions

Daily emissions were estimated by incorporating annual activity day factors for a given area source category operation into the annual emission estimate calculation. The annual activity day factor is determined by the activity of a given source category during a week. For example, automobile refinishing establishments typically operate five (5) days per week while the use of consumer products occurs seven (7) days per week. The annual activity day factors are calculated by:

$$\text{AADF} = (\text{WAF}) * (52\ \text{weeks/year}) \qquad (2)$$

where:
AADF = Annual activity day factor
WAF = Weekly Activity Factor (Activity Days/Week)

iii. Seasonal Adjustment Factor

Activity for several source categories fluctuates on a seasonal basis. For example, architectural surface coating and pesticide application activities occur more in the warmer months (June, July and August). Conversely, some activities do not occur very often in the warmer months such as heating activities. Some activities are considered uniform throughout the year, such as marine vessel, aircraft, railroad, and industrial surface coating operations. In order to estimate seasonal average daily emissions, the annual emissions are adjusted as follows:

$$\text{Emissions}_{\text{Season}} = \text{Emissions}_{\text{Annual}} * \text{SAF/AADF} \qquad (3)$$

where:
SAF = Seasonal Adjustment Factor

iv. County Level Emissions

Depending on the activity data obtained for a particular category, emissions are either calculated on a statewide basis and allocated to the county level based on a secondary activity indicator, or are calculated on a county basis and totaled for statewide emissions. For example, architectural coatings emissions are calculated at the county level using county population and dry cleaning emissions are calculated at the county level using county employment. Residential natural gas combustion is calculated at the state level using statewide fuel use estimates published by the United States Department of Energy and is allocated to the county level based on census data regarding the number of houses using natural gas as a primary heat source.

v. Strategies to Eliminate Double Counting

Emissions for some source categories are estimated in both the area source portion of the inventory and in the point source inventory. Reporting the emissions in each category results in double counting of the emissions. Therefore, the area source portion of the inventory must be adjusted for the emissions already accounted for in the point source inventory. There are three ways to eliminate this double counting. One approach is to delete a known point source from the database used to calculate the area source inventory. For example, if a particular industrial incinerator submits an emission statement then it is included in the point source inventory and is not included in the area source inventory. A second approach involves adjusting the source category activity level by subtracting the activity reported in the point source inventory. For example, industrial fuel combustion emissions are estimated in both the point source and the area source inventories. Since the industrial fuel use activity level reported by facilities is accounted for in the point source inventory, this fuel can be subtracted from the area source statewide industrial fuel use activity level in the area source inventory. The resulting area source activity level is then utilized in the calculation to estimate the emissions for this category for area sources. A third approach involves adjusting the source category emission estimate by subtracting the point source emission estimate from the area source emission estimate. For example, emissions from graphic arts operations are estimated in both the point and area source inventories. The point source emissions are based on emission statements submitted by the graphic arts facility. The area source emissions are based on population activity at the county level. The reported point source emissions are subtracted from calculated area source emissions for that county.

vi. Emission Controls

New Jersey has developed a number of air pollution control measures to reduce area source emissions by either requiring VOC content limitations on specific products or requiring installation of a control apparatus to capture a specified percentage of pollutant emissions. For example, the New Jersey Architectural Coatings Rule (N.J.A.C. 7:27-23) limits the VOC content in paints, while the Marine Tank Vessel Loading and Ballasting Operations rule (N.J.A.C. 7:27-16.5) requires that most marine vessel terminals that load or ballast gasoline install and operate a control apparatus that reduces total VOC emissions to the outdoor atmosphere by no less than 95%.

Control efficiency factors have been developed to adjust the emission inventory in response to New Jersey APC measures. For example, the control efficiency for any marine vessel gasoline loading/ballasting operations must be 95% in accordance with the aforementioned New Jersey Marine Vessel rule. The USEPA has also developed air pollution control measures, which are reflected in the calculations, if applicable, such as the National Consumer Products rule which sets standards for consumer products, automobile refinish coatings, and architectural coatings.

The USEPA requires that rule effectiveness and rule penetration factors be applied to adjust the emission inventory whenever control measures have been applied to an inventory.[5] The purpose of the rule effectiveness factor is to account for the underestimation of emissions due to noncompliance with the existing control measures, control device equipment downtime or operating problems, process upsets, and the inability of most emission estimate calculation procedures to incorporate these problems.[6] Rule penetration is a measure of the extent to which a rule applies to a given source category.

[5] Guidelines for Estimating and Applying Rule Effectiveness for Ozone/CO State Implementation Plan Base Year Inventories, Office of Air Quality Planning and Standards, USEPA, November 1992, page 21.
[6] Ibid. page 3.

Whenever a control measure is applied to a specific area source category, the three factors of control efficiency (CE), rule effectiveness (RE), and rule penetration (RP) are incorporated into the two emission estimation equations (1) and (3) as follows:

$$Emissions_{Annual} = \{EF \times AL \times [1 - (CE \times RE \times RP)]\}/CF \quad (5)$$

$$Emissions_{Daily} = \{EF \times AL \times SAF \times [1 - (CE \times RE \times RP)]\}/(AADF \times CF) \quad (6)$$

Control efficiency, rule effectiveness, and rule penetration are normally expressed as percentages but used as fractions in the above equations. For the area emission inventory, the USEPA default rule effectiveness value of eighty percent and rule penetration value of 100 percent was used the majority of the time.

vii. Fugitive Dust

Fugitive dust-related $PM_{2.5}$ and PM_{10} emissions calculated using USEPA emission inventory guidance is not representative of ambient air quality, as demonstrated by monitoring data and USEPA guidance on fugitive dust transport fractions. The USEPA has developed a methodology to reduce the fugitive dust emissions in the ambient air by applying transport factors.[7] New Jersey applied USEPA transport factors when developing the 2011 area source emission inventory. The area source categories affected by the PM transport fractions include paved roads, unpaved roads, construction, mining and quarrying, and agricultural tilling. The USEPA transport factors that were applied to New Jersey's 2011 $PM_{2.5}$ and PM_{10} area source inventory are listed in Table 5, below:

Table 5: PM Transport Fractions for New Jersey Counties

County FIPS	County	PM Transport Fraction
34001	ATLANTIC	0.3377
34003	BERGEN	0.2657
34005	BURLINGTON	0.3008
34007	CAMDEN	0.1375
34009	CAPE MAY	0.8146
34011	CUMBERLAND	0.5151
34013	ESSEX	0.3461
34015	GLOUCESTER	0.4361
34017	HUDSON	0.5286
34019	HUNERDON	0.4911
34021	MERCER	0.3472
34023	MIDDLESEX	0.3273
34025	MONMOUTH	0.5468
34027	MORRIS	0.2297
34029	OCEAN	0.5196
34031	PASSAIC	0.1971
34033	SALEM	0.5905
34035	SOMERSET	0.3635
34037	SUSSEX	0.3404
34039	UNION	0.3117

[7] U.S. Environmental Protections Agency. *Emissions Modeling Clearinghouse - Fugitive Dust Fractions*. February 2007. (http://www.epa.gov/ttn/chief/emch/dustfractions).

B. Ammonia Emissions

Ammonia emissions in New Jersey's 2011 inventory from livestock waste and fertilizer were prepared by the USEPA for the 2011 NEI using the Carnegie Mellon University (CMU) Ammonia Model, v3.6. Ammonia emissions for industrial refrigeration, composting, and publicly owned treatment works were calculated by E.H. Pechan & Associates, Inc. for the Mid-Atlantic/Northeast Visibility Union Regional Planning Organization (MANE-VU RPO).[8]

Ammonia emissions for wildfires, industrial and commercial combustion sources, and prescribed burning were estimated by New Jersey in the same manner as the other pollutants in New Jersey's inventory, as discussed in Section III(A) and in the calculation methodology sheets.

Ammonia emissions from domestic and wild animals and human perspiration are included in the biogenic inventory. The biogenic inventory is discussed in Section VI.

C. Wildfire Emissions

Wildfires are exceptional events, are not spread out over the entire year, and are unpredictable from year to year. For this reason, the USEPA has changed the way wildfires are reported in their US National Emission Inventory (NEI). They are now required to be reported as events. For this SIP inventory, New Jersey used an average of emissions from 2000-2011 to estimate 2011 emissions from wildfires (SCC 2810001000). The 12-year average of wildfire emissions from 2000-2011 presents a more representative estimate of wildfire emissions for the 2011 periodic inventory. An average estimate is appropriate for the periodic inventory so that evaluations of the impact of permanent and enforceable control measures in future inventory projections will not be biased. This approach was recommended by USEPA.[9]

D. Area Source Categories Added from the USEPA National Emission Inventory (NEI)

New Jersey added several categories to the 2011 area source inventory that were calculated by the USEPA for the 2011 National Emission Inventory (NEI). These categories consisted of: All of the Residential Wood Categories (SCC 2104008100 – SCC 2104009000) for all pollutants, Industrial Combustion Wood (SCC 2102008000) for all pollutants, Commercial Combustion Wood (SCC 2103008000) for all pollutants, Gasoline Distribution Stage 1; Pipeline (SCC 2505040120) for VOC, and Cremation – Humans (SCC 2810060100) for all pollutants, except ammonia.

E. Area Source Inventory Data

Tables 2 and 3 present the 2011 area source emission inventory by county. Attachment 3 contains the detailed area source emission inventory for VOC, NO_x, CO, SO_2, $PM_{2.5}$, PM_{10}, and NH_3, respectively. These attachments are only available electronically.

[8] E.H. Pecan & Associates, Inc., 2004, "Technical Memorandum: MANE-VU 2002 Ammonia Emissions Inventory for Miscellaneous Sources".
[9] Email correspondence with Alison Eyth, USEPA Emission Inventory and Analysis Group, April 13, 2012.

IV. Onroad Sources

The onroad source components of the 2011 emission inventories are estimates of exhaust (i.e., tailpipe) and brake/tire emissions from all onroad vehicles (gasoline, diesel and natural gas fueled) operating in the New Jersey counties within the state. 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 MOVES2010b Version 2012/04/10). 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) and South Jersey Transportation Planning Organization (SJTPO) 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.

A. Activity Estimates

The vehicle activity estimates used in these emission inventories were calculated with the TDMs used by the MPOs that cover the state of New Jersey. The MPOs are the North Jersey Transportation Planning Authority (NJTPA), the South Jersey Transportation Planning Organization (SJTPO), and the Delaware Valley Regional Planning Commission (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. The highway networks cover all 21 counties within the state so that the TDMs generate activity data for the entire state. Attachment 4 presents the DVMT used for the 2011 inventory.

i. NJTPA and SJTPO

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 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.

The South Jersey Regional Transportation Model was validated for the year 2007. 2010 VMT and emissions were estimated with the 2007 HPMS adjustments (2007 model run vs. 2007 NJDOT HPMS VMT). The difference between Model and HPMS regional total VMT was 144% in the summer and 104% in the winter. 2011 activity levels were based on the 2010 travel model year adjusted to the 2011 HPMS VMT. It included reconciliation of model VMT with HPMS plus one year VMT growth. The difference between 2010 SJTPO travel model VMT and 2011 HPMS data vary from 83% and 138% for individual counties in two seasons – summer and winter.

Traffic at the South Jersey Transportation Planning Organization and North Jersey Transportation Planning Authority boundaries was established using validation year traffic count data. 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.

ii. 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 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. 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 screen lines 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.

B. MOVES Model Inputs

The USEPA’s MOVES2010b (MOtor Vehicle Emission Simulator) was used to estimate air pollution emissions from onroad mobile sources including buses, cars, trucks and motorcycles. The MOVES input files that contain local (non-default) data are included in Attachment 5 and include:

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

- HPMSVTypeYear
- MonthVMTFraction
- DayVMTFraction
- HourVMTFraction
- MeteorologyData
- Retrofit Strategy

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

i. 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). The IM program representations were included for both fuel type 1 and fuel type 5.
- 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 5 years for the 2011 representation.
- 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 2011 I/M program shown

Table 6: 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	2006
3	2	11	1970	2011
4	2	22 (5015)	1981	1995
5	D	D	D	D
6	2	41 (gas cap)	1970	2011
7	D	D	D	D
8	D	D	D	D
9	2	51 (exhOBD)	1996	2006
10	D	D	D	D
11	2	12 (TSI)	1981	1995
12	1	41	1970	1995
13	1	45 (GC/evOBD)	1996	2011
14	1	22	1981	1995
15	2	41	1970	1995
16	1	51	1996	2011
17	2	41	1970	2006
18	2	45	1996	2006
19	1	12	1981	1995
20	1	11	1970	2011
21	2	41	1970	1995
22	2	45	1996	2000
23	2	43 (evOBD)	2001	2006
24	1	41	1970	1995
25	1	45	1996	2000
26	1	43	2001	2011
27	1	41	1970	2000

2011 IM Representation

- 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 7: 2011 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 8: 2011 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

ii. 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 its 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 6.

iii. 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 data from the various sources were used to estimate the coefficients of polynomials that represent a best fit of the data based on maximizing the R-squared in the curve fitting process. The values from the polynomials 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. Further details regarding the establishment of the age distribution factors for the New Jersey fleet are provided electronically in Attachment 7.

iv. Average Speed Distribution

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

v. 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.

vi. Ramp Fraction

For the NJTPA and SJTPO counties the fraction of travel that occurs on highway ramps is generated based on outputs from the regional transportation models. For the DVRPC counties the MOVES default value of 8% is used.

vii. Road Type Distribution

For the NJTPA and SJTPO counties the fraction of travel that occurs on each road type is generated based on outputs from the regional transportation models 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.

viii. 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).

