Appendix V
2007 Attainment Emissions Inventory

1.0 Attainment Emissions Inventory Introduction

The 2007 $PM_{2.5}$ redesignation attainment emission Inventory is a compilation of annual emissions from fine particulate matter ($PM_{2.5}$), oxides of nitrogen (NO_x), and sulfur dioxide (SO_2). The sources are divided into four sectors and each making up one component of the inventory: point sources, area (nonpoint) sources, onroad sources, nonroad sources.

The 2007 attainment emissions inventory was prepared with the support of the Mid-Atlantic Regional Air Management Association (MARAMA) and its contractors, AMEC Environment and Infrastructure and SRA International, Inc. A copy of the Technical Support Document[1] prepared by AMEC and SRA for MARAMA is included as Attachment 1 to this appendix.

2.0 Fugitive Dust

As discussed in New Jersey's 2002 Periodic Emission Inventory, Attachment 2, dated May 2006, New Jersey believes that the fugitive dust-related $PM_{2.5}$ emissions calculated using USEPA inventory guidance is not representative of ambient air quality, as demonstrated by a review of monitoring data and EPA guidance on $PM_{2.5}$ fugitive dust transport fractions. The USEPA has developed a methodology to reduce the fugitive dust emissions by applying "transport factors" at the county level.[2] MARAMA applied the USEPA "transport factors" when developing the 2007 area source emission inventory. Additional details regarding the transport factors can be found in EPA's guidance and in the *Technical Support Document for the Development of the 2025 Emission Inventory for PM Counties in the MANE-VU Region, Version 3.3,* prepared by AMEC and SRA for MARAMA, and dated January 23, 2012. A copy of the TSD is included as Attachment 1 to Appendix VI.

A table of area source SCCs affected by the PM transport fractions is included as Exhibit 2.1 on page 9 of the MARAMA 2025 Inventory TSD. The area source categories affected by the PM transport fractions include paved roads, unpaved roads, construction, mining and quarrying, and agricultural tilling. A table of the NonEGU Point sources affected by the PM transport fraction is included as Exhibit 3.1 on page 46 of the MARAMA TSD. The NonEGU Point sources affected by the PM transport fraction include dust from paved and unpaved roadways, dust from stock/storage piles, landfill activity, quarry activity, and raw material handling.

The USEPA transport factors that were applied to New Jersey's 2007 $PM_{2.5}$ Area and Point source inventories are listed in Table 1, below:

[1] 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.
[2] U.S. Environmental Protections Agency. *Emissions Modeling Clearinghouse - Fugitive Dust Fractions*. February 2007. (http://www.epa.gov/ttn/chief/emch/dustfractions).

Table 1
PM Transport Fractions for New Jersey PM Nonattainment Counties

County FIPS	County	PM Transport Fraction
34003	BERGEN	0.2657
34005	BURLINGTON	0.3008
34007	CAMDEN	0.1375
34013	ESSEX	0.3461
34015	GLOUCESTER	0.4361
34017	HUDSON	0.5286
34021	MERCER	0.3472
34023	MIDDLESEX	0.3273
34025	MONMOUTH	0.5468
34027	MORRIS	0.2297
34031	PASSAIC	0.1971
34035	SOMERSET	0.3635
34039	UNION	0.3117

3.0 Point Sources

For the purposes of this 2007 emissions 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 sources emissions inventory.

3.1 NO_x, SO_2, and $PM_{2.5}$ Emissions From Emission Statements

The 2007 point source inventories for NO_x, SO_2, 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 594 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 2007.

Emission Statement data are submitted through NJDEP's data entry software, known as Remote Air Data Input Users System (RADIUS). Table 2 provides a brief description of the Emission Statement information collected.

Table 2: 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 8.1), the data was submitted to the USEPA's NEI database in National Inventory Format (NIF). For the 2007 inventory, this NIF file (NEI_48.xml) was provided to MARAMA's contractor, who ran queries to extract the emissions data. This file is available electronically.

