The State of New Jersey

Department of Environmental Protection

2002 Periodic Emission Inventory

May 2006

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# Acronyms and Abbreviations

AADF Annual Activity Day Factors

APC Air Pollution Control

BAQP Bureau of Air Quality Planning

CAA Clean Air Act

CE Control Efficiency

CERR Consolidated Emissions Reporting Rule

CFR Code of Federal Regulations

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

FAA Federal Aviation Agency

FC Fuel Combustion

GSE Ground Support Equipment

HDDV Heavy Duty Diesel Vehicles

I/M Inspection and Maintenance

LDGT Light Duty Gasoline Trucks

LDGV Light Duty Gasoline Vehicle

LPG Liquefied Petroleum Gas

LTO Landing and Take-off Operations

MPO Metropolitan Planning Organization

NH3 Ammonia

NAAQS National Ambient Air Quality Standard

NAICS North American Industry Classification System

NEI National Emissions Inventory

NJDEP New Jersey Department of Environmental Protection

NJEMS New Jersey Emission Management Systems

NJTPA North Jersey Transportation Planning Authority

NLIA Newark Liberty International Airport

NNEM NONROAD Emission Model

NOx Oxides of Nitrogen

PM10 Particulate Matter less than 10 micrometers in diameter

PM2.5 Particulate Matter less than 2.5 micrometers in diameter

POTW Publicly Owned Treatment Works

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

SIC Standard Industrial Classification

SIP State Implementation Plan

SMOKE Sparse Matrix Operator Kernel Emissions

SJTPO South Jersey Transportation Planning Organization

SO2 Sulfur Dioxide

SOx Oxides of Sulfur

TDM Travel Demand Model

TPD tons per day

TPY tons per year

TSP Total Suspension Particulates

USEPA United States Environmental Protection Agency

VMT Vehicle Miles Traveled

VOC Volatile Organic Compound

WEBI Web Intelligence Server

# 

# I. Introduction

## A. Statutory and Regulatory Background

Section 110 (a)(2)(F) of the Clean Air Act (42 U.S.C. §§ 7410 (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 and emissions related data. The 1990 amendments to the Clean Air Act revised many of the provisions of the Clean Air Act including establishing periodic emission inventory requirements applicable to certain areas that were designated nonattainment for certain pollutants. For example, 42 U.S.C. § 7511a.(a)(3)(A) required states to submit an emission inventory every three years for 1-hour ozone nonattainment areas beginning in 1993. The inventories would include all ozone precursors including volatile organic compounds (VOC), oxides of nitrogen (NOx), and carbon monoxide. Similarly, 42 U.S.C. § 7512a.(a)(5) required States to submit an inventory every three years for carbon monoxide nonattainment areas for the same source classes as ozone, except biogenic sources.

The USEPA did not codify these statutory requirements in the Code of Federal Regulations, but has simply relied on the statutory language to implement the emissions inventory requirements. As part of the NOx State Implementation Plan (SIP) Call rule (40 CFR 51.121) the USEPA established emissions reporting requirements to be included in the SIPs submitted by the affected states.

In 2002, the USEPA promulgated the Consolidated Emission Reporting Rule, 40 CFR 51, Subpart A, that

* Consolidated the various emissions reporting requirements that already existed into one place in the Code of Federal Regulations;
* Established new reporting requirements related to particulate matter less than 2.5 micrometers in diameter (PM2.5), its precursors (ammonia (NH3), oxides of sulfur (SOx), NOx, and VOC), and regional haze;
* Established new requirements for the statewide reporting of area source and mobile source emissions; and,
* Required two types of inventories - annual inventories and three-year cycle inventories.

The following maps represent New Jersey’s nonattainment areas for 8-hour ozone (Figure 1) and PM2.5 (Figure 2) and maintenance areas for carbon monoxide (Figure 3). The 2002 periodic emission inventory is based on the 8-hour ozone standard (0.08 ppm) as the 1-hour ozone standard (0.12 ppm) was revoked by the USEPA on June 15, 2005[[1]](#footnote-1).



**New Jersey 8-Hour Ozone Nonattainment Areas**

**Figure 1: Designated 8-Hour Ozone Nonattainment Areas**

## 

**Figure 2: NJ Fine Particulate Matter Nonattainment Area**



**Figure 3: NJ Carbon Monoxide (CO) Maintenance Area**



## B. Emissions Inventory Overview

The 2002 Periodic Emission Inventory is a compilation of the emissions from sources of biogenic (natural) and anthropogenic (human-made) VOC, NOx, carbon monoxide, particulate matter less than 10 micrometers in diameter (PM10), PM2.5, sulfur dioxide (SO2) and ammonia in the outdoor air.[[2]](#footnote-2) The sources are divided into five sectors and each making up one component of the inventory: point sources, area (nonpoint) sources, onroad sources, nonroad sources and biogenic sources.

This report includes the 2002 emissions inventory for the parameters listed in Table 1.

**Table 1: 2002 Inventories Prepared**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Summer Day** | **Winter Day** | **Annual** |
| **VOC** | √ |  | √ |
| **NOx** | √ |  | √ |
| **CO** | √ | √ | √ |
| **PM10** |  | √ | √ |
| **PM2.5** |  | √ | √ |
| **SO2** |  |  | √ |
| **NH3** |  |  | √ |

## C. Emissions Inventory Summary

A summary of the 2002 Periodic Emission Inventory for New Jersey is presented in Table 2 by pollutant and source sector. Table 3 presents the inventory data by pollutant and county. Table 4 presents the inventory data by pollutant, source sector, and county. A series of graphs showing the top fifteen pollutants by Source Classification Code (SCC) for each pollutant and source sector can be found in Attachment 1.

Note, the summary tables, graphs, and the detailed county source sector tables found in the attachments to this report contain adjusted values for fugitive dust. Discussion on the fugitive dust inventory and the adjustment can be found in Attachment 2.

Table 2: 2002 Statewide Emission Inventory by Source Sector and Pollutant

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **VOC** | | | **NOx** | | |
| **Source Sector** | **Tons per Summer Day** | **Tons per Year** | **% of Total Annual Inventory** | **Tons per Summer Day** | **Tons per Year** | **% of Total Annual Inventory** |
| Point | 113.15 | 30,169 | 6.41% | 280.36 | 52,121 | 14.77% |
| Area | 369.83 | 127,673 | 27.12% | 35.92 | 26,742 | 7.58% |
| On-road | 274.74 | 106,589 | 22.65% | 558.66 | 206,280 | 58.44% |
| Non-road | 220.60 | 70,407 | 14.96% | 231.56 | 66,443 | 18.82% |
| Biogenic | 371.95 | 135,851 | 28.86% | 3.78 | 1,382 | 0.39% |
| Total in State | 1,350.27 | 470,689 |  | 1,110.28 | 352,968 |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **CO** | | | **PM10 \*** | |
| **Source Sector** | **Tons per Summer Day** | **Tons per Year** | **% of Total Annual Inventory** | **Tons per Year** | **% of Total Annual Inventory** |
| Point | 91.33 | 13,254 | 0.60% | 5,555 | 13.37% |
| Area | 66.45 | 94,067 | 4.26% | 24,760 | 59.61% |
| On-road | 2,856.37 | 1,421,004 | 64.39% | 4,718 | 11.36% |
| Non-road | 2,497.80 | 665,944 | 30.18% | 6,505 | 15.66% |
| Biogenic | 34.09 | 12,451 | 0.56% | 0 | 0.00% |
| **Total in State** | 5,546.06 | 2,206,720 |  | 41,538 |  |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **PM2.5\*** | | **SO2** | | **NH3** | |
| **Source Sector** | **Tons per Year** | **% of Total Inventory** | **Tons per Year** | **% of Total Inventory** | **Tons per Year** | **% of Total Inventory** |
| Point | 4,868 | 16.02% | 61,231 | 64.68% | 38 | 0.15% |
| Area | 16,230 | 53.42% | 10,876 | 11.49% | 8,005 | 31.37% |
| On-road | 3,361 | 11.06% | 5,793 | 6.12% | 7,469 | 29.27% |
| Non-road | 5,922 | 19.49% | 16,772 | 17.72% | 970 | 3.80% |
| Biogenic | 0 | 0.00% | 0 | 0.00% | 9,032 | 35.40% |
| **Total in State** | 30,381 |  | 94,672 |  | 25,514 |  |

**\*** These totals include adjusted emissions from fugitive dust categories. See Attachment 2 of this report forfurther discussion.

Table 3: 2002 Statewide Emission Inventory by County and Pollutant

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **VOC** | | **NOx** | | **CO** | |
| **County** | **Tons per Summer Day** | **Tons per Year** | **Tons per Summer Day** | **Tons per Year** | **Tons per Summer Day** | **Tons per Year** |
| Atlantic | 74.67 | 27,426 | 33.81 | 9,706 | 231.81 | 85,555 |
| Bergen | 105.32 | 34,106 | 94.16 | 34,452 | 687.81 | 261,862 |
| Burlington | 87.21 | 31,814 | 58.36 | 18,214 | 297.22 | 126,456 |
| Camden | 65.00 | 22,629 | 41.44 | 15,119 | 270.18 | 107,408 |
| Cape May | 52.34 | 19,481 | 34.50 | 8,636 | 138.03 | 50,041 |
| Cumberland | 54.20 | 19,375 | 30.04 | 7,829 | 112.26 | 40,088 |
| Essex | 68.06 | 22,580 | 89.32 | 29,578 | 377.56 | 152,468 |
| Gloucester | 84.24 | 30,076 | 42.19 | 14,615 | 183.78 | 74,719 |
| Hudson | 46.01 | 15,111 | 95.68 | 25,367 | 167.38 | 67,897 |
| Hunterdon | 28.22 | 10,636 | 32.07 | 8,651 | 122.35 | 50,996 |
| Mercer | 46.45 | 16,068 | 81.81 | 25,295 | 231.25 | 90,194 |
| Middlesex | 104.31 | 34,222 | 123.50 | 33,048 | 554.35 | 212,020 |
| Monmouth | 91.54 | 32,769 | 57.20 | 21,301 | 444.94 | 180,921 |
| Morris | 69.79 | 25,153 | 50.34 | 18,978 | 443.13 | 174,989 |
| Ocean | 103.91 | 37,326 | 38.56 | 13,676 | 314.77 | 125,240 |
| Passaic | 49.71 | 17,014 | 34.46 | 12,682 | 206.76 | 85,648 |
| Salem | 34.63 | 11,726 | 31.01 | 7,727 | 75.03 | 26,533 |
| Somerset | 42.74 | 14,963 | 36.61 | 12,602 | 228.92 | 88,817 |
| Sussex | 34.90 | 14,544 | 10.86 | 4,140 | 84.06 | 43,747 |
| Union | 77.80 | 22,468 | 73.69 | 23,906 | 286.34 | 117,897 |
| Warren | 29.22 | 11,204 | 20.70 | 7,451 | 87.86 | 43,226 |
| **Total in State** | 1,350.27 | 470,689 | 1,110.28 | 352,968 | 5546.07 | 2,206,720 |