New Jersey motor vehicle registration was assembled and aggregated by NJDEP. It was collected for 2011 and arranged in MOVES input format. For some vehicle types the US census data was used to allocate vehicle populations to individual counties. The calculations and methodology for the estimation of VPOPs for 2011 are included in Attachment 8.

ix. HPMS VType Year

The VMT by vehicle type is based on the HPMS VMT data from the New Jersey Department of Transportation.

The DVRPC typical summer day runs were performed with the VMT inputs for all of the July weekdays. This is because the MonthVMTFraction table assigned all of the VMT to July and the DayVMTFraction table assigned all of the VMT to weekdays. The daily VMT was multiplied by 22.14 (31*(5/7)=22.14) which corresponds to an average value for a July weekdayday of any year. This value was used instead of the number of weekday in the actual analysis year since the weekday/weekend and monthly factors are calculated by combining counts from 3 years. HPMS guidance is to count 1/3 of the sample universe each year, and apply a growth factor to the other links.

x. Month VMT Fraction

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

xi. 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.

xii. Hour VMT Fraction

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

xiii. Meteorology Data

The meteorology data required by MOVES are hourly values for temperature and relative humidity. The meteorology data for the annual inventories were average monthly values based on historical averages. The meteorology data for the typical summer work weekday inventories were historical average values for the summer months of June, July and August. The MOVES meteorology file is provided electronically in Attachment 5.

xiv. Retrofit Strategy

The New Jersey Diesel Retrofit Law was established in 2005 to clean up emissions from certain onroad diesel-powered motor vehicles through the use of PM retrofit emission control technology. There is no cost to the owners of regulated vehicles to install the Best Available Retrofit Technology; the purchase and installation costs for the retrofit technology are reimbursed by the State. Progress to date includes the retrofit of over: 1200 solid waste trucks, 750 transit buses and 1000 intercity buses.

In order to model the emission reduction benefits of this program the MOVES On-Road Retrofit option was used under Strategies on the MOVES Navigation Panel. The On-Road Retrofit strategy panel (described in Section 2.9.9 and Appendix D of the MOVES User Guide) allows the user to enter information about diesel trucks and buses that have installed additional emission control equipment. An On-Road Retrofit Input File was developed using the MOVES Retrofit Converter (Excel) (Updated March 2012) downloaded from the USEPA MOVES website. The retrofitted fraction of each vehicle type was applied to the New Jersey vehicle fleet on a statewide basis. The MOVES retrofit strategy file is provided electronically in Attachment 5.

C. Onroad Inventory Data

Tables 2 and 3 present onroad source emission inventories for annual and typical summer work weekday, respectively. Attachment 4 contains additional onroad source emission inventories and Attachment 8 contains MOVES input and output databases.

V. Nonroad Sources

Non-road Mobile Sources include internal combustion engines used to propel marine vessels, airplanes, and locomotives, or to operate equipment such as forklifts, lawn and garden equipment, portable generators, etc. For activities other than marine vessels, airplanes, and locomotives, the inventory was developed using the most current version of USEPA's NONROAD model NONROAD2008a (July 2009 version). Since the NONROAD model does not include emissions from marine vessels, airplanes, and locomotives, these emissions were estimated using the latest USEPA guidance or by following the methodology developed by groups such as the Eastern Regional Technical Advisory Committee (ERTAC) and Starcrest.

A. Nonroad Model

The USEPA's NONROAD2008a model estimates emissions from equipment such as recreational marine vessels, recreational land-based vehicles, farm and construction machinery, lawn and garden equipment, aircraft ground support equipment (GSE) and rail maintenance equipment. This equipment is powered by diesel, gasoline, compressed natural gas or liquefied petroleum gas engines. The user runs the NONROAD2008a model via utilization of the graphical user interface (GUI) included in the model template. This was conducted by New Jersey for the summer weekday and annual emission inventory.

The following subsections describe the summer weekday and annual 2011 runs conducted for New Jersey.

i. NONROAD Model Runs Inputs

New Jersey ran the NONROAD2008a for daily summer weekday and annual emissions, for the year 2011, and for every county by inputting its own specific fuel parameters and climatological data. New Jersey utilized 2011 year specific meteorology data from the National Oceanic and Atmospheric Administration Climatological Data and fuel oil property revisions based on a New Jersey review of a USEPA gasoline formulation survey data (Reid vapor pressure, sulfur content, oxygenate fractions and ethanol volume and content) and diesel fuel sulfur content included in the USEPA's "Suggested Nationwide Average Fuel Properties".

The normal maximum and minimum and average ambient daily weekday summer season (June, July and August) and annual 2011 temperatures were compiled from those reported at Newark Airport and Allentown Pennsylvania. These were applied to the North New Jersey (NNJ) Counties that constitute the Northern Reformulated Fuel Gasoline (RFG) Region (Bergen, Essex, Hudson, Hunterdon, Middlesex, Monmouth, Morris, Passaic, Somerset, Sussex, Union and Warren). 2011 temperatures were also complied from those reported at Philadelphia Airport and Wilmington Delaware. These were applied to the South New Jersey (SNJ) counties that constitute the Southern RFG Region counties (Atlantic, Burlington, Camden, Cape May, Cumberland, Gloucester, Mercer, Ocean and Salem). Similarly, New Jersey compiled seasonal USEPA RFG formulations survey data into summer and annual averages for application into the Northern and Southern New Jersey counties referenced above as specified in Exhibit A.1 below.

Exhibit A.1
Temperatures and Fuel Oil Specification Inputs Used in 2011 USEPA NONROAD Model Runs

Gasoline Specifications Used for 2011 in the MOBILE Model	Northern RFG-Annual	Southern RFG-Annual	Northern RFG-Summer	Southern RFG-Summer*
Fuel Reid Vapor Pressure (psi)	9.86	9.84	7.04	7.00
Fuel Oxygen Content (% by weight)	3.43	3.43	3.43	3.43
Gasoline sulfur Level	.003945	.003874	.003717	.003701
Ethanol Volume	9.85	9.81	9.89	9.87
Ethanol Market Share	1.000	1.000	1.000	1.000
Diesel Sulfur %	.0032	.0032	.0032	.0032
Marine Diesel Sulfur%	.0236	.0236	.0236	.0236
CNG/LPG Sulfur%	.0030	.0030	.0030	.0030
Minimum Temperature	46.00	47.77	65.85	67.43
Maximum Temperature	64.50	66.27	85.88	86.90
Average Ambient Temperature	55.25	57.03	75.90	77.19
Stage II Control	0	0	0	0

Specifics on the input data compiled, other assumptions and references for this data can be found in the 2011 Non-Road Model Input file included in Attachment 9-1C. This attachment is only available electronically.

ii. NONROAD Model Allocation Files for Population and Housing Update

Several NONROAD categories use housing unit or population data to allocate the emissions to the county level from State calculations. Mid-Atlantic Regional Air Management Association (MARAMA) States identified some discrepancies in the housing and population data contained in the NONROAD model and requested that their Contractor, AMEC, update the allocation files for those categories. As a consequence, AMEC obtained 1 and 2 unit housing information and updated 2007 population estimates. Data were obtained from the sources listed in Exhibit A.2.

Exhibit A.2
Data Sources for Population and Housing Data

Source Type	Data Source
2007 Population Data Source	http://www.census.gov/popest/counties/CO-EST2008-01.html
Total Housing Data Source	http://www.census.gov/popest/housing/HU-EST2007-CO.html
1 yr – 1 and 2 Unit Housing Data	2007 American Community Survey 1-Year Estimates
3 yr – 1 and 2 Unit Housing Data	B25024. UNITS IN STRUCTURE - Universe: HOUSING UNITS Data Set: 2005-2007 American Community Survey 3-Year Estimates, Survey: American Community Survey

Three sources for the housing unit data were required to evaluate all counties within the MARAMA region. Census data are frequently withheld when the data reporting can lead to disclosure of confidential business information or due to incomplete survey response. For the 1 and 2 unit housing data, the predominant source was the 1 year - 1 and 2 unit housing data. If that was unavailable due to either confidentiality issues or lack of survey response, then the 3 year data was used by determining an average value for the three year period. Finally, if no data were available for the 3 year - 1 and 2 unit housing information, total housing unit data were utilized. The revised housing unit data affected the allocation of residential lawn and garden equipment.

New Jersey provided revised human population data for 2002, 2005, 2010, 2015 and 2020. This human population data is the same as those used by the Metropolitan Planning Organizations in their travel demand models to calculate on-road sector emissions.

iii. Recreational Marine Vessel Population Revision

Total New Jersey default populations for each of the three major recreational marine vessel categories contained in the NONROAD model (outboard, inboard/sterndrive and personal watercraft) were updated. The National Marine Manufacturers Association (NMMA) provided updated populations for the outboard and personal watercraft vessel engine categories for the 2007 base year. Because the population files used by the NONROAD model were configured with population values for various horsepower categories, the contractor determined the fraction of the total for each marine vessel type in each horsepower category from the NONROAD default population files. These fractions were then used to allocate the total state population obtained from NMMA to the various horsepower categories. The only exception to this was the addition of data for sailboats. The sailboat populations were split among the outboard and inboard/sterndrive watercraft vessels.

Updated recreational marine population data was also estimated for the years 2017 and 2020s. EPA had recommended that rather than use the default growth algorithm built into the nonroad model for those states that had their 2007 base year data updated for this category, separate population estimates for each projection year should be prepared and included in the population files. AMEC then used the national growth factors supplied in the default NONROAD model file to estimate populations for each year. Each horsepower/population category in the 2007 population file was grown to 2011 using the ratio between the 2005 and 2015 national growth factors.

iv. Airport Ground Support Equipment Removal

New Jersey provided revised equipment population values for Airport Ground Support Equipment. As discussed in Section V(C)(iv) of this document, emissions from airport ground support equipment are also included in USEPA's aircraft inventory prepared using the Federal Aviation Administration's Emissions and Dispersion Modeling System (EDMS). Correspondence with USEPA indicated that USEPA considers the emissions calculated by EDMS to be better than those calculated by the NONROAD model. For this reason, all emissions calculated by the NONROAD model for airport ground support equipment were removed from the inventory to avoid double counting.

v. NONROAD Model Growth and Control Information

In estimating emissions, the NONROAD model includes growth and scrappage rates for equipment in addition to a variety of control programs. It is not possible to separate out the emissions due to "growth only" or "control only" in a single run. That is, the model run provides a single estimate that is a "growth and control" scenario.

The growth data used in the NONROAD model is documented in a USEPA report.[10] The GROWTH packet of the NONROAD model cross-references each SCC to a growth indicator code. The indicator code is an arbitrary code that identifies an actual predicted value such as human population or employment that is used to estimate the future year equipment population. The GROWTH packet also defines the scrappage curves used to estimate the future year model year distribution.

The NONROAD model also accounts for all USEPA emission standards for Nonroad equipment. There are multiple standards that vary by equipment type, rated power, model year, and pollutant. Exhibit A.3 is a summary of the emission control programs accounted for in the NONROAD model. A complete summary of the nonroad equipment emission standards can be found on USEPA's nonroad emission standards reference guide website.