3.2 Emission Offsets (Emission Reduction Credits)

Section IV.C.3 (Emission Reduction Credits from Shutdowns and Curtailments) of Appendix S to 40 C.F.R. pt. 51, states that emissions reductions achieved by shutting down an existing source or curtailing production or operating hours may be credited for offsets if such reductions are surplus, permanent, quantifiable, and federally enforceable and the shutdown or curtailment occurred after the last day of the base year for the SIP planning process. Appendix S allows the use of pre-base year shutdown and curtailment credits of $PM_{2.5}$, and its precursors (SO_2 and NO_x), emissions for offsets, provided the projected emissions inventory used to develop the attainment demonstration explicitly includes emissions for offsets from such previously shutdown or curtailed emission units.

Although this SIP is not an attainment demonstration, potential offset emissions were added to the emission inventory to be conservative to account for potential emission reduction credits (ERCs) that may be used by stationary sources pursuant to N.J.AC. 7:27-18, "Emission Offset Rules." To incorporate these potential emissions into the inventory, New Jersey allocated the statewide pre-base year (2007) banked offsets available from 2001-2006 to the county level, proportioned by population, for $PM_{2.5}$, NO_x and SO_2. The emissions were assigned to SCC 23-99-000-000 (miscellaneous industrial processes: not elsewhere classified) with an identifier of "OFFSET99999". The emissions were entered as point sources at the county centroid with an assumed stack height of 10 feet.

3.3 Rule Effectiveness

Per the USEPA's guidance,[3] [4] a rule effectiveness factor was applied to all applicable sources for the NO_x, SO_2, and $PM_{2.5}$ 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 2007 inventory if the overall control efficiency is not reported in the Emission Statement Program. All remaining sources had the eighty percent rule effectiveness applied in accordance with USEPA guidance.

3.3.1 Emissions Calculation/Reporting Methodology

Facilities had the option to calculate and report pollutant source emissions based on several calculation methods. If a facility calculated their emissions based on continuous emissions monitoring, predictive emissions monitoring, source test or material balance, using engineering knowledge of the process, the NJDEP concluded that these facilities had accounted for factors for which a rule effectiveness factor is otherwise applied. Therefore, in these cases, the eighty percent rule effectiveness factor was not applied.

3.3.2 Overall Efficiency of Control Equipment

As part of their Emission Statement Program, facilities are required to report overall efficiency, which is the combined control efficiency of all devices that control a given source. The overall efficiency accounts for the:

1) Amount of time a control device is operating while a process or source is in use,
2) Control efficiency, and
3) Capture efficiency of any and all control devices present for a process or source.

The NJDEP determined that facilities reporting an overall efficiency for a source have already accounted for factors which a rule effectiveness factor is otherwise applied. Therefore, in these cases, the eighty percent rule effectiveness factor was not applied. However, for the few instances where a rule does not require a control device on a facility, and therefore, the facility would not have reported an overall efficiency for a source, then the eighty percent rule effectiveness factor was applied to these sources. An example of the latter is the New Jersey's recent revision to the Sulfur in Fuel Rule, where the reduction of SO_2 is due the reduction of sulfur in the fuel, not a control device.

3.4 Point Source Emission Inventory

Table 3 summarizes the 2007 point source emission inventory by county for $PM_{2.5}$, NO_x and SO_2. Attachments 2, 3 and 4 contain the detailed point source emission inventories. These attachments are only available electronically.

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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.

Table 3
2007 Point Source Emission Inventory by County and Pollutant

County	$PM_{2.5}$* Tons per Year	NO_x Tons per Year	SO_2 Tons per Year
New Jersey Portion of Northern NJ-NY-CT NAA			
Bergen	188	851	46
Essex	230	2,361	299
Hudson	2,142	3,873	4,467
Mercer	1,079	2,233	14,432
Middlesex	458	2,065	367
Monmouth	33	195	43
Morris	32	196	55
Passaic	6	95	20
Somerset	72	260	35
Union	697	3,699	596
Total	**4,937**	**15,827**	**20,359**
New Jersey Portion of Southern NJ-Phila. NAA			
Burlington	174	516	157
Camden	155	756	76
Gloucester	471	3,181	1,801
Total	**799**	**4,453**	**2,035**

***** These totals include adjusted emissions from fugitive dust categories.

4.0 Area Sources

The area source component of the 2007 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.