**Table 3 (continued): 2002 Statewide Emission Inventory by County and Pollutant**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **County** | **PM10\***  **Tons per Year** | **PM2.5\***  **Tons per Year** | **SO2**  **Tons per Year** | **NH3 Tons per Year** |
| Atlantic | 2,282 | 1,889 | 886 | 823 |
| Bergen | 2,164 | 1,540 | 2,155 | 2,390 |
| Burlington | 3,209 | 2,362 | 3,568 | 1,535 |
| Camden | 1,823 | 1,382 | 2,038 | 1,238 |
| Cape May | 1,468 | 1,254 | 13,409 | 334 |
| Cumberland | 1,467 | 1,201 | 3,281 | 652 |
| Essex | 1,682 | 1,280 | 4,597 | 1,934 |
| Gloucester | 2,103 | 1,514 | 7,275 | 1,006 |
| Hudson | 2,690 | 1,825 | 21,653 | 1,325 |
| Hunterdon | 1,426 | 908 | 695 | 934 |
| Mercer | 1,613 | 1,062 | 15,594 | 1,032 |
| Middlesex | 2,561 | 1,643 | 2,395 | 2,122 |
| Monmouth | 2,520 | 1,781 | 1,947 | 1,725 |
| Morris | 2,473 | 1,812 | 1,529 | 1,464 |
| Ocean | 3,091 | 2,341 | 1,196 | 1,291 |
| Passaic | 1,242 | 881 | 974 | 1,126 |
| Salem | 1,234 | 927 | 5,504 | 657 |
| Somerset | 1,435 | 797 | 744 | 1,092 |
| Sussex | 1,849 | 1,449 | 733 | 674 |
| Union | 1,569 | 1,330 | 3,856 | 1,467 |
| Warren | 1,629 | 1,205 | 643 | 688 |
| **Total in State** | 41,538 | 30,381 | 94,672 | 25,514 |

**\*** These totals include adjusted emissions from fugitive dust categories. See Attachment 2 of this

report forfurther discussion.

Table 4: 2002 Statewide Emission Inventory by County and Source Sector

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **County** | **VOC**  **Tons per Summer Day** | | | | | **VOC**  **Tons per Year** | | | | |
| **Point Sources** | **Area Sources** | **On-road Sources** | **Non-road Sources** | **Biogenic** | **Point Sources** | **Area Sources** | **On-road Sources** | **Non-road Sources** | **Biogenic** |
| Atlantic | 0.15 | 11.04 | 12.85 | 10.25 | 40.38 | 52 | 5,492 | 3,613 | 3,521 | 14,748 |
| Bergen | 5.72 | 36.86 | 36.09 | 22.05 | 4.60 | 773 | 11,243 | 14,048 | 6,361 | 1,681 |
| Burlington | 4.02 | 17.54 | 15.80 | 10.01 | 39.84 | 927 | 7,057 | 6,278 | 3,000 | 14,552 |
| Camden | 1.23 | 22.68 | 13.80 | 7.23 | 20.06 | 453 | 7,228 | 5,512 | 2,110 | 7,326 |
| Cape May | 0.20 | 5.26 | 4.72 | 22.61 | 19.55 | 39 | 2,474 | 1,348 | 8,480 | 7,140 |
| Cumberland | 0.46 | 8.93 | 5.37 | 11.03 | 28.41 | 102 | 3,208 | 1,492 | 4,196 | 10,377 |
| Essex | 2.95 | 31.53 | 18.26 | 11.92 | 3.40 | 791 | 9,568 | 7,238 | 3,739 | 1,244 |
| Gloucester | 32.01 | 20.39 | 9.10 | 5.91 | 16.83 | 11,560 | 7,032 | 3,650 | 1,686 | 6,148 |
| Hudson | 7.33 | 21.09 | 9.10 | 5.22 | 3.27 | 2,104 | 6,628 | 3,567 | 1,617 | 1,195 |
| Hunterdon | 0.64 | 5.49 | 5.99 | 3.66 | 12.44 | 144 | 2,468 | 2,441 | 1,038 | 4,545 |
| Mercer | 2.13 | 13.06 | 11.60 | 7.01 | 12.65 | 446 | 4,445 | 4,636 | 1,922 | 4,619 |
| Middlesex | 16.08 | 34.87 | 26.00 | 14.58 | 12.78 | 4,366 | 10,594 | 10,478 | 4,115 | 4,669 |
| Monmouth | 1.37 | 24.65 | 22.26 | 21.26 | 22.00 | 287 | 8,477 | 8,973 | 6,996 | 8,036 |
| Morris | 1.27 | 20.81 | 18.87 | 15.09 | 13.75 | 309 | 7,947 | 7,662 | 4,211 | 5,024 |
| Ocean | 0.26 | 24.01 | 14.30 | 21.54 | 43.80 | 76 | 7,746 | 5,792 | 7,714 | 15,998 |
| Passaic | 1.99 | 19.84 | 10.22 | 6.62 | 11.04 | 253 | 6,537 | 4,109 | 2,081 | 4,034 |
| Salem | 4.92 | 3.47 | 4.23 | 3.37 | 18.64 | 1,034 | 1,516 | 1,205 | 1,162 | 6,809 |
| Somerset | 0.73 | 12.29 | 10.65 | 6.87 | 12.20 | 224 | 4,075 | 4,311 | 1,898 | 4,455 |
| Sussex | 0.25 | 5.69 | 4.62 | 3.86 | 20.48 | 38 | 3,656 | 1,881 | 1,490 | 7,479 |
| Union | 26.56 | 25.26 | 15.92 | 7.75 | 2.31 | 5,382 | 7,652 | 6,354 | 2,237 | 843 |
| Warren | 2.88 | 5.07 | 4.99 | 2.78 | 13.50 | 809 | 2,631 | 2,001 | 832 | 4,931 |
| Total in State | 113.15 | 369.83 | 274.74 | 220.60 | 371.95 | 30,169 | 127,673 | 106,589 | 70,407 | 135,851 |

**Table 4 (continued): 2002 Statewide Emission Inventory by County and Source Sector**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **County** | **NOx**  **Tons per Summer Day** | | | | | **NOx**  **Tons per Year** | | | | | |
| **Point Sources** | **Area Sources** | **On-road Sources** | **Non-road Sources** | **Biogenic** | | **Point Sources** | **Area Sources** | **On-road Sources** | **Non-road Sources** | **Biogenic** | |
| Atlantic | 1.67 | 1.17 | 24.50 | 6.26 | 0.21 | | 129 | 964 | 6,764 | 1,771 | 78 | |
| Bergen | 3.64 | 3.83 | 63.24 | 23.38 | 0.07 | | 988 | 2,815 | 23,917 | 6,707 | 25 | |
| Burlington | 12.35 | 1.77 | 31.10 | 12.88 | 0.26 | | 1,273 | 1,424 | 11,644 | 3,776 | 97 | |
| Camden | 2.69 | 2.10 | 27.00 | 9.44 | 0.21 | | 776 | 1,523 | 10,074 | 2,669 | 77 | |
| Cape May | 19.15 | 0.42 | 8.82 | 5.92 | 0.19 | | 3,819 | 357 | 2,433 | 1,959 | 68 | |
| Cumberland | 10.50 | 0.65 | 10.61 | 7.94 | 0.34 | | 1,778 | 469 | 2,883 | 2,574 | 125 | |
| Essex | 16.18 | 3.31 | 44.06 | 25.70 | 0.07 | | 2,441 | 2,436 | 16,537 | 8,137 | 27 | |
| Gloucester | 14.48 | 1.01 | 18.50 | 8.01 | 0.19 | | 4,645 | 800 | 6,899 | 2,200 | 71 | |
| Hudson | 51.61 | 2.24 | 21.05 | 20.71 | 0.07 | | 9,776 | 1,735 | 7,853 | 5,976 | 27 | |
| Hunterdon | 9.47 | 0.54 | 17.17 | 4.70 | 0.19 | | 491 | 424 | 6,444 | 1,223 | 69 | |
| Mercer | 47.87 | 1.72 | 22.70 | 9.32 | 0.20 | | 13,034 | 1,257 | 8,505 | 2,427 | 72 | |
| Middlesex | 44.47 | 3.33 | 58.00 | 17.54 | 0.16 | | 3,651 | 2,343 | 22,147 | 4,849 | 58 | |
| Monmouth | 0.86 | 2.23 | 38.15 | 15.74 | 0.22 | | 240 | 1,806 | 14,860 | 4,316 | 79 | |
| Morris | 1.18 | 2.40 | 35.06 | 11.58 | 0.12 | | 284 | 1,752 | 13,748 | 3,151 | 43 | |
| Ocean | 3.68 | 2.39 | 24.65 | 7.57 | 0.27 | | 395 | 1,507 | 9,538 | 2,138 | 98 | |
| Passaic | 0.68 | 1.79 | 23.01 | 8.88 | 0.10 | | 122 | 1,361 | 8,748 | 2,413 | 38 | |
| Salem | 15.26 | 0.31 | 11.91 | 3.21 | 0.32 | | 3,267 | 227 | 3,185 | 932 | 116 | |
| Somerset | 3.60 | 1.44 | 23.85 | 7.57 | 0.15 | | 313 | 1,048 | 9,090 | 2,097 | 54 | |
| Sussex | 0.21 | 0.57 | 7.47 | 2.46 | 0.15 | | 39 | 495 | 2,936 | 615 | 55 | |
| Union | 18.88 | 2.26 | 32.22 | 20.25 | 0.08 | | 4,080 | 1,621 | 12,294 | 5,883 | 28 | |
| Warren | 1.93 | 0.47 | 15.60 | 2.48 | 0.22 | | 580 | 379 | 5,782 | 631 | 79 | |
| **Total in State** | 280.36 | 35.92 | 558.66 | 231.56 | 3.78 | | 52,121 | 26,742 | 206,280 | 66,443 | 1,382 | |