Exhibit A.3
Control Programs Included in the USEPA's NONROAD Model

Regulation	Description
Control of Air Pollution; Determination of Significance for Nonroad Sources and Emission Standards for New Nonroad Compression Ignition Engines At or Above 37 Kilowatts 59 FR 31036 June 17, 1994	This rule establishes Tier 1 exhaust emission standards for HC, NO_x, CO, and PM for nonroad compression-ignition (CI) engines ≥37kW (≥50hp). Marine engines are not included in this rule. The start dates and pollutants affected vary by hp category as follows: 50-100 hp: Tier 1,1998; NO_x only 100-175 hp: Tier 1, 1997; NO_x only 175-750 hp: Tier 1, 1996; HC, CO, NO_x, PM >750 hp: Tier 1, 2000; HC, CO, NO_x, PM
Emissions for New Nonroad Spark-Ignition Engines At or Below 19 Kilowatts; Final Rule 60 FR 34581 July 3, 1995	This rule establishes Phase 1 exhaust emission standards for HC, N NO_x Ox, and CO for nonroad spark-ignition engines ≤19kW (≤25hp). This rule includes both handheld (HH) and non-hand-held (NHH) engines. The Phase 1 standards become effective in 1997 for: Class I NHH engines (<225cc), Class II NHH engines (≥225cc), Class III HH engines (<20cc), and Class IV HH engines (≥20cc and <50cc). The Phase 1 standards become effective in 1998 for: Class V HH engines (≥50cc)
Final Rule for New Gasoline Spark-Ignition Marine Engines; Exemptions for New Nonroad Compression-Ignition Engines at or Above 37 Kilowatts and New Nonroad Spark-Ignition Engines at or Below 19 Kilowatts 61 FR 52088 October 4, 1996	This rule establishes exhaust emission standards for HC+ NO_x for personal watercraft and outboard (PWC/OB) marine SI engines. The standards are phased in from 1998-2006.
Control of Emissions of Air Pollution From Nonroad Diesel Engines 63 FR 56967 October 23, 1998	This final rule sets Tier 1 standards for engines under 50 hp, phasing in from 1999 to 2000. It also phases in more stringent Tier 2 standards for all engine sizes from 2001 to 2006, and yet more stringent Tier 3 standards for engines rated over 50 hp from 2006 to 2008. The Tier 2 standards apply to NMHC+ NO_x, CO, and PM, whereas the Tier 3

[10] U.S. Environmental Protection Agency. Nonroad Engine Growth Estimates. EPA-420/P-04-08.

Regulation	Description
	standards apply to NMHC+ NO_x and CO. The start dates by hp category and tier are as follows: hp<25: Tier 1,2000; Tier 2, 2005; no Tier 3 25-50 hp: Tier 1, 1999; Tier 2, 2004; no Tier 3 50-100 hp: Tier 2, 2004; Tier 3, 2008 100-175 hp: Tier 2, 2003; Tier 3, 2007 175-300 hp: Tier 2, 2003; Tier 3, 2006 300-600 hp: Tier 2, 2001, Tier 3, 2006 600-750 hp: Tier 2, 2002; Tier 3, 2006 >750 hp: Tier 2, 2006, no Tier 3 This rule does not apply to marine diesel engines above 50 hp.
Phase 2: Emission Standards for New Nonroad Nonhandheld Spark Ignition Engines At or Below 19 Kilowatts 64 FR 15207 March 30, 1999	This rule establishes Phase 2 exhaust emission standards for HC+ NO_x for nonroad nonhandheld (NHH) spark-ignition engines ≤19kW (≤25hp). The Phase 2 standards for Class I NHH engines (<225cc) become effective on August 1, 2007 (or August 1, 2003 for any engine initially produced on or after that date). The Phase 2 standards for Class II NHH engines (≥225cc) are phased in from 2001-2005.
Phase 2: Emission Standards for New Nonroad Spark-Ignition Handheld Engines At or Below 19 Kilowatts and Minor Amendments to Emission Requirements Applicable to Small Spark-Ignition Engines and Marine Spark-Ignition Engines; Final Rule 65 FR 24268 April 25, 2000	This rule establishes Phase 2 exhaust emission standards for HC+ NO_x for nonroad handheld (HH) spark-ignition engines ≤19kW (≤25hp). The Phase 2 standards are phased in from 2002-2005 for Class III and Class IV engines and are phased in from 2004-2007 for Class V engines.
Control of Emissions From Nonroad Large Spark-Ignition Engines and Recreational Engines (Marine and Land-Based); Final Rule 67 FR 68241 November 8, 2002	This rule establishes exhaust and evaporative standards for several nonroad categories: 1) Two tiers of emission standards are established for large spark-ignition engines over 19 kW. Tier 1 includes exhaust standards for HC+ NO_x and CO and is phased in from 2004-2006. Tier 2 becomes effective in 2007 and includes exhaust standards for HC+ NO_x and CO, as along with evaporative controls affecting fuel line permeation, diurnal emissions and running loss emissions. 2) Exhaust and evaporative emission standards are established for recreational vehicles, which include snowmobiles, off-highway motorcycles, and all-terrain vehicles (ATVs). For snowmobiles, HC and CO exhaust standards are phased-in from 2006-2012. For off-highway motorcycles, HC+ NO_x and CO exhaust emission standards are phased in from 2006-2007. For ATVs, HC+NO_x and CO exhaust emission standards are phased in from 2006-2007. Evaporative emission standards for fuel tank and hose permeation apply to all recreational vehicles beginning in 2008. 3) Exhaust emission standards for HC+ NO_x, CO, and PM for recreational marine diesel engines over 50 hp begin in 2006-2009, depending on the engine displacement. These

Regulation	Description
	are “Tier 2” equivalent standards.
Control of Emissions of Air Pollution From Nonroad Diesel Engines and Fuel; Final Rule (Clean Air Nonroad Diesel Rule – Tier 4) 69 FR 38958 June 29, 2004	This final rule sets Tier 4 exhaust standards for CI engines covering all hp categories (except marine and locomotives), and also regulates nonroad diesel fuel sulfur content. 1) The Tier 4 start dates and pollutants affected vary by hp and tier as follows: hp<25: 2008, PM only 25-50 hp: Tier 4 transitional, 2008, PM only; Tier 4 final, 2013, NMHC+ NO_x and PM 50-75 hp: Tier 4 transitional, 2008; PM only; Tier 4 final, 2013, NMHC+ NO_x and PM 75-175 hp: Tier 4 transitional, 2012, HC, NO_x, and PM; Tier 4 final, 2014, HC, NO_x, PM 175-750 hp:Tier 4 transitional, 2011, HC, NO_x, and PM; Tier 4 final, 2014, HC, NO_x, PM >750 hp: Tier 4 transitional, 2011, HC, NO_x, and PM; Tier 4 final, 2015, HC, NO_x, PM 2) This rule will reduce nonroad diesel fuel sulfur levels in two steps. First, starting in 2007, fuel sulfur levels in nonroad diesel fuel will be limited to a maximum of 500 ppm, the same as for current highway diesel fuel. Second, starting in 2010, fuel sulfur levels in most nonroad diesel fuel will be reduced to 15 ppm.
Control of Emissions From Nonroad Spark-Ignition Engines and Equipment; Final Rule (Bond Rule) 73 FR 59034 October 8, 2008	This rule establishes exhaust and evaporative standards for small SI engines and marine SI engines: 1) Phase 3 HC+ NO_x exhaust emission standards are established for Class I NHH engines starting in 2012 and for Class II NHH engines starting in 2011. There are no new exhaust emission standards for handheld engines. New evaporative standards are adopted for both handheld and nonhandheld equipment. The new evaporative standards control fuel tank permeation, fuel hose permeation, and diffusion losses. The evaporative standards begin in 2012 for Class I NHH engines and 2011 for Class II NHH engines. For handheld engines, the evaporative standards are phased-in from 2012-2016. 2) More stringent HC+ NO_x and CO standards are established for marine SI PWC/OB engines beginning in 2010. In addition, new exhaust HC+ NO_x and CO standards are established for sterndrive and inboard (SD/I) marine SI engines also beginning in 2010. High performance SD/I engines are subject to separate HC+ NO_x and CO exhaust standards that are phased-in from 2010-2011. New evaporative standards were also adopted for all marine SI engines that control fuel hose permeation, diurnal emissions, and fuel tank permeation emissions. The hose permeation, diurnal, and tank permeation standards take effect in 2009, 2010, and 2011, respectively.

vi. NONROAD Model Run Operation

The NONROAD model run operation comprises the inputting of the climatic and fuel specification data and New Jersey specific files into the model template panels, the running of the model, and the selection of the model run output format included in reporting utility panels. The settings for each template and reporting utility panel in the NONROAD model are detailed below.

NONROAD MODEL TEMPLATE SETTINGS

- OPTIONS: A short descriptive term for the run is entered for each State specific run and also all the temperature and fuel oil parameters included in Exhibit A.1 above.
- GEOGRAPHY: The "county" option was selected for each State specific run. All counties within the New Jersey were selected for the run.
- PERIOD: Includes the episode, growth and technology panels. On the episode panel, the year 2011 was selected in the drop down box and added to the year selections area. This automatically directs the model to grow emissions and apply all phased-in nonroad control measures to the end of this 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 nonroad 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. Additionally, selections were made to specify emissions for an average weekday during the summer season.
- SOURCES: All sources were selected. Thus all fuels and all vehicle types were selected for each State run. Aircraft ground support equipment was included in the run specifications but those records were removed during post-processing steps.
- REGION: The "county" option was selected for the state of New Jersey. Thus all counties in New Jersey were selected for the 21 runs to be conducted for each of the 21 New Jersey counties..
- ADVANCED OPTIONS: GEOGRAPHIC ALLOCATION: The NONROAD model default file for housing "NJ_HOUSE.ALO" was replaced with the updated New Jersey housing file created by AMEC "34000hou.ALO" discussed in Section V(A)(ii) above. Additionally, the NONROAD model default file for population "NJ_POP.ALO" was replaced with the updated New Jersey population file "34000cen.ALO". These files can be found in the 2011 Non-Road Model Inputs directory included in Attachment 9-1C. This attachment is only available electronically.
- ADVANCED OPTIONS: EQUIP. POPULATION: The NONROAD model default nonroad equipment population, "NJ.POP", was replaced with the updated New Jersey nonroad equipment population "34000.pop". This file can be found in the 2011 Non-Road Model Inputs directory included in Attachment 9-1C. This attachment is only available electronically.
- MODEL: Select RUN with template options to run model.

REPORTING UTILITY SETTINGS

- REPORTS: Select the Emissions Totals by SCC.
- SELECT RUN TO USE: Select the desired run imported from the output file of the NONROAD MODEL
- REPORT ONE STATE/COUNTY: Select desired county in New Jersey.
- POLLUTANTS TO REPORT: Select all pollutants.
- SELECT THE HC: Select VOC.
- SELECT THE PM SIZE: Select $PM_{2.5}$.

Specifics on the runs conducted with these template and reporting utility settings, other assumptions and references for data can be found in the 2011 Non-Road Model Output files included in Attachment 9-1B. This attachment is only available electronically.

vii. Nonroad Model Emission Inventory

Table 9 summarizes the 2011 NONROAD Model equipment emission inventory by county for summer weekday and annual Volatile Organic Compound (VOC), Nitrogen Oxides (NOx), Carbon Monoxide (CO) emissions, and annual Particulate Matter ($PM_{2.5}$), Sulfur Dioxide (SO_2) and Ammonia (NH_3) emissions. Attachment 9-A contains the detailed NONROAD Model equipment emission inventory. This attachment is only available electronically.

Table 9: 2011 NON-ROAD Model Equipment Emissions by County and Pollutant

	VOC		**NOx**		**CO**	
County	**Tons per Day**	**Tons per Year**	**Tons per Day**	**Tons Per Year**	**Tons per Day**	**Tons per Year**
Atlantic	18.83	2,206	0.21	1,173	25.33	12,404
Bergen	18.46	3,832	0.57	3,330	68.41	52,391
Burlington	2.77	2,056	0.17	1,527	14.81	19,956
Camden	3.96	1,440	0.61	1,158	56.99	16,801
Cape May	0.46	2,932	0.19	1,245	13.15	12,459
Cumberland	8.14	772	1.05	773	74.80	5,493
Essex	9.96	1,486	1.87	1,829	135.73	20,232
Gloucester	20.17	1,257	6.54	885	553.91	12,750
Hudson	7.98	1,112	2.19	1,631	178.89	11,927
Hunterdon	6.52	844	1.93	716	138.83	8,800
Mercer	0.02	1,188	0.07	1,441	0.39	14,254
Middlesex	1.99	2,565	7.21	2,942	49.31	34,821
Monmouth	0.30	2,692	1.85	2,445	8.66	29,663
Morris	0.00	2,542	0.38	1,892	1.43	30,316
Ocean	0.36	4,455	4.34	2,299	2.25	25,425
Passaic	1.31	1,475	17.82	1,287	7.52	16,938
Salem	3.32	524	26.89	314	17.86	3,158
Somerset	0.94	1,654	10.12	1,320	4.79	21,491
Sussex	0.29	1,183	3.16	573	1.58	7,433
Union	1.21	1,566	9.18	1,354	5.29	20,949
Warren	24.68	658	7.86	376	63.47	4,919
Total in State	**131.66**	**38,439**	**104.19**	**30,509**	**1423.41**	**382,579**

Table 9 (cont'd) 2011 NON-ROAD Model Equipment Emissions by County and Pollutant

	PM2.5	SO2	NH3
County	**Tons per Year**	**Tons Per Year**	**Tons per Year**
Atlantic	117	6	NA
Bergen	321	12	NA
Burlington	159	5	NA
Camden	115	4	NA
Cape May	126	9	NA
Cumberland	53	5	NA
Essex	160	6	NA
Gloucester	96	3	NA
Hudson	137	5	NA
Hunterdon	78	2	NA
Mercer	144	5	NA
Middlesex	276	10	NA
Monmouth	236	10	NA
Morris	199	7	NA
Ocean	209	13	NA
Passaic	119	5	NA
Salem	30	1	NA
Somerset	149	5	NA
Sussex	69	2	NA
Union	130	5	NA
Warren	43	1	NA
Total in State	**2,966**	**121**	NA

B. Commercial Marine Vessels (CMV)

For the purpose of emission calculations, CMV engines are divided into three categories based on displacement (swept volume) per cylinder. Category 1 and Category 2 marine diesel engines typically range in size from about 500 to 8,000 kW (700 to 11,000 hp). These engines are used to provide propulsion power on many kinds of vessels including tugboats, pushboats, supply vessels, fishing vessels, and other commercial vessels in and around ports. They are also used as stand-alone generators for auxiliary electrical power on vessels. Category 3 marine diesel engines typically range in size from 2,500 to 70,000 kW (3,000 to 100,000 hp). These are very large marine diesel engines used for propulsion power on ocean-going vessels such as container ships, oil tankers, bulk carriers and cruise ships.