4.1 $PM_{2.5}$, NO_x and SO_2 Emission Calculation Procedures

The $PM_{2.5}$, NO_x, and SO_2 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 calculated on an annual basis. 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 5.

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

4.1.1 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:

$$Emissions_{Annual} = EF \times AL/CF \quad (1)$$

where:

$Emissions_{Annual}$ = Annual pollutant emissions in tons per year
EF = Annual emission factor
AL = Annual activity level
CF = Factor to convert pounds to tons

4.1.2 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.

4.1.3 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.

4.1.4 Emission Controls

New Jersey has developed a number of air pollution control (APC) measures to reduce area source emissions. Table 4 lists the New Jersey rules that apply to the 2007 area source $PM_{2.5}$ attainment inventory:

Table 4
Area Source Rules that Apply to the 2007 $PM_{2.5}$ Attainment Inventory

Rule	Applicable SCC Codes
N.J.A.C. 7:27-2: Control and Prohibition of Open Burning	2610000100, 2610000400, 2610030000, 2610040400, 2801500170, 2810015000, 2801500100, 2801500300, 2801500600
N.J.A.C. 7:27-9: Sulfur in Fuels	2102004000, 2102005000, 2102011000, 2103004000, 2103005000, 2103011000, 2104011000
N.J.A.C. 7:27-10: Sulfur in Solid Fuels	2102001000,2102002000, 2103001000, 2103002000, 2104001000, 2104004000
N.J.A.C. 7:27-11: Incinerators	2601010000, 2601030000, 2601000000, 2601030000

Control efficiency (CE) factors for the control measures have been estimated and applied to the emission inventory. The USEPA requires that rule effectiveness (RE) and rule penetration (RP) 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.

Whenever a control measure is applicable to a specific area source category, the three factors of CE, RE, and RP are incorporated into emission estimation equation (1) as follows:

$$Emissions_{Annual} = \{EF \times AL \times [1 - (CE \times RE \times RP)]\}/CF \qquad (2)$$

CE, RE and RP 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. In the instance where CE is included in the emission factor, the CE is expressed as a "0" in equation number 2.

4.1.5 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 Emissions Inventory (NEI). They are now required to be reported as events. For this SIP inventory, New Jersey used an average of emissions from 2000-2007 to estimate 2007 emissions from wildfires (SCC 2810001000). A large wildfire occurred in Burlington County in 2007. The 8-year average of wildfire emissions from 2000-2007 presents a more representative estimate of wildfire emissions for the 2007 attainment inventory. An averaged estimate is appropriate for the attainment inventory so that evaluations of the impact of

[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.

permanent and enforceable control measures in future inventory projections will not be biased. This approach was recommended by USEPA.[7]

4.2 Area Source Emission Inventory

Table 5 summarizes the 2007 area source emission inventory by county for $PM_{2.5}$, NO_x and SO_2. Attachment 6 contains the detailed area source emission inventories. This attachment is only available electronically.

Table 5
2007 Area Source Emission Inventory by County and Pollutant

County	$PM_{2.5}$* Tons per Year	NO_x Tons per Year	SO_2 Tons per Year
New Jersey Portion of Northern NJ-NY-CT NAA			
Bergen	597	2,515	731
Essex	531	2,094	739
Hudson	415	1,522	418
Mercer	293	1,125	331
Middlesex	902	2,187	574
Monmouth	846	1,654	459
Morris	742	1,564	683
Passaic	331	1,138	333
Somerset	478	939	248
Union	364	1,383	467
Total	**5,499**	**16,122**	**4,983**
New Jersey Portion of Southern NJ-Phila. NAA			
Burlington	1,702	1,397	443
Camden	423	1,358	412
Gloucester	732	728	274
Total	**2,857**	**3,483**	**1,129**

***** These totals include adjusted emissions from fugitive dust categories.

5.0 Onroad Sources

New Jersey's 2007 attainment emissions inventory for onroad sources is discussed in Appendix VII.

6.0 Nonroad Sources

Nonroad 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 as embedded in the National Mobile Inventory Model (NMIM). 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 groups such as the Eastern Regional Technical Advisory Committee (ERTAC) and Starcrest.