**Table 4 (continued): 2002 Statewide Emission Inventory by County and Source Sector**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **County** | **CO**  **Tons per Summer Day** | | | | | **CO**  **Tons per Year** | | | | | |
| **Point Sources** | **Area Sources** | **On-road Sources** | **Non-road Sources** | **Biogenic** | | **Point Sources** | **Area Sources** | **On-road Sources** | **Non-road Sources** | **Biogenic** |
| Atlantic | 0.40 | 2.66 | 155.53 | 70.26 | 2.96 | | 66 | 10,726 | 53,885 | 19,798 | 1,080 |
| Bergen | 2.45 | 2.07 | 324.50 | 358.25 | 0.54 | | 619 | 1,453 | 166,589 | 93,002 | 199 |
| Burlington | 1.67 | 1.97 | 168.90 | 121.35 | 3.33 | | 413 | 9,709 | 83,768 | 31,350 | 1,216 |
| Camden | 3.38 | 6.89 | 145.90 | 112.44 | 1.57 | | 1,154 | 3,789 | 72,489 | 29,402 | 574 |
| Cape May | 2.19 | 0.66 | 53.58 | 80.06 | 1.54 | | 311 | 4,145 | 18,758 | 26,265 | 562 |
| Cumberland | 1.59 | 1.13 | 56.91 | 50.35 | 2.28 | | 126 | 3,196 | 19,994 | 15,941 | 831 |
| Essex | 3.80 | 2.40 | 187.93 | 182.98 | 0.45 | | 624 | 1,306 | 96,967 | 53,407 | 164 |
| Gloucester | 3.34 | 1.54 | 99.80 | 77.69 | 1.41 | | 1,029 | 4,513 | 49,458 | 19,203 | 516 |
| Hudson | 9.51 | 1.22 | 87.49 | 68.72 | 0.44 | | 2,058 | 896 | 44,767 | 20,015 | 161 |
| Hunterdon | 6.47 | 1.03 | 64.94 | 48.31 | 1.60 | | 259 | 3,973 | 34,283 | 11,896 | 585 |
| Mercer | 1.58 | 1.37 | 122.70 | 104.18 | 1.42 | | 323 | 2,567 | 61,101 | 25,685 | 518 |
| Middlesex | 34.55 | 2.54 | 287.54 | 228.84 | 1.16 | | 3,034 | 1,309 | 149,288 | 57,965 | 424 |
| Monmouth | 1.35 | 1.79 | 227.22 | 212.60 | 1.98 | | 381 | 5,252 | 118,952 | 55,614 | 722 |
| Morris | 2.31 | 2.35 | 209.14 | 227.91 | 1.42 | | 266 | 8,121 | 109,947 | 56,136 | 519 |
| Ocean | 1.29 | 29.78 | 135.96 | 143.85 | 3.89 | | 271 | 10,563 | 72,072 | 40,914 | 1,420 |
| Passaic | 0.45 | 1.23 | 105.86 | 98.09 | 1.13 | | 68 | 2,985 | 55,414 | 26,769 | 412 |
| Salem | 2.37 | 0.57 | 49.04 | 21.42 | 1.63 | | 487 | 2,389 | 17,071 | 5,991 | 595 |
| Somerset | 6.09 | 1.16 | 112.52 | 107.75 | 1.40 | | 226 | 2,079 | 59,270 | 26,731 | 511 |
| Sussex | 0.34 | 1.80 | 42.35 | 37.57 | 2.00 | | 83 | 8,995 | 23,055 | 10,883 | 731 |
| Union | 4.12 | 1.11 | 162.44 | 118.31 | 0.36 | | 1,012 | 794 | 84,178 | 31,780 | 133 |
| Warren | 2.08 | 1.19 | 56.12 | 26.89 | 1.58 | | 444 | 5,306 | 29,700 | 7,198 | 578 |
| Total in State | 91.33 | 66.45 | 2,856.37 | 2,497.80 | 34.09 | | 13,254 | 94,067 | 1,421,004 | 665,944 | 12,451 |

**Table 4 (continued): 2002 Statewide Emission Inventory by County and Source Sector**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **County** | **PM10\***  **Tons per Year** | | | | | **PM2.5\***  **Tons per Year** | | | | |
| **Point Sources** | **Area Sources** | **On-road Sources** | **Non-road Sources** | **Biogenic** | **Point Sources** | **Area Sources** | **On-road Sources** | **Non-road Sources** | **Biogenic** |
| Atlantic | 17 | 1,863 | 154 | 248 | NA | 19 | 1,541 | 104 | 225 | NA |
| Bergen | 135 | 981 | 524 | 524 | NA | 149 | 537 | 376 | 478 | NA |
| Burlington | 318 | 2,145 | 275 | 471 | NA | 308 | 1,448 | 193 | 413 | NA |
| Camden | 126 | 1,210 | 238 | 249 | NA | 233 | 754 | 167 | 228 | NA |
| Cape May | 102 | 799 | 58 | 509 | NA | 109 | 637 | 40 | 468 | NA |
| Cumberland | 266 | 721 | 73 | 407 | NA | 280 | 495 | 52 | 374 | NA |
| Essex | 203 | 646 | 389 | 444 | NA | 185 | 411 | 291 | 393 | NA |
| Gloucester | 531 | 1,169 | 161 | 242 | NA | 426 | 754 | 112 | 222 | NA |
| Hudson | 1,705 | 431 | 179 | 375 | NA | 1,077 | 269 | 134 | 345 | NA |
| Hunterdon | 50 | 1,115 | 148 | 113 | NA | 50 | 644 | 111 | 103 | NA |
| Mercer | 221 | 967 | 201 | 224 | NA | 188 | 530 | 141 | 203 | NA |
| Middlesex | 537 | 1,162 | 486 | 376 | NA | 483 | 467 | 347 | 346 | NA |
| Monmouth | 48 | 1,575 | 352 | 545 | NA | 55 | 981 | 244 | 501 | NA |
| Morris | 46 | 1,813 | 305 | 309 | NA | 39 | 1,284 | 209 | 280 | NA |
| Ocean | 39 | 2,377 | 229 | 446 | NA | 38 | 1,734 | 160 | 409 | NA |
| Passaic | 18 | 835 | 195 | 194 | NA | 19 | 543 | 141 | 178 | NA |
| Salem | 435 | 590 | 77 | 132 | NA | 371 | 377 | 57 | 122 | NA |
| Somerset | 76 | 984 | 211 | 164 | NA | 55 | 441 | 152 | 149 | NA |
| Sussex | 6 | 1,667 | 77 | 99 | NA | 5 | 1,301 | 54 | 89 | NA |
| Union | 434 | 512 | 261 | 362 | NA | 540 | 272 | 185 | 333 | NA |
| Warren | 240 | 1,195 | 123 | 71 | NA | 240 | 809 | 92 | 64 | NA |
| Total in State | 5,555 | 24,760 | 4,718 | 6,505 | NA | 4,868 | 16,230 | 3,361 | 5,922 | NA |

**\*** These totals include adjusted emissions from fugitive dust categories. See Attachment 2 of this report forfurther discussion.

**Table 4 (continued): 2002 Statewide Emission Inventory by County and Source Sector**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **County** | **SO2** Tons per Year | | | | | **NH3**  **Tons per Year** | | | | |
| **Point Sources** | **Area Sources** | **On-road Sources** | **Non-road Sources** | **Biogenic** | **Point Sources** | **Area Sources** | **On-road Sources** | **Non-road Sources** | **Biogenic** |
| Atlantic | 10 | 498 | 202 | 176 | NA | 0 | 184 | 297 | 13 | 329 |
| Bergen | 82 | 819 | 634 | 620 | NA | 0 | 543 | 821 | 163 | 863 |
| Burlington | 286 | 459 | 361 | 2,462 | NA | 0 | 522 | 454 | 39 | 520 |
| Camden | 162 | 506 | 313 | 1,057 | NA | 0 | 281 | 393 | 46 | 518 |
| Cape May | 12,178 | 163 | 75 | 993 | NA | 5 | 86 | 107 | 6 | 130 |
| Cumberland | 665 | 412 | 89 | 2,115 | NA | 1 | 310 | 118 | 20 | 203 |
| Essex | 2,110 | 1,078 | 429 | 980 | NA | 0 | 598 | 492 | 82 | 762 |
| Gloucester | 5,431 | 390 | 211 | 1,243 | NA | 0 | 445 | 265 | 22 | 274 |
| Hudson | 19,250 | 625 | 196 | 1,582 | NA | 14 | 461 | 222 | 56 | 572 |
| Hunterdon | 18 | 391 | 163 | 123 | NA | 0 | 569 | 187 | 14 | 164 |
| Mercer | 14,379 | 450 | 264 | 501 | NA | 3 | 310 | 331 | 41 | 347 |
| Middlesex | 504 | 689 | 590 | 612 | NA | 11 | 492 | 765 | 108 | 746 |
| Monmouth | 55 | 510 | 453 | 929 | NA | 0 | 399 | 628 | 47 | 651 |
| Morris | 52 | 798 | 403 | 276 | NA | 0 | 273 | 572 | 75 | 544 |
| Ocean | 38 | 652 | 290 | 216 | NA | 0 | 258 | 396 | 21 | 616 |
| Passaic | 26 | 494 | 231 | 223 | NA | 0 | 264 | 292 | 65 | 505 |
| Salem | 4,590 | 156 | 85 | 673 | NA | 1 | 463 | 97 | 7 | 89 |
| Somerset | 41 | 273 | 250 | 180 | NA | 0 | 423 | 317 | 43 | 309 |
| Sussex | 0 | 566 | 98 | 69 | NA | 0 | 296 | 135 | 8 | 235 |
| Union | 1,253 | 602 | 321 | 1,680 | NA | 3 | 456 | 425 | 82 | 501 |
| Warren | 101 | 345 | 134 | 63 | NA | 0 | 371 | 152 | 12 | 153 |
| Total in State | 61,231 | 10,876 | 5,793 | 16,772 | NA | 38 | 8,005 | 7,469 | 970 | 9,032 |

# II. Point Sources

For the purposes of this 2002 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 NOx
* 100 tons per year of carbon monoxide, PM2.5, PM10, SO2, ammonia

The remaining stationary sources are included in the area sources emissions inventory.