The majority of marine vessels are powered by diesel engines that are either fueled with distillate or residual fuel oil blends. For the purpose of emission inventories, USEPA has assumed that Category 3 vessels primarily use residual blends while Category 1 and 2 vessels typically use distillate fuels.

CMV emission inventories for Category 1, 2 and 3 vessels were available from the USEPA 2011 National Emission Inventory (NEI). This NEI database included residual and diesel fueled CMV emissions for both the port and underway operation modes of Cruise (C), Maneuver (M), Reduced Speed Zone (Z) and Hotelling (H) that can be configured into CMV Category 1, 2 and 3 vessels emission inventories. This database was matched to GIS ArcInfo shape files for use in plotting emissions. Information on how this database was developed is included in the USEPA's 2011 National Emission Inventory, Version I Technical Support Document, November 2013-draft.

New Jersey indicated that they had developed CMV emission inventories that they preferred over those provided by USEPA for certain counties. However, these emissions were only available in NIF area source file format (county/SCC summary level) and not spatially allocated. Thus for consistency, NJDEP mapped the shape files to determine exactly what constituted the port and underway areas in both South and North New Jersey. New Jersey visually determined that the USEPA shape files for the port mainly constituted the docking facilities themselves while those for the underway region constituted almost all the waterborne area outside or adjacent to the docking facilities. On this basis and following guidance included in a September 28, 2011 email from Laurel Driver of the USEPA, New Jersey classified all residual fueled (Category 3) vessels not otherwise docked as conducting either a C or Z mode of underway operation and all residual fueled (Category 3) docked vessels as conducting an H mode of port operation. For all diesel fueled (Category 2) vessels, New Jersey classified them as mainly conducting either a C mode of underway operation, and in a few instances where EPA made this determination, as conducting a M mode of port operation. Exhibit B provides a summary of these determinations as well as the Source Category Code (SCC) designation of each CMV operation included in the 2011 emission inventory:

Exhibit B
CMV SCC, Description, Mode and Vessel Category

SCC	Description	Emission Mode	Vessel Category
2280002100	Diesel Port	M	Category 1 & 2
2280002200	Diesel Underway	C	Category 1 & 2
2280003100	Residual Port	H or M	Category 3
2280003200	Residual Port	C or Z	Category 3

Finally, the 2011 CMV emission inventory was originally developed to determine annual emissions. Summer weekday activity data was not readily available to determine actual summer weekday emissions. These emissions were otherwise estimated from the division of annual emissions by 364 days.

A description of how annual CMV emissions were determined for the North and South New Jersey counties follows below.

i. New Jersey Portion of the NYNNJ Harbor System

The most significant New Jersey CMV operations occur in the NJ portion of the NYNNJ Harbor system. This encompasses the NNJ counties of Bergen, Hudson, Essex, Union, Middlesex and Monmouth. CMV emissions for this harbor system were mainly developed from the information included in the CMV Emission Inventory Report prepared by Starcrest Consulting Croup, LLC.[11] This inventory was prepared as a part of the New York Harbor Deepening Project. This 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 was 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. These emission estimates

[11] Starcrest Consulting Group, LLC, 2003, "The New York, Northern New Jersey, Long Island Nonattainment Area Commercial Marine Vessel Emissions Inventory"

were prepared based on estimated horsepower demand. The original inventory was conducted for the year 2000 and did not consider USEPA Tier 1 or MARPOL control measures for CMV. Therefore, NJDEP needed to grow the emissions to 2011 and then apply USEPA Tier 1/MARPOL control factors to the grown emissions.

New York New Jersey Port Authority (NYNJPA) Trade Statistics were used to grow the North NJ Starcrest emissions from 2000 to 2011. These trade statistics provide the total bulk and general cargo tonnage and the number of motor vehicles and twenty foot equivalent containers (TEUs) delivered to or from Northern Jersey ports from 2000 to 2011. New Jersey divided the amount of cargo, TEUs and cars delivered in 2011 over those delivered in 2000 to obtain growth factors to be applied to each type of category 3 vessel emissions associated with their delivery to and from the port. This is a direct correspondence because the Starcrest report includes separate emissions for each major type of category 3 vessel that operates in the port. For example, the growth in containers delivered to and from the port in 2000 to 2011 relates directly to the growth in containerships, hence their emission growth during this period. Similarly, the growth in bulk and general cargo and cars respectively relates to the growth in category 3 bulk carriers, RoRo vessels and car carriers emissions. In concern for category 3 tankers, the growth rate was based on the increase in petroleum products delivered to New Jersey from 2000 and 2011 as determined by the Energy Information Administration (EIA), United States Department of Energy.

The Starcrest report also specifically relates emissions from harborcraft such as assist tug boats to the specific type of OGV that they assist in their harbor maneuvering and docking so that the same OGV growth factors may be applied to them. In concern for towboats, which represent the other major contributor of harborcraft emissions that operates in the New York and North New Jersey harbor, New Jersey assumed that their growth would relate to the increase in bulk and general cargo from 2000 to 2011. This is because towboats pull or push barges that transport bulk and general cargo.

Only one county in the North New Jersey, Passaic County, was not associated with the NYNNJ Harbor system and so was not included in the Starcrest report. Therefore, New Jersey relied upon the USEPA 2008 NEI to determine CMV emissions for this county. The 2008 NEI estimate was considered to be a better representation of CMV emissions for this county then those presented in the USEPA 2011 NEI.

New Jersey has no significant lightering operations in the NYNNJ Harbor System.

ii. New Jersey Portion of the Delaware River Basin

In concern for the Southern New Jersey counties associated with CMV operations in the Delaware River Basin, New Jersey relied on the above referenced USEPA 2011 NEI and the State of Delaware. New Jersey used the USEPA 2011 NEI to develop all of Category 3, 2 and 1 CMV underway and port emissions for Mercer, Burlington, Camden and Gloucester counties. New Jersey used the 2011 Delaware Category 3, 2 and 1 CMV underway and port inventory to develop its own inventory for these categories for Cape May, Cumberland and Salem counties.

New Jersey assumed that CMV emissions generated in the New Jersey counties on the eastern bank of the Delaware River Basin except for individual port operations are equivalent to those generated in corresponding Pennsylvania and Delaware counties located on the western bank. New Jersey has no significant lightering operations in the Delaware River Basin.

iii. CMV Category 1 & 2 Diesel Control Factors

Once emissions were grown to the inventory year 2011, then a control factor for each pollutant was calculated by dividing the emission factor for the inventory year (2011) controlled emissions by the baseline (2000) controlled emission factor included in the controlled CMV diesel inventory developed in the USEPA's regulatory impact assessments (RIA). The USEPA's May 2008 RIA (EPA2008a) was used to develop projection year inventories for category 1 and 2 vessels (diesel).12

In developing their emission projections, USEPA considered the following scenarios that accounted for both the 2004 Nonroad diesel rule and the 2008 diesel marine vessel rule:

1. The impact of existing tier 1 and 2 engine regulations that took effect in 2007,
2. The 2004 Clean Air Nonroad Diesel Rule that will decrease the allowable levels of sulfur in fuel beginning in 2007, and
3. Fleet turnover,
4. The reductions from USEPA's 2008 rule Final Locomotive-Marine rule for Tier 3 and 4 engines,
5. The 2008 final rule that includes the first-ever national emission standards for existing marine diesel engines, applying to engines larger than 600kW when they are remanufactured. The rule also sets Tier 3 emissions standards for newly-built engines that are phasing in from 2009. Finally, the rule establishes Tier 4 standards;

Exhibit B.3 shows the control factors to be applied from 2000 to 2011 for the two CMV diesel fueled classifications and pollutants. These 2011 control factors (CF) are subtracted from the uncontrolled factor of 100 % before application to uncontrolled 2011 emissions (UNC_EMISS), i.e. UNC_EMISS*(1-CF). Thus the NO_x control factor of 0.188 would generate controlled emissions that represent 91.8 percent of uncontrolled emissions. Control and growth factors similar to these were already included in the USEPA 2011 NEI CMV inventory used by New Jersey.

Exhibit B.3
CMV Category 1 & 2 Diesel Control Factors by Pollutant

CMV Category	VOC	CO	NO_x	$PM_{2.5}$	SO_2
Category 1 Auxiliary	0.076	0.178	0.188	0.308	0.910
Category 1	0.123	0.160	0.226	0.308	0.910
Category 2	NA	0.044	0.209	0.296	0.080

[12] U.S. Environmental Protection Agency. Regulatory Impact Analysis: Control or Emissions of Air Pollution from Locomotive Engines and Marine Compression Engines Less than 30 Liters Per Cylinder. EPA420-R-08-001a. May 2008.

iv. CMV Category 3 Residual Oil Control Factors

On December 22, 2009, USEPA announced final emission standards under the Clean Air Act for new marine engines with per-cylinder displacement at or above 30 liters (called Category 3 marine diesel engines) installed on U.S.-flagged vessels. The final engine standards are equivalent to those adopted in the amendments to Annex VI to the International Convention for the Prevention of Pollution from Ships (a treaty called "MARPOL"). The emission standards apply in two stages: near-term standards for newly-built engines will apply beginning in 2011, and long-term standards requiring an 80 percent reduction in NO_x will begin in 2016. USEPA also adopted changes to the diesel fuel program to allow for the production and sale of diesel fuel with no more than 1,000 ppm sulfur for use in Category 3 marine vessels. The regulations generally forbid production and sale of fuels with more than 1,000 ppm sulfur for use in most U.S. waters, unless operators achieve equivalent emission reductions in other ways.

On March 26, 2010, the International Maritime Organization (IMO) officially designated waters off North American coasts as an emissions control area (ECA) in which stringent international emission standards will apply to ships. In practice, implementation of the ECA means that ships entering the designated area would need to use compliant fuel for the duration of their voyage that is within that area, including time in port and voyages whose routes pass through the area without calling on a port. The North American ECA includes waters adjacent to the Atlantic extending up to 200 nautical miles from the east coast of the US. The quality of fuel that complies with the ECA standard will change over time. From the effective date in 2012 until 2015, fuel used by vessels operating in designated areas cannot exceed 1.0 percent sulfur (10,000 ppm). Beginning in 2015, fuel used by vessels operating in these areas cannot exceed 0.1 percent sulfur (1,000 ppm). Beginning in 2016, NO_x after treatment requirements become applicable.

To calculate a control factor that accounted for reductions included in the USEPA controlled inventory, it was necessary to first calculate a “growth only” scenario applying USEPA’s 4.5 percent annual growth rate to the 2000 base emissions. Once the growth rate was applied, then a control factor for each pollutant was calculated by dividing the future year controlled emissions by the future year “growth only” emissions. USEPA’s December 2009 RIA and April 2009 proposal were used to develop these projection year inventories for category 3 vessels (residual).1314

Exhibit B.4 shows the control factors that apply to the residual CMV emissions grown from 2000 to 2011. These control factors are applied directly to the grown emissions. Thus the NO_x control factor of 0.446 would control NO_x emissions by 55.4 percent.

Exhibit B.4 shows the control factors that apply to the residual CMV Category 3 emissions grown from 2000 to 2011. These 2011 control factors (CF) are subtracted from the uncontrolled factor of 100 % before application to uncontrolled 2011 emissions (UNC_EMISS), i.e. UNC_EMISS*(1-CF). Thus the NO_x control factor of 0.209 would generate controlled emissions that represent 79.1 percent of uncontrolled emissions.

[13] Regulatory Impact Analysis: Control of Emissions of Air pollution from Category 3 Marine Diesel Engines. EPA420-R-09-019.
[14] Proposal to Designate an Emissions Control Area for Nitrogen Oxides, Sulfur Oxides, and Particulate Matter. EPA420-R-09-007.