7 Email correspondence with Alison Eyth, USEPA Emission Inventory and Analysis Group, April 13, 2012.

6.1 NONROAD Model Equipment

The USEPA's NONROAD 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 National Mobile Inventory Model (NMIM) runs the nonroad model by inputting monthly national county data (NCD) such as county specific fuel parameters and temperatures. This enables NMIM to develop nonroad model emission estimates for any specific year, month or season. Most of the work associated with executing NMIM involved updating the NMIM county database with State-specific information. This was accomplished by AMEC (formally MACTEC), MARAMA's contractor. For this analysis, AMEC used the NMIM2008 software (version NMIM20090504), the National County Database (version NCD20090531), and NONROAD2008a (July 2009 version) as a starting point. NCD20090531 contains the 2007 year-specific meteorology data set that USEPA used to calculate 2007 emissions in addition to fuel revisions for years 2006-2011. Additional changes were made to the NCD20090531 based on review of data by the States as discussed below. The purpose of this review was to create a new NCD specific to the 2007 base year model run. AMEC performed these changes and conducted all the NMIM runs. The following subsections describe these changes applied to the 2007 model runs conducted for New Jersey.

6.1.1 State Review of NMIM Fuel Characteristics

New Jersey commented on fuel characteristics data and changes were made to the underlying MySQL database to incorporate those changes into the USEPA's NONROAD model. These included changes to Reid Vapor Pressure, sulfur and oxygenate fractions. Where changes were made, the Contractor created new gasoline type IDs. The twenty gasoline fuel record types added to the "gasoline" table in the MySQL NCD database for New Jersey is shown in Table 6 below:

Table 6
New Jersey Added Gasoline Fuel Record Types

GASOLINE IDENTIFICATION	AVERAGE REID VAPOR PRESSURE	AVERAGE SULFUR%	AVERAGE MAXIMUM SULFUR%	AVERAGE ETHANOL%
1905	10.45	0.003884	0.0065	9.77
1906	12.99333	0.003347	0.005767	9.952564
1926	10.61	0.004023	0.0059	9.73
1927	13.42	0.00372	0.0071	9.920882
1962	10.66	0.004295	0.0065	9.9
1963	13.42	0.003161	0.0051	9.967692
2018	10.61	0.004023	0.0059	9.73
2019	13.42	0.00372	0.0071	9.920882
2046	6.880187	0.003338	0.006157	9.81232
2254	12.99333	0.003347	0.005767	9.952564
2255	10.42143	0.003427	0.005257	9.998571
2256	6.941806	0.003077	0.005609	9.802004
2282	13.42	0.00372	0.0071	9.920882
2283	10.61	0.0033	0.004975	10.0275

GASOLINE IDENTIFICATION	AVERAGE REID VAPOR PRESSURE	AVERAGE SULFUR%	AVERAGE MAXIMUM SULFUR%	AVERAGE ETHANOL%
2341	13.42	0.003161	0.0051	9.967692
2342	10.66	0.003406	0.004967	9.966667
2343	6.95121	0.002959	0.0055	9.772723
2407	13.42	0.00372	0.0071	9.920882
2408	10.61	0.003363	0.00514	10.062
2409	6.880728	0.003421	0.0062	9.814258

Other NONROAD model parameters included in the 2007 NMIM NONROAD model run for New Jersey were a diesel sulfur percentage of 0.1139, a marine diesel sulfur percentage of 0.1332 and an ethanol market share of 100%.

6.1.2 Update of NMIM Allocation Files for Population and Housing

Several NONROAD categories use housing unit or population data to allocate the emissions to the county level from State calculations. MARAMA States identified some discrepancies in the housing and population data contained in the NONROAD model and requested that the Contractor update the allocation files for those categories. As a consequence, the Contractor obtained 1 and 2 unit housing information and updated 2007 population estimates. Data were obtained from the sources listed in Exhibit 6.1.2.

Exhibit 6.1.2
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. Revised allocation files for all MARAMA States (except NY) were developed and utilized in the NMIM modeling for this category.

NJ 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 onroad sector emissions. Because of the way NONROAD handles missing data, if data for 2007 are not found, the most current data (in this case 2005) are used to assist in determining a 2007 value.