## VOC, NOx, Carbon Monoxide, SO2, and PM10 Emissions From Emission

## Statements

The 2002 point source inventories for VOC, NOx, carbon monoxide, SO2, and PM10 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 662 facilities were identified in New Jersey as meeting one of the required criteria in 2002. Attachment 3outlines the procedure for developing the VOC, NOx, carbon monoxide, SO2, and PM10 point source inventories from the Emission Statement database. Any modifications made to the data reported in the Emission Statement database that was incorporated into the inventory is also documented in this attachment.

Emission Statement data are submitted through NJDEP's data entry software, known as Remote Air Data Input Users System (RADIUS). Table 5 provides a brief description of the Emission Statement information collected.

Table 5: 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 |

## B. PM2.5 Emissions

The 2002 PM2.5 emissions were calculated by the NJDEP. The PM10 emissions reported by facilities in their emission statements were input into the USEPA PM2.5 calculator. If PM10 emissions were not reported, then total suspended particulate emissions (TSP) were used in the calculator. Filterable PM2.5 and condensable PM2.5 emissions were calculated, then these emissions were added together to produce the final PM2.5 emissions.

## C. Ammonia Emissions

Ammonia emissions for point sources were taken from estimates prepared by the USEPA and presented in the 2002 National Emissions Inventory (NEI) v1. [[3]](#footnote-3)

## D. Rule Effectiveness

Per the USEPA's guidance,[[4]](#footnote-4) a rule effectiveness factor was applied to all applicable sources for the VOC, NOx, carbon monoxide, and SO2 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 most of the point sources in the 2002 inventory, for the reasons discussed below. All remaining sources had the eighty percent rule effectiveness applied in accordance with USEPA guidance.

Rule effectiveness was not applied to PM10 and PM2.5 emissions. Per the USEPA guidance, there is insufficient evidence to draw broad conclusions on the application of rule effectiveness to the PM related inventories, therefore, no rule effectiveness was applied to PM inventories or its precursors.[[5]](#footnote-5) Rule effectiveness was not applied to the ammonia inventory because the emissions were taken from the USEPA NEI.

### i. 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.

### ii. Overall Efficiency versus Design Efficiency of Control Equipment

As part of their Emission Statement, facilities can report either overall efficiency or design efficiency of control equipment. The overall efficiency 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.

In contrast, the design efficiency is the percent reduction in the amount of an air contaminant by the control device as it was initially anticipated or designed before actual construction and operation. 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, if the facility reports a design efficiency for a source, then pollution control equipment failures and control equipment downtime have not been accounted for, therefore, the eighty percent rule effectiveness factor was applied to these sources.

### iii. Back Calculating Controlled/Uncontrolled Emissions so Rule Effectiveness Factors Can Be Applied

As discussed above, the NJDEP allows facilities the option of using design efficiency for control devices when calculating and reporting emissions.In these cases, it is necessary to back-calculate uncontrolled emissions for these sources and then re-apply the controlled design efficiencies which now include the rule effectiveness factor. This is done using the following basic equation:

ECRR = EUNC x [1-(CE/100)] OR (1)

EUNC = ECRR (2)

[1 - (CE/100)] AND

ECR = EUNC x [1-(RP x (CE/100) x (RE/100)] (3)

where:

ECRR = Controlled Emissions Reported

ECR = Controlled Emissions with RE Applied

EUNC = Uncontrolled Emissions

CE = The Reported Design Efficiency

RE = Rule Effectiveness Factor

RP = Rule Penetration (1.00 for all point sources).

# Example of actual emission unit with Rule Effectiveness applied

* VOC emissions
* Best engineering judgement was used as the calculation method
* Emission unit has a control device with 89% overall efficiency
* Reported emissions are 30.49 pounds per day and 3.66 tons per year

EUNC = 3.66 tons per year = 33.27 tons per year of uncontrolled emissions

[1-(89/100)]

ECR = 33.27 tons per year \* [1-(1 \* (89/100) \* (80/1000))]

= 9.58 tons per year of emissions emitted

## E. Summary of Point Source Inventory Data

Table 6 presents the 2002 point source emission inventory by county. Attachments 4 through 9 contain the detailed point source emission inventories for VOC, NOx, carbon monoxide, PM10, PM2.5, and SO2, respectively. Ammonia emissions for point sources can be found in Attachment 10. These attachments are only available electronically.

Table 6: 2002 Statewide Point Source Emission Inventory by County and Pollutant

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **VOC** | | **NOx** | | | **CO** | | |
| **County** | **Tons per Summer Day** | **Tons per Year** | | **Tons per Summer Day** | **Tons per Year** | | **Tons per Summer Day** | **Tons per Year** | |
| Atlantic | 0.15 | 52 | | 1.67 | 129 | | 0.40 | 66 | |
| Bergen | 5.72 | 773 | | 3.64 | 988 | | 2.45 | 619 | |
| Burlington | 4.02 | 927 | | 12.35 | 1,273 | | 1.67 | 413 | |
| Camden | 1.23 | 453 | | 2.69 | 776 | | 3.38 | 1,154 | |
| Cape May | 0.20 | 39 | | 19.15 | 3,819 | | 2.19 | 311 | |
| Cumberland | 0.46 | 102 | | 10.50 | 1,778 | | 1.59 | 126 | |
| Essex | 2.95 | 791 | | 16.18 | 2,441 | | 3.80 | 624 | |
| Gloucester | 32.01 | 11,560 | | 14.48 | 4,645 | | 3.34 | 1,029 | |
| Hudson | 7.33 | 2,104 | | 51.61 | 9,776 | | 9.51 | 2,058 | |
| Hunterdon | 0.64 | 144 | | 9.47 | 491 | | 6.47 | 259 | |
| Mercer | 2.13 | 446 | | 47.87 | 13,034 | | 1.58 | 323 | |
| Middlesex | 16.08 | 4,366 | | 44.47 | 3,651 | | 34.55 | 3,034 | |
| Monmouth | 1.37 | 287 | | 0.86 | 240 | | 1.35 | 381 | |
| Morris | 1.27 | 309 | | 1.18 | 284 | | 2.31 | 266 | |
| Ocean | 0.26 | 76 | | 3.68 | 395 | | 1.29 | 271 | |
| Passaic | 1.99 | 253 | | 0.68 | 122 | | 0.45 | 68 | |
| Salem | 4.92 | 1,034 | | 15.26 | 3,267 | | 2.37 | 487 | |
| Somerset | 0.73 | 224 | | 3.60 | 313 | | 6.09 | 226 | |
| Sussex | 0.25 | 38 | | 0.21 | 39 | | 0.34 | 83 | |
| Union | 26.56 | 5,382 | | 18.88 | 4,080 | | 4.12 | 1,012 | |
| Warren | 2.88 | 809 | | 1.93 | 580 | | 2.08 | 444 | |
| Total in State | 113.15 | 30,169 | | 280.36 | 52,121 | | 91.33 | 13,254 | |

**Table 6 (continued): 2002 Statewide Point Source Emission Inventory by County and Pollutant**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **County** | **PM10\***  **Tons per Year** | **PM2.5\***  **Tons per Year** | **SO2**  **Tons per Year** | **NH3**  **Tons per Year** |
| Atlantic | 17 | 19 | 10 | 0 |
| Bergen | 135 | 149 | 82 | 0 |
| Burlington | 318 | 308 | 286 | 0 |
| Camden | 126 | 233 | 162 | 0 |
| Cape May | 102 | 109 | 12,178 | 5 |
| Cumberland | 266 | 280 | 665 | 1 |
| Essex | 203 | 185 | 2,110 | 0 |
| Gloucester | 531 | 426 | 5,431 | 0 |
| Hudson | 1,705 | 1,077 | 19,250 | 14 |
| Hunterdon | 50 | 50 | 18 | 0 |
| Mercer | 221 | 188 | 14,379 | 3 |
| Middlesex | 537 | 483 | 504 | 11 |
| Monmouth | 48 | 55 | 55 | 0 |
| Morris | 46 | 39 | 52 | 0 |
| Ocean | 39 | 38 | 38 | 0 |
| Passaic | 18 | 19 | 26 | 0 |
| Salem | 435 | 371 | 4,590 | 1 |
| Somerset | 76 | 55 | 41 | 0 |
| Sussex | 6 | 5 | 0 | 0 |
| Union | 434 | 540 | 1,253 | 3 |
| Warren | 240 | 240 | 101 | 0 |
| Total in State | 5,555 | 4,868 | 61,231 | 38 |

**\*** These totals include adjusted emissions from fugitive dust categories. See Attachment 2 of this report for

further discussion.

# III. Area Sources

The area source component of the 2002 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, NOx, Carbon Monoxide, SO2, PM2.5, and PM10 Emission Calculation Procedures

The VOC, NOx, carbon monoxide, SO2, PM2.5, and PM10 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 11.

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:

EmissionsAnnual = EF x AL/CF (1)

where:

EmissionsAnnual = 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:

AADF = (WAF) \* (52 weeks/year) (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:

EmissionsSeason = EmissionsAnnual \* SAF/AADF (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 landfill 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.[[6]](#footnote-6) 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.[[7]](#footnote-7) Rule penetration is a measure of the extent to which a rule applies to a given source category.

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:

EmissionsAnnual = {EF x AL x [ 1 - (CE x RE x RP)]}/CF (5)

EmissionsDaily = {EF x AL x SAF x [1- (CE x RE x RP)]}/ (AADF x CF) (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.