Exhibit B.4
CMV Residual Oil Control Factors by Pollutant

CMV Category	NOx	$PM_{2.5}$	SO_2
Category 3	0.064	0.670	0.642

Additionally, NOx emissions for residual oil fueled vessels decreased by 10.52 % from the application of USEPA Tier 1 CMV regulations for NO_X that were applicable to the actual 2011 inventory year[15].

v. Commercial Marine Vessel Emission Inventory

Table 10 summarizes the 2011 CMV emission inventory by country for both summer weekday and annual Volatile Organic Compound (VOC), Nitrogen Oxides (NOx), Carbon Monoxide (CO) emissions and annual Particulate Matter ($PM_{2.5}$), Sulfur Dioxide (SO_2) emissions. Ammonia (NH_3) emissions were not readily available. Attachment 9-2A contains the detailed CMV source emission inventory. This attachment is only available electronically.

Table 10: 2011 CMV Emissions by County and Pollutant

	VOC		NOx		CO	
County	**Tons per Day**	**Tons per Year**	**Tons per Day**	**Tons Per Year**	**Tons per Day**	**Tons per Year**
Atlantic	0.00	1	0.07	24	0.01	5
Bergen	0.03	12	0.57	208	0.10	38
Burlington	0.01	4	0.29	107	0.03	12
Camden	0.07	26	2.14	782	0.23	83
Cape May	0.53	195	2.01	734	0.20	75
Cumberland	0.34	124	1.75	638	0.19	68
Essex	0.03	10	0.72	265	0.14	50
Gloucester	0.11	40	3.90	1423	0.65	237
Hudson	0.29	105	7.00	2554	1.40	510
Hunterdon	0.00	0	0.00	0	0.00	0
Mercer	0.00	0	0.00	0	0.00	0
Middlesex	0.06	21	1.08	394	0.20	73
Monmouth	0.11	40	2.10	766	0.47	173
Morris	0.00	0	0.00	0	0.00	0
Ocean	0.01	2	0.17	62	0.02	9
Passaic	0.00	0	0.02	6	0.00	1
Salem	0.10	35	0.42	153	0.05	17
Somerset	0.00	0	0.00	0	0.00	0
Sussex	0.00	0	0.00	0	0.00	0
Union	0.30	109	6.19	2260	1.15	420
Warren	0.00	0	0.00	0	0.00	0
Total in State	**1.98**	**722**	**28.43**	**10,375**	**4.85**	**1,770**

[15] Final Regulatory Support Document: Control of Emissions from New Marine Compression-Ignition Engines at or Above 30 Liters per Cylinder, EPA420-R-03-004, Table 4.3-1, Category 3 Marine Vessel NOx National Emission Inventories, page 4-14, January 2003

Table 10 (cont'd) 2011 CMV Model Equipment Emissions by County and Pollutant

	PM2.5	SO2	NH3
County	**Tons per Year**	**Tons Per Year**	**Tons per Year**
Atlantic	1	0	NA
Bergen	10	9	NA
Burlington	3	53	NA
Camden	23	215	NA
Cape May	28	30	NA
Cumberland	27	25	NA
Essex	10	127	NA
Gloucester	44	387	NA
Hudson	88	428	NA
Hunterdon	0	0	NA
Mercer	0	0	NA
Middlesex	18	61	NA
Monmouth	26	252	NA
Morris	0	0	NA
Ocean	2	8	NA
Passaic	0	0	NA
Salem	6	6	NA
Somerset	0	0	NA
Sussex	0	0	NA
Union	96	569	NA
Warren	0	0	NA
Total in State	**381**	**2,170**	NA

C. Aircraft

Aircraft emissions in the 2011 inventory are available in either a county-by-county or airport-by-airport basis for six types of aircraft operations:

- Air carrier operations represent landings and take-offs (LTOs) of commercial aircraft with seating capacity of more than 60 seats (SCC 22-75-020-000);
- Commuter/air taxi operations are one category. Commuter operations include LTOs by aircraft with 60 or fewer seats that transport regional passengers on scheduled commercial flights. Air taxi operations include LTOs by aircraft with 60 or fewer seats conducted on non-scheduled or for-hire flights (SCC 22-75-060-011 (Piston) or 012 (Turbine);
- General aviation represents all civil aviation LTOs not classified as commercial (SCC 22-75-050-011 (Piston) or 012 (Turbine):
- Military operations represent LTOs by military aircraft (SCC 22-75-001-000);
- Ground Support Equipment (GSE) typically includes aircraft refueling and baggage handling vehicles and equipment, aircraft towing vehicles, and passenger buses (SCC 22-65-008-005 (4-Stroke Gasoline), 22-67-008-005 (LPG), 22-68-008-005 (CNG), 22-70-008-005 (Diesel); and

- Auxiliary power units (APUs) provide power to start the main engines and run the heating, cooling, and ventilation systems prior to starting the main engines. (SCC 22-75-070-000).

This inventory was originally developed to determine annual emissions. Summer weekday activity data was not readily available to determine actual summer weekday emissions. These emissions were otherwise estimated from the division of annual emissions by 364 days.

i. Emission Dispersion Modeling of New Jersey Airports

New Jersey aircraft emissions were calculated based on the number of landing and take-off (LTO) cycles generated at each airport. Four airports which are Newark Liberty International, Teterboro, Naval Aerospace Lakehurst Base and McGuire Air Force Base supplied LTO counts for each specific aircraft type (i.e., Boeing 707, AirBus 300) that operated at their airport for 2011. Six other airports which are Atlantic City, Millville Municipal, Morris Municipal, Essex County, Trenton Mercer County and Monmouth Executive supplied these counts for the base year 2007. These emissions were grown to 2011 from application of airport specific growth factors for four operation types: commercial, general, air taxi and military. This operational data was obtained from the Federal Aviation Agency (FAA) 5010 Report Database discussed in Section V(C)(ii) below.

A compilation of these airports LTO counts can be found in the 2011 Aircraft Inputs directory included in Attachment 9-3C. This attachment is only available electronically.

The ten airport LTO counts were applied to the Emissions and Dispersion Modeling System (EDMS), the Federal Aviation Agency (FAA) aircraft emissions modeling tool, to determine their emissions. The emission outputs generated from the EDMS can be found in the 2011 Aircraft Outputs directory included in Attachment 9-3B. This attachment is only available electronically.

ii. Federal Aviation Agency (FAA) Airports and EDMS Airport Growth Factors

For all other remaining public use airports, total LTO numbers for the aircraft categories of commercial, military, air taxi and general aviation airports as reported in the Federal Aviation Administration's (FAA) 5010 Report Database for the year 2011 was obtained.[16] A compilation of these airports LTO counts can be found in the 2011 Aircraft Inputs directory included in Attachment 9-3C. This attachment is only available electronically. An average aircraft emission factor developed from the most common aircraft types for a given category was applied to the total aircraft category counts.

An average aircraft emission factor developed from the most common aircraft types for a given aircraft category was applied to the total aircraft category counts. A compilation of these calculations can be found in the 2011 Aircraft Inputs directory included in Attachment 9-3B.

iii. New Jersey Department of Transportation (NJDOT)

Private Use Airports and Heliports

For private use airports and heliports, total LTO numbers for the general aviation category was obtained from the New Jersey Department of Transportation (NJDOT). An average aircraft emission factor developed from the most common aircraft type for these facilities was applied to

[16] Federal Aviation Administration, 5010 2011 Database File

the total aircraft category counts. A compilation of these airports LTO counts can be found in the 2011 Aircraft Inputs directory included in Attachment 9-3C. This attachment is only available electronically.

An average aircraft emission factor developed from the most common aircraft types for a given aircraft category was applied to the total aircraft category counts. A compilation of these calculations can be found in the 2011 Aircraft Inputs directory included in Attachment 9-3B.

iv. Aircraft Ground Support Equipment (GSE)

NJ provided GSE/Auxiliary Power Unit (APU) emissions for each of the seven major airports that submitted LTO fleet mix counts. The EDMS model determined these emissions by applying default GSE/APU equipment to those aircraft types that are known to use these units. These emissions had GSE emissions as a single value without an indication of the fuel type of the equipment. In this case, the fuel type ratios used in the USEPA NEI were used to divide GSE emissions by their SCC designated fuel type. Those ratios are included in Exhibit C.4 below:

Exhibit C.4
GSE Fractional Apportionment

SCC	SCC Level Two	Fraction
2265008005	Off-highway Vehicle Gasoline, 4-Stroke	0.1686
2267008005	LPG	0.0165
2268008005	CNG	0.0131
2270008005	Off-highway Vehicle Diesel	0.8017

In concern for those smaller airports whose emissions were not determined by the EDMS, they can be considered to not generate any GSE/APU emissions because many Air Taxis, General Aviation and Military aircraft do not use GSE/APU.

v. Aircraft Control Factors

The NO_x aircraft engine emissions standards adopted by USEPA in November 2005 were reviewed.17 The standards are equivalent to the NO_x emission standards (adopted in 1999 for implementation beginning in 2004) of the United Nations International Civil Aviation Organization (ICAO), and will bring the US aircraft standards into alignment with the international standards. The standards apply to new aircraft engines used on commercial aircraft including small regional jets, single-aisle and twin-aisle aircraft, and 747s and larger aircraft. The standards also apply to general aviation and military aircraft, which sometimes use commercial engines. For example, small regional jet engines are used in executive general aviation aircraft, and larger commercial aircraft engines may be used in military transport aircraft.

Nearly all previously certified or in-production engine models currently meet or perform better than the standards USEPA adopted in the November 2005 rule. In addition, manufacturers have already been developing improved technology in response to the ICAO standards. According to USEPA's recent analysis for the proposed transport rule, this rule is expected to

[17] U.S. Environmental Protection Agency. Control of Air Pollution from Aircraft and Aircraft Engines, Emission Standards and Test Procedures: Final Rule. November 17, 2005.

reduce NO_x emissions by approximately 2 percent in 2015 and 3 percent in 2020.18 Because of the relatively small amount of NO_x reductions, our aircraft emission projections do not account for this control program.

USEPA has also issued an Advance Notice of Proposed Rulemaking (ANPR) on lead emissions from piston-engine aircraft using leaded aviation gasoline.19 However, this rule has not yet been adopted and co-benefits for criteria air pollutants are likely to be small. Therefore, the effects of this rule were not included in the future-year emissions projections.

vi. Aircraft Emission Inventory

Table 11 summarizes the 2011 aircraft emission inventory by country for both summer weekday and annual Volatile Organic Compound (VOC), Nitrogen Oxides (NOx), Carbon Monoxide (CO) emissions and annual Particulate Matter ($PM_{2.5}$) and Sulfur Dioxide (SO_2) emissions. Annual ammonia (NH_3) emissions are not readily available. Attachment 9-3A contains the detailed aircraft source emission inventories. This attachment is only available electronically.

Table 11: 2011 Aircraft Emissions by County and Pollutant

	VOC		NOx		CO	
County	**Tons per Day**	**Tons per Year**	**Tons per Day**	**Tons Per Year**	**Tons per Day**	**Tons per Year**
Atlantic	0.71	260	1.64	596	3.10	1128
Bergen	0.89	325	0.43	157	2.98	1083
Burlington	0.31	114	3.06	1115	4.58	1665
Camden	0.02	6	0.00	1	0.17	61
Cape May	0.04	15	0.02	7	1.97	715
Cumberland	0.08	30	0.01	4	1.16	423
Essex	1.28	466	7.23	2632	12.83	4670
Gloucester	0.02	9	0.01	4	1.06	384
Hudson	0.00	1	0.00	0	0.00	1
Hunterdon	0.05	17	0.02	7	1.86	677
Mercer	0.25	91	0.06	22	2.24	817
Middlesex	0.02	7	0.00	2	0.44	160
Monmouth	0.11	41	0.01	5	0.91	329
Morris	0.05	18	0.07	27	3.63	1320
Ocean	0.14	50	1.10	402	1.67	607
Passaic	0.01	4	0.01	2	0.55	201
Salem	0.01	5	0.01	2	0.55	202
Somerset	0.08	28	0.03	10	2.89	1053
Sussex	0.03	12	0.02	6	1.65	600
Union	0.08	31	0.01	5	1.11	406
Warren	0.03	12	0.01	4	1.21	441
Total in State	4.23	1541	13.76	5008	46.55	16943

[18] U.S. Environmental Protection Agency. Transport Rule Emission Inventories Notice of Data Availability (NODA). Docket ID No. EPA-HQ-QAR-2009-0491. October 27, 2010.
[19] U.S> Environmental Protection Agency. Advance Notice of Proposed Rulemaking on Lead Emissions from Piston-Engine Aircraft Using Leaded Aviation gasoline. April 2010.