6.1.3 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. Because the population files used by the NONROAD model (and thus NMIM) 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.

6.1.4 Airport Ground Support Equipment Removal

New Jersey provided revised equipment population values for Airport Ground Support Equipment. As discussed in Section 7 of this TSD, emissions from airport ground support equipment is 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 NONROAD. For this reason, all emissions calculated by NMIM/NONROAD for airport ground support equipment were removed from the inventory to avoid double counting.

6.1.5 NMIM Run Specifications

The run specifications for each NMIM run were developed on a State-by-State basis. The settings for each specification panel within the NMIM model are detailed below.

- Description: A short descriptive term for the run was entered for each State specific run.
- Geography: The "county" option was selected for each State specific run. All counties within a State were selected for the run.
- Time: On the time panel, the year 2007 was selected in the drop down box and added to the year selections area. The Use Yearly Weather Data check box was also selected. Every month in the Months check box area was selected.
- Vehicles/Equipment: Only the nonroad vehicle/equipment area was selected. 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.
- Fleet: No selections or information was entered in this panel.
- Pollutants: All criteria pollutants (with HC reported as VOC) were selected except for CO_2. Exhaust PM_{10} and $PM_{2.5}$ were also selected.
- Advanced features: Only the server and database were selected in this panel.

- Output: Under the Geographic Representation panel the County selection was made. In the General Output area, a new database was selected on the server for the output.

All added external files for use in each State run were placed in the external files directory of the NCD. Entries for all external files included were added to the countynrfiles table of the NCD.

6.1.6 NONROAD Model Equipment Emission Inventory

Table 7 summarizes the 2007 nonroad model source emission inventory by county for $PM_{2.5}$, NO_x and SO_2. Attachment 7 contains the detailed nonroad source emission inventories. This attachment is only available electronically.

Table 7
2007 NONROAD Model Equipment
Emission Inventory by County and Pollutant

County	$PM_{2.5}$* Tons per Year	NO_x Tons per Year	SO_2 Tons per Year
New Jersey Portion of Northern NJ-NY-CT NAA			
Bergen	338	4,065	186
Essex	173	2,264	118
Hudson	154	1,932	118
Mercer	156	1,728	104
Middlesex	295	3,629	188
Monmouth	254	2,802	161
Morris	209	2,353	107
Passaic	127	1,613	75
Somerset	155	1,620	79
Union	136	1,733	74
Total	**1997**	**23,738**	**1208**
New Jersey Portion of Southern NJ-Phila. NAA			
Burlington	172	1849	96
Camden	123	1413	71
Gloucester	103	1057	55
Total	**397**	**4320**	**221**

6.2 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 USEPA 2008 National Emission Inventory (NEI)8. 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.

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 6.2 provides a summary of these determinations as well as the Source Category Code (SCC) designation of each CMV operation included in the 2007 emission inventory:

Exhibit 6.2
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

A description of how CMV emissions were determined for specific New Jersey counties follows below. This description is presented in two parts analogous with the different methodologies applied for those Northern New Jersey counties associated with the New York North New Jersey (NYNNJ) Harbor system and for those Southern New Jersey counties associated with the New Jersey Delaware River Basin. Only one county, Passaic County, was not associated with either the harbor system or the river basin. Therefore, New Jersey relied upon the USEPA 2008 NEI to determine cmv emissions for this county.

6.2.1 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 North Jersey 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 Emissions Inventory Report prepared by Starcrest

[8] U.S. Environmental Protection Agency. Documentation for the Commercial Marine Vessel Component of the National Emissions Inventory Methodology, Eastern Research Group report # 0245.02.302.001, USEPA Contract number EP-D-07-097. March 30, 2010.

Consulting Croup, LLC.[9] 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. From these emission estimates 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 2007 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 Northern NJ Starcrest emissions from 2000 to 2007. 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 2007. New Jersey divided the amount of cargo, TEUs and cars delivered in 2007 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 2007 relates directly to the growth in containerships and hence the growth in their emissions 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 2007 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 2007. This is because towboats pull or push barges that transport bulk and general cargo.