## B. Ammonia Emissions

Wildfire ammonia emissions were estimated using the activity data and emission factors supplied with v3.1 of the Carnegie Mellon University (CMU) application.[[8]](#footnote-8)

Estimated ammonia emissions for industrial refrigeration, composting, and publicly owned treatment works were taken from inventory work completed by E.H. Pechan & Associates, Inc. for the Mid-Atlantic/Northeast Visibility Union Regional Planning Organization (MANE-VU RPO).[[9]](#footnote-9) In preparing for the 2002 inventory effort, New York emission inventory staff noted that the first two of these source categories were not accounted for in the USEPA's 1999 NEI inventory and that they may represent significant sources of ammonia. In addition, MANE-VU determined that there was a large variability in the existing estimates of emissions from POTWs and decided to prepare an independent estimate of ammonia emissions from this source. Therefore, MANE-VU committed to prepare inventories for these source categories for the MANE-VU states.

Estimated ammonia emissions for livestock waste were taken from recent estimates prepared by the USEPA.[[10]](#footnote-10) These emission estimates address beef, dairy, swine, poultry, sheep, goat, and horse operations that raise animals both in confined animal feeding operations or on pasture.

Estimated ammonia emissions for fertilizer application, industrial and commercial combustion sources, and prescribed burning were taken from estimates prepared by the USEPA and presented in the 2002 NEI v1.[[11]](#footnote-11)

## 

## C. Summary of Area Source Inventory Data

Table 7 presents the 2002 area source emission inventory by county. Attachment 12 contains the detailed area source emission inventory for VOC, NOx, carbon monoxide, SO2, PM2.5 PM10, and ammonia, respectively. These attachments are only available electronically.

Table 7: 2002 Statewide Area Source Emission Inventory by County and Pollutant

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **VOC** | | **NOx** | | **CO** | |
| **County** | **Tons per Summer Day** | **Tons per Year** | **Tons per Summer Day** | **Tons per Year** | **Tons per Summer Day** | **Tons per Year** |
| Atlantic | 11.04 | 5,492 | 1.17 | 964 | 2.66 | 10,726 |
| Bergen | 36.86 | 11,243 | 3.83 | 2,815 | 2.07 | 1,453 |
| Burlington | 17.54 | 7,057 | 1.77 | 1,424 | 1.97 | 9,709 |
| Camden | 22.68 | 7,228 | 2.10 | 1,523 | 6.89 | 3,789 |
| Cape May | 5.26 | 2,474 | 0.42 | 357 | 0.66 | 4,145 |
| Cumberland | 8.93 | 3,208 | 0.65 | 469 | 1.13 | 3,196 |
| Essex | 31.53 | 9,568 | 3.31 | 2,436 | 2.40 | 1,306 |
| Gloucester | 20.39 | 7,032 | 1.01 | 800 | 1.54 | 4,513 |
| Hudson | 21.09 | 6,628 | 2.24 | 1,735 | 1.22 | 896 |
| Hunterdon | 5.49 | 2,468 | 0.54 | 424 | 1.03 | 3,973 |
| Mercer | 13.06 | 4,445 | 1.72 | 1,257 | 1.37 | 2,567 |
| Middlesex | 34.87 | 10,594 | 3.33 | 2,343 | 2.54 | 1,309 |
| Monmouth | 24.65 | 8,477 | 2.23 | 1,806 | 1.79 | 5,252 |
| Morris | 20.81 | 7,947 | 2.40 | 1,752 | 2.35 | 8,121 |
| Ocean | 24.01 | 7,746 | 2.39 | 1,507 | 29.78 | 10,563 |
| Passaic | 19.84 | 6,537 | 1.79 | 1,361 | 1.23 | 2,985 |
| Salem | 3.47 | 1,516 | 0.31 | 227 | 0.57 | 2,389 |
| Somerset | 12.29 | 4,075 | 1.44 | 1,048 | 1.16 | 2,079 |
| Sussex | 5.69 | 3,656 | 0.57 | 495 | 1.80 | 8,995 |
| Union | 25.26 | 7,652 | 2.26 | 1,621 | 1.11 | 794 |
| Warren | 5.07 | 2,631 | 0.47 | 379 | 1.19 | 5,306 |
| Total in State | **369.83** | **127,673** | **35.92** | **26,742** | **66.45** | **94,067** |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **County** | **PM10\***  **Tons per Year** | **PM2.5\***  **Tons per Year** | **SO2**  **Tons per Year** | **NH3**  **Tons per Year** |
| Atlantic | 1,863 | 1,541 | 498 | 184 |
| Bergen | 981 | 537 | 819 | 543 |
| Burlington | 2,145 | 1,448 | 459 | 522 |
| Camden | 1,210 | 754 | 506 | 281 |
| Cape May | 799 | 637 | 163 | 86 |
| Cumberland | 721 | 495 | 412 | 310 |
| Essex | 646 | 411 | 1,078 | 598 |
| Gloucester | 1,169 | 754 | 390 | 445 |
| Hudson | 431 | 269 | 625 | 461 |
| Hunterdon | 1,115 | 644 | 391 | 569 |
| Mercer | 967 | 530 | 450 | 310 |
| Middlesex | 1,162 | 467 | 689 | 492 |
| Monmouth | 1,575 | 981 | 510 | 399 |
| Morris | 1,813 | 1,284 | 798 | 273 |
| Ocean | 2,377 | 1,734 | 652 | 258 |
| Passaic | 835 | 543 | 494 | 264 |
| Salem | 590 | 377 | 156 | 463 |
| Somerset | 984 | 441 | 273 | 423 |
| Sussex | 1,667 | 1,301 | 566 | 296 |
| Union | 512 | 287 | 602 | 456 |
| Warren | 1,195 | 809 | 345 | 371 |
| Total in State | **24,760** | **16,230** | **10,876** | **8,005** |

**\*** These totals include adjusted emissions from fugitive dust categories. See Attachment 2 of this report forfurther discussion.

# IV. On-road Sources

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

## Daily Vehicle Miles Traveled

The DVMT used in this emission inventory was calculated with the travel demand models (TDMs) used by the three Metropolitan Planning Organizations in the State. Metropolitan Planning Organizations are charged with developing transportation plans and programs that promote the safe and efficient management, operation, and development of transportation systems while minimizing fuel consumption and air pollution. The three Metropolitan Planning Organizations with jurisdiction in New Jersey are the North Jersey Transportation Planning Authority, the Delaware Valley Regional Planning Commission and the South Jersey Transportation Planning Organization. Figure 4 is a map showing the counties included in each of the three Metropolitan Planning Organizations.

Figure 4: Metropolitan Planning Organizations in New Jersey



In general, the TDMs use demographic data, such as population, employment, housing density, and shopping patterns, to estimate the demand for travel in the modeled area. This travel demand is then distributed throughout the available roadways and transit routes, referred to as links. The model is based on an algorithm which takes into account factors such as transit fares, tolls, traffic volume, and time of day to estimate how many people travel from one point to another on any given link. The number of vehicles traveling on each link is then used to estimate the speed of travel and the total number of vehicle miles traveled in a day. The TDM output is adjusted for any vehicle miles traveled that are not accounted for in the model, such as reductions due to transportation control measures or increases due to local roadway traffic. Attachment 13 presents the DVMT used for the 2002 inventory by roadway class and vehicle type.

**B. SJTPO and NJTPA DVMT Calculations**

The current South Jersey Travel Demand Model (SJTDM) was validated for the year 2000. The comparisons between estimated and observed DVMT by facility type were within a range of 80% to 150%.

The current North Jersey Regional Transportation Model (NJRTM) was validated for the year 1996. The NJRTM estimated DVMT is approximately 99.6% of the regional observed DVMT. The comparisons between estimated and observed DVMT by facility type were within a range of 96% to 110%.

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

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

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

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

The emission estimates include all DVMT within the model region, including local “off-model” roadways. Since the highway network covers the entire non-attainment region, there are no areas for which DVMT is not included. The entire State of New Jersey is covered by the summation of three Metropolitan Planning Organization models, so that the DVMT from the entire state is covered as part of the “modeled” DVMT.

The NJRTM and SJTDM contain two types of external trips (External-External, External-Internal) used to estimate DVMT from vehicles moving into and out of the Metropolitan Planning Organization regions. The external-external purpose represents trips that have both origin and destination outside of the modeled region. These trips are referred to as “*pass-through*” trips. The External-Internal trip purpose includes trips for which one of its trip “ends” is inside the model region while the other is outside of the region. The vehicle trips at the edge of the respective Metropolitan Planning Organization models are obtained from observed counts provided by the New Jersey Department of Transportation and other agencies such as the Port Authority of New York and New Jersey, to help ensure traffic volume consistency at the boundaries between the Metropolitan Planning Organizations.

**C. Delaware Valley Regional Planning Commission DVMT Calculations**

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

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

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

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

The Delaware Valley Regional Planning Commission’s travel demand model was validated in 2000 for the 1997 base year and again in 2005 for 2000 conditions. Both of these validations included a comparison of simulated and counted traffic volumes at 355 locations that cross a series of 14 screenlines. For 1997 conditions, the simulated traffic volumes were 1.4 percent higher than the counted volumes, with an overall R2 of 0.83, an acceptable correspondence. As part of the validation exercise, simulated transit ridership is also compared to passenger counts. These differences for the 1997 and 2000 validations were 6.1 percent and 4.0 percent, respectively.

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

Traffic volumes crossing the travel demand model boundary, or cordon, are controlled through an extensive traffic counting program. The Delaware Valley Regional Planning Commission 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 Delaware Valley Regional Planning Commission region. The cordon volumes used in the 2002 inventory were interpolated between 2000 and 2005 volumes.

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

## D. MOBILE Model and Model Inputs

The USEPA MOBILE computer model estimates vehicle emission factors for carbon monoxide; exhaust, brake and tire wear direct particulate matter; and ozone and particulate matter precursors. Over time, there have been several versions of the MOBILE model developed and released by the USEPA for use by the states in estimating emissions from onroad sources. The NJDEP used version MOBILE6.2.03 (hereafter referred to as MOBILE6) dated September 24, 2003 and officially released on May 19, 2004 (69 FR 28830 (May 19, 2004)) in developing the 2002 inventory.