Table 11 (cont'd) 2011 Aircraft Model Equipment Emissions by County and Pollutant

	PM2.5	SO2	NH3
County	**Tons per Year**	**Tons Per Year**	**Tons per Year**
Atlantic	13	54	NA
Bergen	10	27	NA
Burlington	13	85	NA
Camden	0	0	NA
Cape May	0	1	NA
Cumberland	2	1	NA
Essex	47	253	NA
Gloucester	0	1	NA
Hudson	0	0	NA
Hunterdon	0	1	NA
Mercer	4	5	NA
Middlesex	0	0	NA
Monmouth	1	2	NA
Morris	4	70	NA
Ocean	3	21	NA
Passaic	0	0	NA
Salem	0	0	NA
Somerset	0	2	NA
Sussex	0	1	NA
Union	0	1	NA
Warren	0	1	NA
Total in State	99	527	**NA**

D. Railroad Diesel Locomotives

Railroad diesel locomotive engines are classified into the following categories:

- Class I line haul diesel locomotives are operated by large freight railroad companies and are used to power freight train operations over long distances (SCC 22-85-002-006);
- Class II/III line haul diesel locomotives are operated by smaller freight railroad companies and are used to power freight train operations over long distances (SCC 22-85-002-007);
- Inter-city passenger train diesel locomotives are operated
- Primarily by Amtrak to provide inter-city passenger transport (SCC 22-85-002-008);
- Independent commuter diesel rail systems operate locomotives provide passenger transport within a metropolitan area (SCC 22-85-002-009); and
- Yard/switch diesel locomotives are used in freight yards to assemble and disassemble trains, for short hauls of trains that are made up of only a few cars (SCC 22-85-002-010).

This inventory was originally developed to determine annual emissions. Summer weekday activity data was not readily available to determine actual summer weekday emissions. These emissions were otherwise estimated from the division of annual emissions by 364 days.

i. Class II/III Line Haul, Yard, Commuter and Passenger Diesel Locomotives

USEPA has developed fuel usage based emission factors for each of the above referenced locomotive engine categories. New Jersey developed its emission inventory for these categories by applying these emission factors to specific 2007 fuel usage data received from Class II/III line haul and independent commuter rail systems and yard/switch freight and commuter rail yards for every county except Mercer, Monmouth and Somerset counties. An estimation of fuel consumption based on gross tons miles (tons of freight and number of cars 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. This emission inventory was grown to 2011 as explained in Section V(D)(iv) below.

In concern for Class II/III line haul emissions for Mercer, Monmouth and Somerset counties, the 2011 USEPA NEI railroad inventory was used to develop these emissions. This is because survey data could not be obtained for these counties.

In concern for passenger locomotive emissions (AMTRAK), there were no emissions. This is because AMTRAK only used electric powered locomotives on the Northeast corridor line in New Jersey. These electric engines do not generate any emissions.

Specifics on the equations used for the calculation of these base year emissions, other assumptions and references for data can be found in the Railroad file included in Attachment 9-4B.

ii. Class I Line Haul Diesel Locomotives

In concern for the Class 1 line haul locomotives, New Jersey relied on the USEPA 2011 NEI railroad inventory to develop Class I line haul locomotive inventories. Information on how this database was developed is included in the USEPA's 2011 National Emission Inventory, Version I Technical Support Document, November 2013-draft. This rail inventory included both the State and the County level Class 1 line haul emissions in NIF format. This inventory was developed from national locomotive fuel consumption data and additional confidential information provided by the two major Class 1 line-haul railroads that operate in New Jersey (Norfolk Southern and CSX).

Specifics on the equations used for the calculation of these base year emissions, other assumptions and references for data can be found in the Railroad file included in Attachment 9-4B.

iii. Railroad Diesel Hydrocarbon Emissions

Both Class I and Class II/III emissions were reported as hydrocarbons (HC). These emissions were converted to VOC emissions by multiplying the HC emissions by a factor of 1.053.[20]

iv. Railroad Diesel Locomotives Growth Factors

In March 2008, USEPA finalized a three part diesel locomotive rule that will dramatically reduce emissions from diesel locomotives of all types -- line-haul, switch, and passenger rail. As part of this work, USEPA performed the RIA referenced above in Section V(B)(iii) (EPA2008a), to document the projection methodologies it utilized to develop the baseline (pre-control) and controlled diesel locomotive emissions included in the national emission inventory for calendar

[20] U.S. Environmental Protection Agency. Emission Factors for Locomotives; EPA-420F09025, 2009.

years 2002 through These projection methodologies used 2006 Annual Energy Outlook energy use projection data from the U.S. Department of Energy, Energy Information Administration (EIA2006).21 This data showed that freight rail energy use will grow 1.6 percent annually. New Jersey used this growth rate for all diesel locomotive operations.

v. Railroad Diesel Locomotives Control Factors

To calculate control factors that accounted for reductions included in the USEPA controlled inventory, it was necessary to first calculate a "growth only" scenario applying USEPA's 1.6 percent annual growth rate to the 2007 and 2008 baseline emissions without application of any diesel locomotive controls. The controlled inventory developed also used the EIA2006 1.6 percent annual growth in fuel use in addition to the consideration of the following control measures:

1. The impact of existing regulations for Tier 0, 1, and 2 locomotive engines that take effect in 2008,

2. The 2004 Clean Air Nonroad Diesel Rule that will decrease allowable levels of sulfur in locomotives fuel beginning in 2007,

3. Fleet turnover.

4. Reductions from USEPA's 2008 Final Locomotive-Marine rule for Tier 3 and 4 engines. This rule lowered diesel sulfur content and tightened emission standards for existing and new locomotives.

5. Voluntary retrofits under the National Clean Diesel Campaign are not included in these projections.

Once the growth rate was applied, then a control factor for each pollutant was calculated by dividing the future year controlled emissions by the future year "growth only" emissions. Exhibit D.5 shows the control factors to be applied from 2007 to 2011 for the four locomotive classifications and pollutants. These growth factors are applied directly to the grown emissions. Thus the NO_x control factor of 0.828 would control emissions by 0.172 percent. The NJDEP applied these growth and control factors to the Class II/III and commuter railroad inventories that it developed. Control and growth factors similar to these were already included in the USEPA 2011 NEI Class I/II/III line haul railroad inventory used by New Jersey.

Exhibit D.5
Railroad Diesel Locomotive Control Factors by Pollutant, and SCC

SCC	NO_x	VOC	$PM_{2.5}$	SO_2
SCC 22-85-002-006 Line Haul Class 1 Operations	0.828	0.806	0.689	0.117
SCC 22-85-002-007 Line Haul Class II / III Operations	0.852	1.000	0.688	0.003
SCC 22-85-002-009 Commuter Rail	0.241	0.801	0.180	0.003
SCC 22-85-002-010 Yard / Switch	0.634	0.937	0.534	0.003

[21] U.S. Department of Energy, Energy Information Administration, Table A-7, Annual Energy Outlook with Projections to 2030 document, DOE/EIA-0383. February 2006.

Specifics on the equations used for the calculation of these grown and controlled base year emissions, other assumptions and references for data can be found in the Railroad file included in Attachment 9-4A.

vi. Railroad Diesel Locomotive Emission Inventory

Table 12 summarizes the 2007 Railroad emission inventory by country for both summer weekday and annual Volatile Organic Compound (VOC), Nitrogen Oxides (NOx), Carbon Monoxide (CO) emissions and annual Particulate Matter ($PM_{2.5}$) and Sulfur Dioxide (SO_2) emissions. Annual ammonia (NH_3) emissions are not readily available. Attachment 9-4A contains the detailed railroad source emission inventory. This attachment is only available electronically.

Table 12: 2011 Railroad Emissions by County and Pollutant

	VOC		NOx		CO	
County	**Tons per Day**	**Tons per Year**	**Tons per Day**	**Tons Per Year**	**Tons per Day**	**Tons per Year**
Atlantic	0.02	5	0.32	117	0.05	17
Bergen	0.11	40	2.32	844	0.33	119
Burlington	0.00	1	0.04	16	0.00	2
Camden	0.04	13	0.76	276	0.10	36
Cape May	0.00	0	0.01	2	0.00	0
Cumberland	0.01	2	0.12	45	0.01	5
Essex	0.05	20	1.13	412	0.15	55
Gloucester	0.01	2	0.15	53	0.02	6
Hudson	0.07	26	1.50	546	0.21	75
Hunterdon	0.04	15	0.83	304	0.12	45
Mercer	0.02	6	0.36	130	0.05	19
Middlesex	0.07	24	1.34	489	0.18	66
Monmouth	0.05	17	1.02	370	0.14	53
Morris	0.03	11	0.66	242	0.09	33
Ocean	0.00	1	0.04	15	0.01	2
Passaic	0.03	10	0.56	205	0.08	29
Salem	0.00	0	0.02	7	0.00	1
Somerset	0.05	19	1.07	391	0.15	56
Sussex	0.01	2	0.15	55	0.01	5
Union	0.05	18	0.99	360	0.14	52
Warren	0.01	3	0.17	63	0.03	10
Total in State	**0.65**	**236**	**13.58**	**4,942**	**1.88**	**685**

Table 12 (cont'd) 2011 Railroad Emissions by County and Pollutant

	PM2.5	SO2	NH3
County	**Tons per Year**	**Tons Per Year**	**Tons per Year**
Atlantic	3	0	NA
Bergen	21	3	NA
Burlington	0	0	NA
Camden	6	0	NA
Cape May	0	0	NA
Cumberland	1	0	NA
Essex	9	1	NA
Gloucester	1	0	NA
Hudson	14	2	NA
Hunterdon	9	2	NA
Mercer	4	1	NA
Middlesex	12	2	NA
Monmouth	9	0	NA
Morris	5	0	NA
Ocean	0	0	NA
Passaic	5	0	NA
Salem	0	0	NA
Somerset	11	3	NA
Sussex	1	0	NA
Union	9	2	NA
Warren	2	1	NA
Total in State	**121**	**18**	**NA**

E. Total Nonroad Emission Inventory

Tables 2 and 3 summarize the 2011 total nonroad (NONROAD model equipment, CMV, Aircraft and Locomotive sources) emission inventory by county for both summer weekday and annual Volatile Organic Compound (VOC), Nitrogen Oxides (NOx), Carbon Monoxide (CO) emissions and annual Particulate Matter ($PM_{2.5}$ and PM_{10}) and Sulfur Dioxide (SO_2) emissions. Annual ammonia (NH_3) emissions are not readily available. Attachment 9 contains the total Nonroad emission inventories. This attachment is only available electronically.

VI. Biogenic Sources

Biogenic emissions are produced by living organisms or biological processes. This biogenic inventory includes emissions from plant matter as well as humans, domestic animals, and wild animals.

The 2011 biogenic emissions for VOC, NO_x, and CO were calculated by the USEPA using the BEIS model, version 3.14.

Ammonia emissions from domestic and wild animals, and from human perspiration in New Jersey's 2011 biogenic emission inventory were estimated using CMU Model, v3.1. These are the same emissions that were included in New Jersey's 2002 ammonia Inventory, as they are the best available estimate and USEPA does not include these emission categories in the NEI. These emissions are included in Attachment 10.

Tables 2 and 3 present the 2011 biogenic source emission inventory.

VII. Quality Assurance

A. Point Sources

This section outlines and discusses the quality assurance checks performed on the point source emission statement data submitted to the NJDEP.

i. Data Entry Checks

Pursuant to N.J.A.C. 7:27-21 et seq., 2011 point source emissions were reported by applicable facilities to the NJDEP through the Emission Statement Program. All applicable facilities reported their 2011 emissions in electronic format; therefore, no data entry quality assurance was necessary.

ii. Completeness Checks & Reasonableness Checks

All of the 532 Emission Statements submitted by applicable facilities in 2011 were checked for completeness. The checklist in Attachment 11 was used for emission statement review. NJDEP staff accessed data from both the New Jersey Environmental Management System (NJEMS) and the NJDEP Emission Statement Program Confidential Cabinet and compiled data into various reports using the Web Intelligence Software and Microsoft Access software (Access) to assist in determining responses to the questions in this checklist. NJEMS is the database that the NJDEP uses to store all emission statement data. The Confidential Cabinet contains all the confidential process data, which are manually reviewed by the NJDEP staff. Web Intelligence Software is the report writer software that the NJDEP uses to access the data stored in the New Jersey Environmental Management System, while Access is the software that the NJDEP uses to configure the data from Web Intelligence Software into other useful reports for error checks. The data source used for determining the response to each specific question in the checklist is identified after each question.

From the Emission Statement Program, the 2011 VOC, NO_x, CO, SO_2, PM_{10}, $PM_{2.5}$ and NH_3 point source inventories were compared to the 2007 inventories[22] in order to identify any anomalies that might indicate calculation or data errors, and to verify reasons for trends towards higher or lower emissions. An overall summary of statewide emission differences is shown in Table 13 below. The annual emissions have all decreased between 2007 and 2011 with the exception of NH_3, which increased slightly due to increases in the electric generating and the waste management sectors. For the summer emissions between 2007 and 2011, VOC stayed steady, NO_x decreased, and CO increased. The increase in summer CO emissions is due specifically to two electric generation facilities with units that tend to operate more during the summer months.