6.2.2 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 NEI and the state of Pennsylvania. New Jersey used the USEPA NEI to develop all of its category 3 CMV underway and port emissions and the category 1 and 2 CMV port emissions for Mercer, Burlington, Camden and Gloucester counties. New Jersey used the Pennsylvania category 1 and 2 underway inventory to develop its own inventory for category 1 and 2 harborcraft underway emissions for these same 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 counties located on the western bank. A similar allocation process had been agreed to by New Jersey and Pennsylvania as part of the 1990 emission inventory submittal. New Jersey did not use the

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

Pennsylvania inventory for category 3 CMV emissions because Pennsylvania had also relied on the USEPA 2008 NEI to determine emissions for this category in the Delaware River Basin.

New Jersey obtained 2008 data from Pennsylvania and the USEPA NEI data was for 2008. No changes were made to the 2008 data for 2007 (i.e., the 2007 emissions were assumed to be equal to 2008). Also, New Jersey has no significant lightering operations.

6.2.3 Commercial Marine Vessel Emission Inventory

Table 8 summarizes the 2007 CMV source emission inventory by county for $PM_{2.5}$, NO_x and SO_2. Attachment 6 contains the detailed nonroad source emission inventories. This attachment is only available electronically.

Table 8
2007 Commercial Marine Vessel Emission Inventory by County and Pollutant

County	$PM_{2.5}$* Tons per Year	NO_x Tons per Year	SO_2 Tons per Year
New Jersey Portion of Northern NJ-NY-CT NAA			
Bergen	10	253	43
Essex	11	329	339
Hudson	109	2714	1265
Mercer	0	0	0
Middlesex	18	467	182
Monmouth	58	820	706
Morris	0	0	0
Passaic	0	6	0
Somerset	0	0	0
Union	100	2710	1574
Total	**306**	**7300**	**4108**
New Jersey Portion of Southern NJ-Phila. NAA			
Burlington	1	15	40
Camden	60	896	560
Gloucester	41	634	795
Total	**102**	**1545**	**1396**

6.3 Aircraft

Aircraft emissions in the 2007 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).

6.3.1 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. Nine Airports which are Jersey Newark Liberty International, Teterboro, Atlantic City, Morris Municipal, Essex County, Mercer County, Naval Lakehurst Base, Monmouth Executive and Millville Municipal supplied New Jersey with LTO counts for each specific aircraft type (i.e., Boeing 707, AirBus 300) that operated at their airport in 2007. These 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.

6.3.2 McGuire Air Force Base (McGuire)

McGuire Air Force Base (McGuire) supplied LTO and Touch and Go information for that facility for general conformity for the year 2005. This information was used for the year 2007 because there has not been any significant change to it. Information on time-in-mode, number of engines and emission factors for military aircraft was obtained from *Air Emission Inventory Guidance for Mobile Sources at Air Force Installations*, January 2002 and used to determine LTOs emissions at this facility.

6.3.3 Federal Aviation Agency (FAA) Airports

For all other remaining 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) Terminal Area Forecast (TAF) System for the year 2007.[10] An average aircraft emission factor developed from the most common aircraft types for a given category was applied to the total aircraft category counts.

6.3.4 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

[10] Federal Aviation Administration, Terminal Area Forecast 2007 Database File

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 6.3.4 below:

Exhibit 6.3.4
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 Taxi, General Aviation and Military aircraft do not use GSE/APU.

6.3.5 Aircraft Emission Inventory

Table 9 summarizes the 2007 aircraft emission inventory by county for $PM_{2.5}$, NO_x and SO_2. Attachment 7 contains the detailed nonroad source emission inventories. This attachment is only available electronically.

Table 9
2007 Total Aircraft Emission Inventory by County and Pollutant

County	$PM_{2.5}$* Tons per Year	NO_x Tons per Year	SO_2 Tons per Year
New Jersey Portion of Northern NJ-NY-CT NAA			
Bergen	9	198.1	31.7
Essex	61	3236	344
Hudson	0	0	0
Mercer	1	30	5
Middlesex	0	3	1
Monmouth	1	8	2
Morris	3	75	15
Passaic	0	2	0
Somerset	0	12	3
Union	0	5	1
Total	**75**	**3568**	**402**
New Jersey Portion of Southern NJ-Phila. NAA			
Burlington	52	540	20
Camden	0	1	0
Gloucester	0	5	1
Total	**52**	**546**	**21**

6.4 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).