The emission factors calculated by the MOBILE6 model are dependent on a variety of data, including temperature, humidity, distribution of travel speeds, fuel type, vehicle age distribution, type of inspection and maintenance (I/M) program, and roadway type. The model is designed so that the user can input state-specific data for many of the variables that affect vehicle emissions. If state-specific data are unavailable, default values are also available for many of the inputs required for the model. The inputs are shown in the calculation files included in Attachments 14 through 17. The model will estimate emission factors for any calendar year between 1952 and 2050, inclusive. The 25 most recent vehicle model years are considered to be in operation in each calendar year.

MOBILE6 differs significantly from its predecessor, MOBILE5. MOBILE6 contains new and improved data including basic emission data derived from more realistic driving conditions. MOBILE6 also incorporates the effects of the Federal regulations affecting onroad mobile sources adopted since 1992. As such, the MOBILE6 model's new design no longer requires separate calculations to incorporate the effects of the Tier I and Tier 2 vehicle regulations and the Heavy Duty Diesel NOx consent decree. In addition the overall effectiveness of an I/M program can be directly specified in the MOBILE6 input file, eliminating the need to perform multiple runs to accurately model the effects of the New Jersey “hybrid” I/M program, i.e., a program which includes both centralized and decentralized facilities.

With regard to the State's I/M program, the NJDEP assumed for the 2002 inventory that New Jersey's I/M program consisted of seventy-four percent centralized facilities and twenty-six percent decentralized facilities in 2002. This assumption is based on data from the NJDEP's I/M program database. A detailed description of many of the specific I/M program inputs used for the 2002 inventory are documented in the November 2002 Revised Performance Standard Modeling SIP Revision.[[12]](#footnote-12) In addition, the NJDEP adjusted the I/M effectiveness values for VOC, NOx, and carbon monoxide from the performance standard values to account for the fact that ten percent of New Jersey's vehicles (i.e., those with non-switchable four wheel-drive or non-switchable traction control) receive a 2500 RPM exhaust emission test instead of an ASM5015 exhaust emission test. By adjusting the I/M effectiveness values to match the performance standard emission factors for the entire fleet (accounting for both the vehicles receiving the ASM 5015 test and the vehicles receiving the 2500 RPM test), the New Jersey I/M program was represented by one model run instead of a combination of two model runs. Also, the latest vehicle registration information, updated in 2003, was used to develop the 2002 inventory.

Maximum and minimum temperatures for specific counties were compiled from normal maximum/minimum temperatures reported for the Newark, Allentown, Philadelphia, and Atlantic City airports in the National Oceanic and Atmospheric Administration Local Climatological Data for 2002. The calculation file from the USEPA MOBILE6 website was used to calculate absolute humidity using the normal dry bulb temperature, the average normal relative humidity and the average mean station pressure. The validity of the calculated absolute humidity was then checked by computing the corresponding relative humidity at the minimum temperature. If the resulting relative humidity exceeded 100% the absolute humidity was reduced until the relative humidity no longer exceeded 100% at the minimum temperature. Temperatures and absolute humidities were established for each month because the MOBILE6 model was run for each month to generate the annual emission estimates. Also, temperatures and absolute humidities were established for average summer (June, July, and August) and average winter (December, January, and February) periods for use in the MOBILE6 runs to generate summer and winter emissions, respectively.

The following gasoline specifications for 2002 were specified as inputs to the MOBILE6 model:

Table 8: Gasoline Specifications Used for 2002 in the MOBILE6 Model

|  |  |  |
| --- | --- | --- |
| **Gasoline Specifications Used for 2002 in the MOBILE Model** | **Northern RFG – Summer\*** | **Northern RFG – Winter\*** |
| Reid Vapor Pressure (psi) | 6.7 | 15 |
| Ether Oxygen Content (% by weight) | 2.1 | 1.5 |
| Ether Market Share | 100 | 70 |
| Ethanol Oxygen Content (% by weight) | NA | 3.5 |
| Ethanol Market Share | 0 | 30 |
| Sulfur Content – Average (ppm) | 129 | 279 |
| Sulfur Content – Maximum (ppm) | 1000 | 1000 |

\* Northern RFG Summer specifications were used for MOBILE runs for the months of May through September. Northern RFG Winter specifications were used for MOBILE runs for the months of October through April.

No actual data for RVP winter gasoline in New Jersey could be found so this value was set at the maximum specification of 15 psi.

The MOBILE6 inputs for Stage 2 effectiveness has been set at 62% based on calculations performed pursuant to New Jersey rule amendments involving Stage 2 controls.

The 2002 inventory was developed using a MOBILE6 Rebuild Program effectiveness rate of 14% to reduce heavy-duty diesel vehicle NOx off-cycle emissions. Recent national data on the actual numbers of chip reflashes being performed during engine rebuilds has indicated that the effectiveness of this program has been significantly less than the suggested MOBILE6 value of 90%. New Jersey has used an effectiveness rate of 14% for 2002 based on the USEPA program summary data reported as of March 31, 2003.

Annual emissions were calculated by performing separate MOBILE runs for each month and averaging the monthly results together to obtain annual averages. The SEASON command was set appropriately for each month so that the correct reformulated gasoline rules would be applied to each month.

## South Jersey Transportation Planning Organization and North Jersey

## Transportation Planning Authority Emission Calculations

Both the South Jersey Transportation Planning Organization and the North Jersey Transportation Planning Authority use a computer model called PPSUITE to estimate emissions from onroad sources. PPSUITE is a group of computer programs that modifies and converts output data from the TDMs, generates MOBILE6 input files, and summarizes MOBILE6 output files, including the calculation of emission inventories using DVMT and emission factors. PPSUITE Version 5 was designed to be compatible with MOBILE6 and was the version used to develop the 2002 emission inventory. The PPSUITE computer files are contained in Attachment 14.

PPSUITE allows the user to perform adjustments to the raw outputs from the TDMs. In addition, PPSUITE calculates link capacities and speed distributions for each hour. Speeds are adjusted when roadways experience overcapacity situations (i.e., traffic jams). PPSUITE then combines the adjusted traffic activity data with the non-traffic-activity MOBILE6 input parameters (such as the I/M program description) to generate a MOBILE6 input file (this file is called M6input.in). A separate MOBILE6 run is performed for each county with separate scenarios for each roadway type. After MOBILE6 is run, PPSUITE multiples vehicle miles traveled by the MOBILE6 emission factors to produce emission inventory results. To accomplish this, PPSUITE uses the composite MOBILE6 emission factors from the MOBILE6 descriptive output. In order to calculate annual emissions, separate sets of MOBILE6 runs were performed for each month and then the 12 months of results were averaged together to compute the annual emissions. For the typical summer or winter weekday emissions, only one set of MOBILE6 runs were necessary.

The files used to generate the 2002 onroad source emission inventory for the North Jersey Transportation Planning Authority and the South Jersey Transportation Planning Organization are contained in Attachments 15 and 16, respectively.

## F. Delaware Valley Regional Planning Commission Emission Calculations

The Delaware Valley Regional Planning Commission uses a slightly different process to calculate onroad emissions. First, the TDM is used to determine the highway/transit volumes and the resultant vehicle miles traveled inventory. Output from the TDM is input into a postprocessor along with speed curve data to generate MOBILE6 input files. The MOBILE6 input files consist of speed distribution files (\*.sp files), vehicle miles traveled by facility files (\*.fc files), and hourly vehicle miles traveled files (\*.hr files) for each county. MOBILE6 is then run with each scenario representing a different county. Composite emission factors from the MOBILE6 descriptive output are combined with vehicle miles traveled data in a spreadsheet to calculate emission inventories by county. Similar to the other Metropolitan Planning Organizations, in order to calculate annual emissions separate sets of MOBILE6 runs were performed for each month and then the twelve months of results were averaged together to compute the annual emissions. Separate single runs were performed to calculate summer and winter emissions respectively. The files used to generate the 2002 on-road source emission inventory for the Delaware Valley Regional Planning Commission are contained in Attachment 17.

## G. Summary of On-road Inventory Data

Table 9 presents the 2002 onroad source emission inventory by county. Attachment 18contains the detailed onroad emission inventory by county and SCC (vehicle type). Attachment 19 contains the Stage 2 vehicle refueling emissions by county. These VOC emissions were calculated and reported for average summer and average annual conditions. The 2002 statewide Stage 2 refueling emissions are 11.83 tons per summer day and 5,281 tons per year.

Table 9: 2002 Statewide On-road Source Emission Inventory by County and Pollutant

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **VOC** | | **NOx** | | **CO** | |
| **County** | **Tons per Summer Day** | **Tons per Year** | **Tons per Summer Day** | **Tons per Year** | **Tons per Summer Day** | **Tons per Year** |
| Atlantic | 12.85 | 3,613 | 24.50 | 6,764 | 155.53 | 53,885 |
| Bergen | 36.09 | 14,048 | 63.24 | 23,917 | 324.50 | 166,589 |
| Burlington | 15.80 | 6,278 | 31.10 | 11,644 | 168.90 | 83,768 |
| Camden | 13.80 | 5,512 | 27.00 | 10,074 | 145.90 | 72,489 |
| Cape May | 4.72 | 1,348 | 8.82 | 2,433 | 53.58 | 18,758 |
| Cumberland | 5.37 | 1,492 | 10.61 | 2,883 | 56.91 | 19,994 |
| Essex | 18.26 | 7,238 | 44.06 | 16,537 | 187.93 | 96,967 |
| Gloucester | 9.10 | 3,650 | 18.50 | 6,899 | 99.80 | 49,458 |
| Hudson | 9.10 | 3,567 | 21.05 | 7,853 | 87.49 | 44,767 |
| Hunterdon | 5.99 | 2,441 | 17.17 | 6,444 | 64.94 | 34,283 |
| Mercer | 11.60 | 4,636 | 22.70 | 8,505 | 122.70 | 61,101 |
| Middlesex | 26.00 | 10,478 | 58.00 | 22,147 | 287.54 | 149,288 |
| Monmouth | 22.26 | 8,973 | 38.15 | 14,860 | 227.22 | 118,952 |
| Morris | 18.87 | 7,662 | 35.06 | 13,748 | 209.14 | 109,947 |
| Ocean | 14.30 | 5,792 | 24.65 | 9,538 | 135.96 | 72,072 |
| Passaic | 10.22 | 4,109 | 23.01 | 8,748 | 105.86 | 55,414 |
| Salem | 4.23 | 1,205 | 11.91 | 3,185 | 49.04 | 17,071 |
| Somerset | 10.65 | 4,311 | 23.85 | 9,090 | 112.52 | 59,270 |
| Sussex | 4.62 | 1,881 | 7.47 | 2,936 | 42.35 | 23,055 |
| Union | 15.92 | 6,354 | 32.22 | 12,294 | 162.44 | 84,178 |
| Warren | 4.99 | 2,001 | 15.60 | 5,782 | 56.12 | 29,700 |
| Total in State | 274.74 | 106,589 | 558.66 | 206,280 | 2,856.37 | 1,421,004 |