[22] AMEC and SRA for MARAMA. Technical Support Document for the Development of the 2007 Emission Inventory for PM Nonattainment Counties in the MANE-VU Region Version 3.3. AMEC Environment and Infrastructure and SRA International, Inc. for Mid-Atlantic Regional Air Management Association (MARAMA), January 23, 2012 (Included as Attachment 12).

Table 13: Statewide Point Source Emission Inventory Comparison

Summer Controlled Emissions (Tons per Day)	New Jersey 2007	New Jersey 2011
VOC	38.84	39.70
NO_x	148.52	128.80
CO	53.59	67.21

Annual Controlled Emissions (Tons per Year)	New Jersey 2007	New Jersey 2011
VOC	10,359	7,320
NO_x	30,045	14,793
CO	10,559	7,055
SO_2	40,667	6,415
$PM_{2.5}$ *	6,924	2,710
PM_{10} *	7,609	3,611
NH_3	970	1,021

***** Fugitive dust transport factors were not applied to the point source inventory because of the very small amount of fugitive particulate emissions in the point source inventory.

B. Area Sources

The 2011 VOC, NO_x, CO, SO_2, PM_{10}, $PM_{2.5}$, and NH_3 emissions from area source categories were calculated, for the most part, by multiplying a USEPA published emission factor by a known indicator of activity for each source category such as employment, population and fuel usage. There are several area source categories and methodologies, resulting in numerous calculations. The area source emissions calculations were checked for accuracy by adding county emission totals and comparing them with the statewide emission totals. The calculations were randomly reviewed by NJDEP Bureau of Air Quality Planning staff to check for accuracy.

The 2011 VOC, NO_x, CO, SO_2, PM_{10}, $PM_{2.5}$, and NH_3 area source inventories were compared to the 2007 inventories in order to identify any anomalies that might indicate calculation or data errors, and to verify reasons for trends towards higher or lower emissions. An overall summary of statewide emission differences is shown in Table 14 below.

As shown in Table 14, summer emissions of VOC have decreased by 18 tons per day between 2007 and 2011. Annual emissions of VOC have decreased by 3,799 tons per year from 2007 to 2011. The most significant decreases in annual VOC emissions include Adhesives (SCC 2440020000), which decreased by 2,456 tpy, Surface Coating-Sheet, Strip, & Coil (SCC 2401050000), which decreased by 1,467 tpy, Portable Fuel Containers (SCC 2501011011), which decreased by 1,193 tpy. These decreases are due to New Jersey rules such as consumer products, adhesives and sealants, asphalt paving, and portable fuel containers. VOC emissions from Woodstoves - freestanding, non-EPA certified (SCC 2104008310) decreased by 1,028 tpy, and Marine Vessel Petroleum Transport-Crude Oil (SCC 2505020030), decreased by 824 tpy. Several additional area source categories showed decreases, primarily due to state rules.

Several area source categories show an increase in annual VOC emissions from 2007 to 2011, which include Gasoline Distribution Stage I; Pipeline (SCC 2505040120), which was not included in the 2007 area source inventory, but is included in the 2011 area source inventory and totals 2,978 tpy. Other increases in VOC include residential wood categories (Wood - Fireplaces: General (SCC 2104008100), which increased by 952 tpy, and Wood - Fireplaces: Insert; non-EPA certified (SCC 2104008210), which increased by 906 tpy). Residential wood burning calculation methodologies have been changed by USEPA from 2007 to 2011, resulting in significantly different results. This methodology change is the cause of the increase in emissions, it is not an actual emission increase. This would primarily affect annual trends, not summer day trends. VOC emissions from Graphic Arts-rotogravure &flexography (SCC 2425030000) increased by 477 tpy due to population growth.

Annual SO_2 emissions have decreased by 2,142 tons per year from 2007 to 2011. The most significant decreases in SO_2 emissions include Residential Combustion Distillate Oil (SCC 2104004000), which decreased by 944 tpy, Commercial/Institutional Combustion Distillate Oil (SCC 2103004000), which decreased by 818 tpy, and Industrial Combustion Residual Oil (SCC 2102005000), which decreased by 127 tpy. The decreases in emissions from these area source categories are due to a decrease in fuel consumption, most notably, a decrease in the use of distillate oil for heating.

Annual emissions have increased from 2007 to 2011 for NO_x, CO, $PM_{2.5}$, and NH_3. There are various reasons for the increase in emissions. The most significant difference between the 2007 and 2011 area source inventories is in the Residential Wood Categories. As mentioned above, residential wood burning methodologies have changed from 2007 to 2011, resulting in significantly different results, these are not actual emission increases. This would primarily affect annual trends, not summer day trends.

Annual NO_x increased by 301 tons per year from 2007 to 2011. The most significant increase is in Residential Natural gas (SCC 2104006000), which increased by 1,034 tpy. Commercial/Institutional Natural Gas Combustion (SCC 2106003000) increased by 139 tpy. These emissions increases are due to increased natural gas consumption. Other annual NO_x increases include Industrial Wood Combustion (SCC 2102008000) and Commercial Wood Combustion (2103008000), which were not included in the 2007 area source inventory, but are included in the 2011 area source inventory and total 420 tons per year. Wood Fireplaces (SCC 2104008100) increased by 131 tpy. The increase in Wood Fireplace emissions is due to the methodology changes discussed above.

There are some large decreases in individual area source NO_x categories, which include Commercial/Institutional Combustion Distillate Oil (SCC 2103004000), which decreased by 587 tpy; Residential Combustion Distillate Oil (SCC 2104004000), which decreased by 557 tpy), and Industrial Combustion Liquid Petroleum Gas (SCC 2102007000), which decreased by 150 tpy. These emissions decreases are due to a decrease in fuel consumption.

Summer emissions of CO have increased by 11 tons per day from 2007 to 2011. Annual CO emissions increased by 9,839 tons per year. There are several reasons for the emissions increases. The largest increases are due to the change in residential wood combustion methodology changes, discussed above. These increases include Wood - Fireplaces: General (SCC 2104008100), which increased by 7,507 tpy, Wood - Fireplaces: Insert; non-EPA certified (SCC 2104008210), which increased by 3,946 tpy, Wood - Fireplaces: Insert; EPA certified; non-catalytic (SCC 2104008220), increased by 1,074 tpy, Firelog-Total: All Combustor Types (SCC 2104009000), which increased by 391 tpy, and Wood - Fireplaces: Insert; EPA certified; catalytic (SCC 2104008230), which increased by 235 tpy.

Other increases in area source CO emissions from 2007 to 2011 include Industrial Wood Combustion (SCC 2102008000) and Commercial Wood Combustion (2103008000), which were not included in the 2007 area source inventory, but are included in the 2011 area source inventory and total 1,147 tpy. Commercial/Institutional Combustion Natural Gas (SCC 2103006000), increased by 538 tpy and Residential Combustion Natural Gas (SCC 2104006000) increased by 440 tpy, due to an increase in natural gas consumption. Managed Burning (SCC 2810015000), increased by 75 tpy, and Structural Fires (SCC 2810030000), increased by 127 tpy.

Annual unadjusted $PM_{2.5}$ emissions increased by 1,815 tons per year from 2007 to 2011. Adjusted $PM_{2.5}$ emissions increased by 1,880 tons per year from 2007 to 2011. The most significant increases in $PM_{2.5}$ emissions are due to the changes in residential wood methodology discussed above. Wood - Fireplaces: General (SCC 2104008100), increased by 1,189 tpy, Wood - Fireplaces: Insert; non-EPA certified (SCC 2104008210), increased by 523 tpy, and Wood - Fireplaces: Insert; EPA certified; non-catalytic (SCC 2104008220), increased by 149 tpy.

Other increases in area source $PM_{2.5}$ emissions from 2007 to 2011 include Industrial Wood Combustion (SCC 2102008000) and Commercial Wood Combustion (2103008000), which were not included in the 2007 area source inventory, but are included in the 2011 area source inventory and total 854 tpy.

There were some decreases in individual area source $PM_{2.5}$ categories from 2007 to 2011. The largest decreases are Wood - Woodstoves - freestanding, non-EPA certified (SCC 2104008310), which decreased by 594 tpy, and Paved Roads (SCC 2294000000), which decreased by 186 tpy.

Annual NH_3 emissions increased by 397 tons per year from 2007 to 2011. The largest increases in NH_3 are from fertilizer categories (SCC 2801700001 – 2801700099), which increased a total of 353 tons per year.

Table 14: Statewide Area Source Emission Inventory Comparison

Summer Controlled Emissions (Tons per Day)	New Jersey 2007	New Jersey 2011
VOC	292.97	274.30
NO_x	31.59	32.06
CO	35.84	47.23

Annual Controlled Emissions (Tons per Year)	New Jersey 2007	New Jersey 2011
VOC	97,693	93,726
NO_x	23,856	24,157
CO	66,502	76,341
SO_2	8,811	6,669
$PM_{2.5}$ unadjusted fugitive dust	16,142	17,786
$PM_{2.5}$ adjusted fugitive dust	12,540	14,420
PM_{10} unadjusted fugitive dust	36,743	37,021
PM_{10} adjusted fugitive dust	20,491	22,072
NH_3	6,600	6,997

C. Onroad Sources

The onroad calculations were randomly reviewed by NJDEP Bureau of Air Quality Planning staff to check for accuracy.

Table 15 presents the comparison of selected 2007 onroad source emission inventories to the corresponding 2011 onroad source inventories. The 2011 inventories are lower than the corresponding 2007 inventories because of the turnover of the fleet from older higher emitting vehicles to newer vehicles with significantly lower emission rates.

Table 15: Statewide Onroad Source Emission Inventory Comparison

Annual Emissions (Tons per Year)	New Jersey 2007	New Jersey 2011
SO_2	917	879
$PM_{2.5}$	4,830	3,557
NH_3	3,216	2,506

Typical Summer Work Weekday Emissions (Tons per Day)	New Jersey 2007	New Jersey 2011
VOC	180.18	101.13
NO_x	388.38	260.25
CO	1,660.55	1,109.26

D. Nonroad Sources

The nonroad calculations were randomly reviewed by NJDEP Bureau of Air Quality Planning staff to check for accuracy. The quality assurance review for the NONROAD Model equipment emissions estimates included New Jersey conducting a visual spot check of Model pollutant results presented on the computer monitor with those included in the corresponding exported spreadsheet. For the CMV, aircraft and locomotive emission estimates, New Jersey conducted a visual spot check of the columns of calculations performed on each excel spreadsheet that was used for these emission estimates.

i. Nonroad Equipment Emissions From NONROAD Model

The 2011 NONROAD Model equipment emission inventory was compared to its corresponding 2007 inventory in order to identify any anomalies that might indicate calculation or data errors, and to verify reasons for trends towards higher or lower emissions. Table 16 below presents this comparison. Comparing these two inventories shows that in 2011, emissions have decreased by about 19% for VOC, about 16% for NOx, about 14% for CO, over 7% for PM_{10} and $PM_{2.5}$ and over 93% for SO_2.

Table 16: Statewide Nonroad Source Emission Inventory Comparison

Summer Controlled Emissions (Tons per Day)	New Jersey 2007 Actual	New Jersey 2011 Actual
VOC	161.28	131.66
NO_x	125.06	104.19
CO	1,651.91	1,423.41

Annual Controlled Emissions (Tons per Year)	New Jersey 2007 Actual	New Jersey 2011 Actual
VOC	47,521	38,439
NO_x	36,345	30,509
CO	445,302	382,579
SO_2	1,905	121
PM_{10}	3,377	3,122
$PM_{2.5}$	3,213	2,966
NH_3	NC(1)	NC(1)

NOTES:
(1) NC = Not Calculated

Emissions decreased from 2007 to 2011 mainly because of nonroad equipment and vehicles fleet turnover from Federal standards taking effect after 2007. This turnover results in the new vehicles and equipment having lower emission standards than the vehicles and equipment that they are replacing from emission standards implemented from after 2007 and through 2011. Some of these rules were promulgated earlier then 2007 but either take effect after 2007 or can be effective in 2007 or earlier but the nonroad equipment had not turned over until after 2007, and so the benefit of these emission standards phasing in is not realized until after 2007.