6.4.1 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. 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.

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.

6.4.2 Class I Line Haul Diesel Locomotives

In concern for the Class 1 line haul locomotives, New Jersey elected to use the Class I Line Haul ERTAC 2008 inventory that was made available to the MARAMA states.[11] The ERTAC 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). All 2008 emissions were assumed to equal 2007 emissions.

[11] Eastern Regional Technical Advisory Committee. ERTAC Rail Emissions Inventory Part 1: Class I Line-Haul Locomotives. October 2010.

6.4.3 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.[12]

6.4.4 Railroad Diesel Locomotive Emission Inventory

Table 10 summarizes the 2007 railroad diesel locomotive emission inventory by county for $PM_{2.5}$, NO_x and SO_2. Attachment 7 contains the detailed nonroad source emission inventories. This attachment is only available electronically.

Table 10
2007 Railroad Diesel Locomotive Emission Inventory by County and Pollutant

County	$PM_{2.5}$* Tons per Year	NO_x Tons per Year	SO_2 Tons per Year
New Jersey Portion of Northern NJ-NY-CT NAA			
Bergen	27	1095	8
Essex	11	452	5
Hudson	17	656	6
Mercer	4	130	1
Middlesex	14	539	6
Monmouth	12	512	4
Morris	7	321	3
Passaic	7	285	2
Somerset	11	409	4
Union	12	454	4
Total	**120**	**4852**	**42**
New Jersey Portion of Southern NJ-Phila. NAA			
Burlington	0	15	0
Camden	7	314	3
Gloucester	1	51	1
Total	**9**	**380**	**4**

6.5. Total Nonroad Emission Inventory

Table 11 summarizes the total nonroad sources 2007 annual emissions inventory by county for $PM_{2.5}$, NO_x and SO_2. This inventory provides a summation of the NONROAD model equipment, CMV, Aircraft and Locomotive sources 2007 annual emissions. Attachment 7 contains the detailed nonroad source emission inventories. This attachment is only available electronically.

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

Table 11
Total 2007 Nonroad Source Emission Inventory by County and Pollutant

County	$PM_{2.5}$* Tons per Year	NO_x Tons per Year	SO_2 Tons per Year
New Jersey Portion of Northern NJ-NY-CT NAA			
Bergen	383	5611	269
Essex	256	6281	805
Hudson	279	5302	1388
Mercer	161	1888	110
Middlesex	327	4637	376
Monmouth	325	4142	872
Morris	219	2749	124
Passaic	134	1906	78
Somerset	166	2040	85
Union	247	4902	1652
Total	**2497**	**39457**	**5761**
New Jersey Portion of Southern NJ-Phila. NAA			
Burlington	225	2420	156
Camden	190	2624	635
Gloucester	146	1747	852
Total	**561**	**6790**	**1642**

7.0 Quality Assurance

7.1 Point Sources

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

7.1.1 Data Entry Checks

Pursuant to N.J.A.C. 7:27-21 et seq., 2007 point source emissions were reported by applicable facilities to the NJDEP through the Emission Statement Program. All applicable facilities reported their 2007 emissions in electronic format, therefore, no data entry quality assurance was necessary.

7.1.2 Completeness Checks & Reasonableness Checks

All of the 594 Emission Statements submitted by applicable facilities in 2007 were checked for completeness. The checklist in Attachment 8 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.

7.2 Area Sources

The $PM_{2.5}$, NO_x and SO_2 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.

7.3 Onroad Sources

The calculations were randomly reviewed by NJDEP Bureau of Air Quality Planning staff to check for accuracy. This is discussed further in Appendix VII.

7.4 Nonroad Sources

The calculations were randomly reviewed by NJDEP Bureau of Air Quality Planning staff to check for accuracy. The quality assurance review for the NMIM NONROAD Model equipment emissions estimates developed by AMEC included New Jersey running the USEPA NONROAD Model with input parameters similar to those used in the NMIM run. The NMIM NONROAD model run and the USEPA NONROAD model run emissions estimates were sufficiently similar to confirm the accuracy of the NMIM run. 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.