#### Table 9 (continued): 2002 Statewide On-road Source Emission Inventory by County and Pollutant

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **County** | **PM10**  **Tons per Year** | **PM2.5**  **Tons per Year** | **SO2**  **Tons per Year** | **NH3**  **Tons per Year** |
| Atlantic | 154 | 104 | 202 | 297 |
| Bergen | 524 | 376 | 634 | 821 |
| Burlington | 275 | 193 | 361 | 454 |
| Camden | 238 | 167 | 313 | 393 |
| Cape May | 58 | 40 | 75 | 107 |
| Cumberland | 73 | 52 | 89 | 118 |
| Essex | 389 | 291 | 429 | 492 |
| Gloucester | 161 | 112 | 211 | 265 |
| Hudson | 179 | 134 | 196 | 222 |
| Hunterdon | 148 | 111 | 163 | 187 |
| Mercer | 201 | 141 | 264 | 331 |
| Middlesex | 486 | 347 | 590 | 765 |
| Monmouth | 352 | 244 | 453 | 628 |
| Morris | 305 | 209 | 403 | 572 |
| Ocean | 229 | 160 | 290 | 396 |
| Passaic | 195 | 141 | 231 | 292 |
| Salem | 77 | 57 | 85 | 97 |
| Somerset | 211 | 152 | 250 | 317 |
| Sussex | 77 | 54 | 98 | 135 |
| Union | 261 | 185 | 321 | 425 |
| Warren | 123 | 92 | 134 | 152 |
| Total in State | 4,718 | 3,361 | 5,793 | 7,469 |

# V. Non-road Sources

## A. Nonroad Equipment Emissions From NONROAD Model

Nonroad equipment emissions for VOC, NOx, carbon monoxide, PM10, PM2.5, and SO2 for the 2002 inventory were calculated using the NONROAD Emissions Equipment Model (NNEM), Version 2.3c (April 2004) developed by the USEPA for use by the states in estimating emissions from nonroad sources. The NNEM includes more than eighty basic and two hundred sixty specific types of nonroad equipment, which are stratified by equipment types, horsepower rating and fuel. Fuel types include gasoline, diesel, compressed natural gas (CNG), and liquefied petroleum gas (LPG).

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

The NLIA GSE inventory was also used to calculate GSE population for other airports in the state. In order to estimate the amount of ground support equipment at other major New Jersey airports, for which the NJDEP lacks specific data, a scaling factor was calculated by comparing the number of air carrier (commercial) and air taxi aircraft landing and take-off operation (LTOs) for NLIA, as reported by the Federal Aviation Administration, to the number of these aircraft LTOs for each major airport in Atlantic, Essex, Burlington, Mercer, Bergen, and Morris counties. The LTOs are shown in Table 10. The scaling factor, per airport, was then applied to the NLIA ground support equipment (GSE) population data and the resultant new population data for each airport was combined with the NLIA data to determine the total statewide GSE population. The statewide GSE population was input into the NNEM model to generate statewide emissions. These emissions were allocated to the county level by inputting the LTOs into the NNEM model for each of the six counties shown in Table 10.

The NNEM also contains default human population data, however, the NJDEP input state specific 2002 human population data for New Jersey. The human population data is the same as those used by the Metropolitan Planning Organizations in their travel demand models to calculate onroad sector emissions. For certain SCCs, the NNEM uses human population as a factor in calculating equipment activity levels.

Other parameters input into the NNEM model to calculate the 2002 nonroad emissions inventory are shown in Table 11.

Table 10: County Level LTOs Used in the NONROAD MODEL

| **COUNTY** | **AIR CARRIERS** | **AIR TAXI** | **TOTAL LTO'S** |
| --- | --- | --- | --- |
| ATLANTIC | 5,675 | 6,055 | 11,730 |
| ESSEX | 145,402 | 50,466 | 195,868 |
| MORRIS | 1 | 9,198 | 9,199 |
| BERGEN | 15,732 | 11,997 | 27,729 |
| MERCER | 2 | 2,008 | 2,010 |
| BURLINGTON(1) | 599 | 5,884 | 6,483 |
| TOTAL STATE | 167,411 | 85,608 | 253,019 |

(1) The air taxi category for Burlington County constitutes military aircraft LTOs from McGuire.

Table 11: Scenario Specific Parameters Used in the NONROAD Model

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | | **Typical Summer Day** | | **Typical Winter Day** | | **Annual** |
| Fuel RVP(1) (psi) | | 6.77 | | 15.00 | | 11.60 |
| Fuel Oxygen(1) weight % | | 2.12 | | 1.93 | | 2.01 |
| Gasoline Sulfur(1) % | | 0.0103 | | 0.0164 | | 0.0139 |
| Diesel Sulfur(2) % | | 0.3080 | | 0.3080 | | 0.3080 |
| LPG/CNG Sulfur % | | 0.0030 | | 0.0030 | | 0.0030 |
| Minimum Temperature(3) | | 66.30 | | 26.70 | | 46.30 |
| Maximum Temperature(3) | | 82.90 | | 41.20 | | 62.60 |
| Average Ambient Temp.(3) | | 74.90 | | 33.00 | | 54.30 |
| Altitude of Region | | LOW | | | | |
| Stage II Control % | | 0.00 | | 0.00 | | 0.00 |
| **Period Parameters** | | | | | | |
| Year of Inventory | 2002 | | | | | |
| Inventory for | Seasonal period | | Seasonal period | | Annual period | |
| Emissions summed for | Typical day | | Typical day | | Period total | |
| Season | Summer | | Winter | | N/A | |
| Day of week | Weekday | | Weekday | | N/A | |

(1) Gasoline parameters for the summer RVP, oxygen, and sulfur levels were obtained from the USEPA survey data for New Jersey for 2002. The winter RVP value was set at the maximum specification level. The annual values were the time weighted average (five months for summer and seven months for winter) of summer and winter gasoline.

(2) Diesel sulfur for nonroad fuel was obtained from: “Draft Regulatory Impact Analysis: Control of Emissions from Non-road Diesel Engines” Section 7.1.4.2 (USEPA 420-R-03-008 April 2003). The average value for Petroleum Administration for Defense District 1 (3384 parts per million (ppm)) was combined with a 10% contribution for the spillover of highway diesel fuel (340 ppm) to nonroad equipment.

(3) Normal daily max/min temperatures and normal dry bulb temperatures were obtained from the National Oceanic and Atmospheric Administration, Local Climatological Data for 2002. Values from airports in Newark, Allentown PA, Philadelphia PA, and Atlantic City were used to represent the counties within the respective air quality areas. Statewide values were the averages for the twenty-one counties.

## B. Aircraft Emissions

Aircraft emissions for VOC, NOx, carbon monoxide, PM10, PM2.5, and SO2 were calculated based on the number of landing and take-off (LTO) cycles generated at each airport. The six major airports in New Jersey, Newark Liberty International, Teterboro, Atlantic City, Morris Municipal, Essex County, and Mercer County, supplied the NJDEP with their aircraft fleet mix. These values were used as inputs to the Emissions and Dispersion Modeling System (EDMS), the Federal Aviation Agency (FAA) modeling tool. LTO numbers for the aircraft categories of commercial, military, air taxi and general aviation for all remaining smaller airports were obtained from the FAA. McGuire Air Force Base (McGuire) supplied LTO and Touch and Go information for that facility. 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. Specifics on the equations and model used for the calculation of these emissions, other assumptions and references for data can be found in the calculation sheet for aircraft included in Attachment 20.

## C. Locomotive Emissions

Locomotive emissions for VOC, NOx, carbon monoxide, PM10, PM2.5, and SO2 were calculated based on the estimated fuel consumption of individual railroad systems operating in New Jersey. The NJDEP received specific fuel use data from many short line freight and commuter railroads. An estimation of fuel consumption based on gross tons miles (tons of freight 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. For example, the larger freight haul operations, i.e. CSX and Norfork Southern, reported nationwide fuel use and national and statewide gross ton miles from which a state fuel index was obtained to calculate state and county level fuel use. Specifics on the equations used for the calculation of these emissions, other assumptions, and references for data can be found in the calculation sheet for locomotives included in Attachment 20.

## D. Commercial Marine Vessel Emissions

Commercial Marine Vessel emissions for VOC, NOx, carbon monoxide, PM10, PM2.5, and SO2 for Northern New Jersey were taken from the Commercial Marine Vessel Emissions Inventory Report prepared by Starcrest Consulting Croup, LLC.[[13]](#footnote-13)  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 this information emissions estimates were prepared based on estimated horsepower demand.

Commercial marine vessel emissions for the Southern New Jersey were estimated using fuel purchases for diesel and residual fuels and the number of trips of self propelled vessels along the Delaware River. Emissions on the Delaware River were split between Pennsylvania and New Jersey by assuming that all northbound emissions were in New Jersey and all southbound emissions were in Pennsylvania. This allocation process was agreed to by the two states as part of the 1990-emission inventory submittal. This fuel-based approach tends to overestimate commercial marine vessel emissions because some of the fuel purchased was used outside of the Delaware River. However, NJDEP did not have comprehensive information similar to above referenced Starcrest report for the Philadelphia/Wilmington/Trenton nonattainment area. Specifics on the equations used for the calculation of these emissions, other assumptions and references for data can be found in the calculation sheet included in Attachment 20.