Additionally, user inputs to the NONROAD2008a model for diesel fuel sulfur content caused the most significant effect on lowering SO_2 emissions from 2007 to 2011. The diesel fuel sulfur content in fuel inputs from 2007 to 2011 decreased from 1139 ppm to 32 ppm for land-based equipment and vehicles and from 1332 to 236 ppm for marine vessels. This sulfur in fuel content decrease occurred from the implementation of the Clean Air Nonroad Diesel Rule – Tier 4 referenced in Section V. This section provides a summary of all the USEPA nonroad equipment emission standards applied to the 2011 NONROAD Model equipment emission inventory.

ii. Commercial Marine Vessel Emissions

The 2011 CMV New Jersey emission inventories were compared to their corresponding 2007 inventory in order to identify any anomalies that might indicate calculation or data errors, and to verify reasons for trends towards higher or lower emissions. Table 17 below presents a comparison of the daily and annual CMV emission inventory conducted in 2007 and 2011.

Table 17: NJ Commercial Marine Vessel Emission Inventory Comparison

Controlled Emissions (Tons per Day)	New Jersey 2007 Actual	New Jersey 2011 Actual
VOC	1.80	1.98
NO_x	30.68	28.50
CO	4.43	4.86

Controlled Emissions (Tons per Year)	New Jersey 2007 Actual	New Jersey 2011 Actual
VOC	656	722
NOx	11,166	10,375
CO	1,614	1,770
SO_2	6,694	2,170
PM_{10}	620	143
$PM_{2.5}$	574	134
NH_3	NC(1)	NC(1)

NOTES:
(1) NC = Not Calculated

Comparing New Jersey CMV inventories, shows decreases in 2011 of approximately 7% for NOx, about 68% for SO_2, and about 77% for PM_{10} and $PM_{2.5}$ emissions and increases of approximately 10% for VOC and CO emissions. NOx, PM_{10}, $PM_{2.5}$ and SO_2 emissions decreased from the application of USEPA CMV and Marpol control measures and nonroad diesel fuel standards as referenced in Section V. VOC and CO emissions increased because these control measures did include controls for these pollutants for category 3 Ocean Going Vessels (OGV) to counter the overall increase in CMV category 3 Ocean Going Vessel (OGV) activities and the harbor craft associated with their movements, i.e. assist tugboats, that occurred from 2007 to 2011.

iii. Aircraft Emissions

The 2011 aircraft New Jersey emission inventories were compared to its corresponding 2007 inventory in order to identify any anomalies that might indicate calculation or data errors, and to verify reasons for trends towards higher or lower emissions. Table 18 below presents this comparison. Comparing these two inventories shows that in 2011, emissions have decreased by about 37% for VOC, about 23% for CO, about 42% for PM_{10}, about 31% for $PM_{2.5}$, about 2% for NOx, and increased by about 4% for SO_2.

Table 18: Statewide Aircraft Emission Inventory Comparison

Controlled Emissions (Tons per Day)	New Jersey 2007 Actual	New Jersey 2011 Actual
VOC	6.68	4.23
NO_x	13.99	13.76
CO	59.95	46.55

Controlled Emissions (Tons per Year)	New Jersey 2007 Actual	New Jersey 2011 Actual
VOC	2,438	1,541
NOx	5,106	5,008
CO	21,881	16,943
SO_2	507	527
PM_{10}	170	99
$PM_{2.5}$	143	99
NH_3	NC(1)	NC(1)

NOTES:
(1) NC = Not Calculated

The emission decrease is mainly due to the fact that landing and take-off operations have decreased at major airports in New Jersey such as Newark Liberty International (EWR), Teterboro, Atlantic City, Morris County and Mercer Trenton. For example, EWR had 8% percent less LTOs in 2011 than in 2007. Another possible reason for the change in emissions from 2007 to 2011 is that the Federal Aviation Agency (FAA) Emission Dispersion Modeling System (EDMS) fleet database was updated. The EDMS model version 5.1.3 (November 2010) was used for the 2007 inventory. While the updated EDMS model 5.1.4.1 (August 2013) was used for the 2011 inventory.

iv. Locomotive Emissions

The 2007 New Jersey locomotive emission inventories were compared to its corresponding 2011 inventory in order to identify any anomalies that might indicate calculation or data errors, and to verify reasons for trends towards higher or lower emissions. Table 19 below presents a comparison of the daily and annual emission locomotive inventory conducted in 2007 and 2011.

Table 19: Statewide Locomotives Emission Inventory Comparison

Controlled Emissions (Tons per Day)	New Jersey 2007 Actual	New Jersey 2011 Actual
VOC	0.76	0.65
NO_x	16.32	13.58
CO	1.77	1.88

Controlled Emissions (Tons per Year)	New Jersey 2007 Actual	New Jersey 2011 Actual
VOC	279	236
NOx	5,957	4,942
CO	645	685
SO_2	55	18
PM_{10}	159	132
$PM_{2.5}$	147	121
NH_3	NC(1)	NC(1)

NOTES:
(1) NC = Not Calculated

Comparing New Jersey CMV inventories, shows decreases in 2011 of approximately 15% for VOC, about 17% for NOx, about 67% for SO_2, about 17% for PM_{10}, about 18% for $PM_{2.5}$ emissions and just an increase of less than 1% for CO. These emissions decreased from the application of USEPA Locomotive engine control measures as referenced in and Nonroad diesel fuel standards as referenced in Section V. While CO emissions increased slightly from growth that occurred from 2007 to 2011.

E. Inventory Evaluation

i. 2011 Inventory

Graphs summarizing the 2011 inventory are included in Attachment 14. As shown on the graphs, in the 2011 emission inventory, biogenic sources represent the largest fraction of VOCs. The area source sector represents the largest fraction of human-made VOC, followed by the nonroad sector. The onroad sector represents the largest fraction of NO_x, followed by the nonroad sector. The nonroad sector represents the largest fraction of carbon monoxide, followed by the onroad sector. The area source sector represents the largest fraction of PM2.5. The area source sector represents the largest fraction of SO_2, followed by the point source sector. Biogenic sources represent the largest fraction of ammonia, while the area source represents the largest fraction of human-made ammonia.

Graphs showing a ranking of human-made emission categories from highest to lowest are included in Attachment 14. As shown in the graphs, the top 5 categories of human-made 2011 emissions for summer VOCs are consumer products, passenger cars, architectural surface coatings, lawn and garden equipment (4 stroke) and industrial surface coatings. The top 5 categories for summer NO_x are passenger car exhaust, construction equipment, passenger trucks, combination long-haul trucks and diesel internal combustion engine power plants. The top 5 categories for annual PM2.5 are woodburning, commercial cooking, paved road dust, passenger car exhaust and construction equipment. The top 5 categories for annual SO_2 are fuel oil combustion, coal power plant boilers, commercial marine vessels, natural gas power plant boilers and passenger car exhaust. The top 5 categories for annual ammonia are livestock, passenger car exhaust, fertilizer, composting and ammonia refrigeration.

Graphs showing a ranking of point source emissions by facility are included in Attachment 14. As shown in the graphs, the top 5 2011 VOC emission facilities are Shell Sewaren Terminal, Colonial Pipeline Woodbridge, IMTT Bayonne, PSEG Edison and Paulsboro Refinery. The top 5 2011 NOx emission facilities are BL England, PSEG Hudson , PSEG Essex, PSEG Burlington and PSEG Edison.

ii. Inventory Trends 2007 to 2011

A comparison of the 2007 human-made emission inventory to the 2011 human-made emission inventory for New Jersey is presented in Table 20, by pollutant (VOC, NO_x and CO) and source sector. This comparison shows the following:

- Total human-made VOC, summer tpd: Overall decrease, decreases in all sectors, except for point.
- Total human-made VOC, tpy: Overall decrease, decreases in all sectors.

- Total human-made NO_x summer tpd: Overall decrease, decreases in all sectors, except for area.
- Total human-made $NO_{x,}$ tpy: Overall decrease, decreases in all sectors, except for area with an increase of 301 tpy.

- Total human-made CO summer tpd: Overall decrease, decreases in onroad and nonroad, increases in point (13 tpd) and area (11 tpd).

- Total human-made CO tpy: Overall decrease. Decreases in point, onroad and nonroad sectors, increase in area sources of 9,839 tpy.

More detailed discussions of increases and decreases are included above in the individual sector comparisons. Decreases are due primarily to Federal and State rules.

Table 20: 2007 and 2011 Statewide Emission Inventory by Source Sector and Pollutant

	VOC		NO_x		CO	
Source Sector	**2007 Tons per Summer Day**	**2011 Tons per Summer Day**	**2007 Tons per Summer Day**	**2011 Tons per Summer Day**	**2007 Tons per Summer Day**	**2011 Tons per Summer Day**
Point	39	40	149	129	54	67
Area	293	274	32	32	36	47
Onroad	180	101	388	260	1,661	1,109
Nonroad	171	139	186	160	1,718	1,477
Total in State	**683**	**554**	**755**	**581**	**3,468**	**2,700**

Table 20 (continued): 2007 and 2011 Statewide Emission Inventory by Source Sector and Pollutant

	VOC		NO_x		CO	
Source Sector	**2007 Tons per Year**	**2011 Tons per Year**	**2007 Tons per Year**	**2011 Tons per Year**	**2007 Tons per Year**	**2011 Tons per Year**
Point	10,359	7,320	30,045	14,793	10,559	7,055
Area	97,693	93,726	23,856	24,157	66,502	76,341
Onroad*	72,224	40,206	135,339	92,356	717,791	455,683
Nonroad	50,875	40,938	58,604	50,834	469,464	401,977
Total in State	**231,151**	**182,190**	**247,844**	**182,140**	**1,264,316**	**941,056**

*2011 Onroad Annual CO emissions are from 2011 USEPA NEI v2 dated February 2015

i. Inventory Trends 2002 to 2011

Graphs showing anthropogenic emission trends from 2002 to 2011 are included in Attachment 14. There were some emission calculation methodology changes in each emission inventory which should be noted when evaluating trends. For the onroad sector, emissions were calculated with a new USEPA model (MOVES) in 2007 and 2011, which was different than the model used for the 2002 inventory (MOBILE6). The new model results in higher NOx and PM2.5 emission estimates, than those in 2002. USEPA Residential wood burning methodologies and calculations changed for each of the inventories shown, resulting in significantly different results, lower in 2007 and higher again in 2011. This would primarily affect annual trends, not summer day trends. For example, PM2.5 was calculated to be 9,363 tpy in 2002 using USEPA EIIP methodology, was calculated to be 3,385 tpy by USEPA in 2008 with the Residential Wood Tool, was modified by New Jersey to be 5,761 tpy in 2008, and was calculated to be 7,052 tpy by USEPA in 2011 using the modified Residential Wood Tool. There are also known issues with the USEPA county distribution of the statewide residential wood burning emissions. Wildfires are not included in the trends graphs, because they are considered events and are inconsistent from year to year. PM2.5 was not reported in the 2002 Emission Statement program, therefore the point source emissions were estimated based on PM10 reporting, resulting in lower emissions in 2002 than 2007. Ammonia was also not reported in the 2002 Emission Statement program. Therefore, the 2007 and 2011 emissions are more representative of actual point source emissions for PM2.5 and ammonia, than 2002 emissions.

As shown in the graphs, estimated human-made emissions of VOCs have decreased from 2002-2011 by about 40%, NO_x has decreased by about 40%, PM2.5 has decreased by about 20%, SO_2 has decreased by about 80%, carbon monoxide has decreased by about 50%, and ammonia has decreased by about 35%.

VOC decreases were achieved in all sectors due to motor vehicle fleet turnover, Federal new engine standards for onroad and off road vehicles and equipment, the National and State low emission vehicle programs, area source rules such as consumer products, portable fuel containers, paints, autobody refinishing, asphalt paving applications, and solvent cleaning operations, and point source controls such as refinery consent decrees.

NO_x decreases were achieved in the onroad sector due to motor vehicle fleet turnover and the National and State low emission vehicle programs, and in the point source sector due primarily to the NO_x budget program for power plants, power plant and refinery consent decrees (contractual agreements) and New Jersey's high electric demand day and multi-pollutant power plant rules. NO_x decreases were achieved in the nonroad sector due to new engine standards for nonroad vehicles and equipment.

Carbon monoxide decreases were achieved primarily in the onroad and nonroad mobile sectors due to motor vehicle fleet turnover and new engine standards for nonroad vehicles and equipment.

Direct PM2.5 has decreased in the point source sector due power plant and refinery consent decrees and in the onroad and nonroad sectors due to motor vehicle fleet turnover, new engine standards for nonroad vehicles and equipment and the National and State low emission vehicle programs. Increases shown on the graphs in onroad and area sources and point sources are due to calculation methodology changes discussed above.

SO_2 decreases were achieved in all sectors and significantly in the point source sector due to the acid rain program and power plant consent decrees, in the area source sector due a decline in the use of distillate oil for heating, and in the onroad and nonroad sectors due to Federal rules that reduced sulfur levels in diesel fuel.

Ammonia decreases were achieved in the onroad and nonroad sectors due to motor vehicle fleet turnover and new engine standards for nonroad vehicles and equipment.