## E. Ammonia Emissions

Ammonia emissions for non-road equipment contained in the NNEM were calculated using the following emission factors, presented in Recommended Improvements to the Carnegie Mellon University Ammonia Emission Inventory Model for use by LADCO: Final Report 902350-2249-FR, dated March 10, 2003:

Diesel-powered engines: 0.17g NH3/gallon fuel

Gasoline-fueled 2- and 4-stroke engines: 0.15g NH3/gallon fuel

No guidance was issued by the USEPA for ammonia emissions for LPG or CNG fueled engines, aircraft, locomotives, and commercial marine vessels, therefore the emissions are reported as zero.

## F. Summary of Nonroad Source Inventory Data

Table 12 presents the 2002 nonroad source emission inventory by county. Attachment 21 contains the detailed nonroad source emission inventory for VOC, NOx, carbon monoxide, PM10, PM2.5, SO2, and ammonia, respectively. Emissions for all pollutants are calculated on an annual basis. In addition, VOC, NOx, and carbon monoxide are calculated for a typical summer day and carbon monoxide, PM10,and PM2.5 are calculated for a winter day. Emissions are calculated and presented by SCC and county. These attachments are only available electronically.

Table 12: 2002 Statewide Non-road Source Emission Inventory by County and Pollutant

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **VOC** | | **NOx** | | **CO** | |
| **County** | **Tons per Summer Day** | **Tons per Year** | **Tons per Summer Day** | **Tons per Year** | **Tons per Summer Day** | **Tons per Year** |
| Atlantic | 10.25 | 3,521 | 6.26 | 1,771 | 70.26 | 19,798 |
| Bergen | 22.05 | 6,361 | 23.38 | 6,707 | 358.25 | 93,002 |
| Burlington | 10.01 | 3,000 | 12.88 | 3,776 | 121.35 | 31,350 |
| Camden | 7.23 | 2,110 | 9.44 | 2,669 | 112.44 | 29,402 |
| Cape May | 22.61 | 8,480 | 5.92 | 1,959 | 80.06 | 26,265 |
| Cumberland | 11.03 | 4,196 | 7.94 | 2,574 | 50.35 | 15,941 |
| Essex | 11.92 | 3,739 | 25.70 | 8,137 | 182.98 | 53,407 |
| Gloucester | 5.91 | 1,686 | 8.01 | 2,200 | 77.69 | 19,203 |
| Hudson | 5.22 | 1,617 | 20.71 | 5,976 | 68.72 | 20,015 |
| Hunterdon | 3.66 | 1,038 | 4.70 | 1,223 | 48.31 | 11,896 |
| Mercer | 7.01 | 1,922 | 9.32 | 2,427 | 104.18 | 25,685 |
| Middlesex | 14.58 | 4,115 | 17.54 | 4,849 | 228.84 | 57,965 |
| Monmouth | 21.26 | 6,996 | 15.74 | 4,316 | 212.60 | 55,614 |
| Morris | 15.09 | 4,211 | 11.58 | 3,151 | 227.91 | 56,136 |
| Ocean | 21.54 | 7,714 | 7.57 | 2,138 | 143.85 | 40,914 |
| Passaic | 6.62 | 2,081 | 8.88 | 2,413 | 98.09 | 26,769 |
| Salem | 3.37 | 1,162 | 3.21 | 932 | 21.42 | 5,991 |
| Somerset | 6.87 | 1,898 | 7.57 | 2,097 | 107.75 | 26,731 |
| Sussex | 3.86 | 1,490 | 2.46 | 615 | 37.57 | 10,883 |
| Union | 7.75 | 2,237 | 20.25 | 5,883 | 118.31 | 31,780 |
| Warren | 2.78 | 832 | 2.48 | 631 | 26.89 | 7,198 |
| Total in State | 220.60 | 70,407 | 231.56 | 66,443 | 2,497.80 | 665,944 |

Table 12 (continued): 2002 Statewide Non-road Source Emission Inventory by County and Pollutant

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| County | **PM10**  **Tons per Year** | **PM2.5**  **Tons per Year** | **SO2**  **Tons per Year** | **NH3**  **Tons per Year** |
| Atlantic | 248 | 225 | 176 | 13 |
| Bergen | 524 | 478 | 620 | 163 |
| Burlington | 471 | 413 | 2,462 | 39 |
| Camden | 249 | 228 | 1,057 | 46 |
| Cape May | 509 | 468 | 993 | 6 |
| Cumberland | 407 | 374 | 2,115 | 20 |
| Essex | 444 | 393 | 980 | 82 |
| Gloucester | 242 | 222 | 1,243 | 22 |
| Hudson | 375 | 345 | 1,582 | 56 |
| Hunterdon | 113 | 103 | 123 | 14 |
| Mercer | 224 | 203 | 501 | 41 |
| Middlesex | 376 | 346 | 612 | 108 |
| Monmouth | 545 | 501 | 929 | 47 |
| Morris | 309 | 280 | 276 | 75 |
| Ocean | 446 | 409 | 216 | 21 |
| Passaic | 194 | 178 | 223 | 65 |
| Salem | 132 | 122 | 673 | 7 |
| Somerset | 164 | 149 | 180 | 43 |
| Sussex | 99 | 89 | 69 | 8 |
| Union | 362 | 333 | 1,680 | 82 |
| Warren | 71 | 64 | 63 | 12 |
| Total in State | 6,505 | 5,922 | 16,772 | 970 |

# 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 biogenic emissions for VOC, NOx,and carbon monoxide were calculated by the USEPA using the BEIS model, version 3.12. These estimates were created using the following data:

1) 2001 annual meteorology

2) BEIS3.12 model via the Sparse Matrix Operator Kernel Emissions (SMOKE)

modeling system

3) Recently revised BEIS3.12 emission factors file

4) BELD3 land use data (1-km original data aggregated to 36-km grid), and

5) Post processing summation of county-total emissions from SMOKE, calculated from 36-km gridded emissions using the "land area" spatial surrogate. This means that when calculating the county-total numbers, the 36-km gridded emissions were assumed to be uniformly distributed over the grid cell for purposes of mapping to the counties.

Biogenic ammonia emissions were estimated using the Carnegie Mellon University ammonia emissions modeling tool. The current version, v3.1, of the Carnegie Mellon University application was used to generate ammonia inventories for human, domestic animal, and wild animal emissions. Several Regional Haze Planning Organizations are planning to use this application to generate part or all of their ammonia inventory, including MANE-VU, LADCO, and CENRAP.

The New Jersey population values in the Carnegie Mellon University application were altered and the 2002 New Jersey population values supplied by the New Jersey Department of Transportation that were used throughout this inventory were used to calculate ammonia emissions associated with human breath and perspiration. The emission estimates were calculated using the emission factors for human emissions supplied with v3.1 of the Carnegie Mellon University application.[[14]](#footnote-14)

The New Jersey cat and dog population values in the Carnegie Mellon University application were updated with 2001 statewide values from the *U.S. Pet: Ownership and Demographic Sourcebook* based on the American Veterinary Medical Association Household Pet Survey for 2001. These statewide population values were apportioned to the county level based on the proportion found in the existing population Carnegie Mellon University activity file. The emission estimates were calculated using the emission factors for domestic animals supplied with v3.1 of the Carnegie Mellon University application.[[15]](#footnote-15)

Emissions for wild animals were estimated using the activity data and emission factors supplied with v3.1 of the Carnegie Mellon University application.[[16]](#footnote-16)

Table 13 presents the 2002 biogenic source emission inventory by county. The more detailed ammonia inventory by SCC and county is included in Attachment 22.

Table 13: 2002 Statewide Biogenic Source Emission Inventory by County and Pollutant

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **VOC\*** | | **NOx \*** | | **CO\*** | |
| **County** | **Tons per Summer Day** | **Tons per Year** | **Tons per Summer Day** | **Tons per Year** | **Tons per Summer Day** | **Tons per Year** |
| Atlantic | 40.38 | 14,748 | 0.21 | 78 | 2.96 | 1,080 |
| Bergen | 4.60 | 1,681 | 0.07 | 25 | 0.54 | 199 |
| Burlington | 39.84 | 14,552 | 0.26 | 97 | 3.33 | 1,216 |
| Camden | 20.06 | 7,326 | 0.21 | 77 | 1.57 | 574 |
| Cape May | 19.55 | 7,140 | 0.19 | 68 | 1.54 | 562 |
| Cumberland | 28.41 | 10,377 | 0.34 | 125 | 2.28 | 831 |
| Essex | 3.40 | 1,244 | 0.07 | 27 | 0.45 | 164 |
| Gloucester | 16.83 | 6,148 | 0.19 | 71 | 1.41 | 516 |
| Hudson | 3.27 | 1,195 | 0.07 | 27 | 0.44 | 161 |
| Hunterdon | 12.44 | 4,545 | 0.19 | 69 | 1.60 | 585 |
| Mercer | 12.65 | 4,619 | 0.20 | 72 | 1.42 | 518 |
| Middlesex | 12.78 | 4,669 | 0.16 | 58 | 1.16 | 424 |
| Monmouth | 22.00 | 8,036 | 0.22 | 79 | 1.98 | 722 |
| Morris | 13.75 | 5,024 | 0.12 | 43 | 1.42 | 519 |
| Ocean | 43.80 | 15,998 | 0.27 | 98 | 3.89 | 1,420 |
| Passaic | 11.04 | 4,034 | 0.10 | 38 | 1.13 | 412 |
| Salem | 18.64 | 6,809 | 0.32 | 116 | 1.63 | 595 |
| Somerset | 12.20 | 4,455 | 0.15 | 54 | 1.40 | 511 |
| Sussex | 20.48 | 7,479 | 0.15 | 55 | 2.00 | 731 |
| Union | 2.31 | 843 | 0.08 | 28 | 0.36 | 133 |
| Warren | 13.50 | 4,931 | 0.22 | 79 | 1.58 | 578 |
| Total in State | 371.95 | 135,851 | 3.78 | 1,382 | 34.09 | 12,451 |

\* The USEPA only supplied Tons per Year values. In order to prepare this comparison it was assumed that biogenic emissions were constant over the year. Therefore, 2002 actual Tons per Day values were calculated by dividing the annual value by 365.24.

**Table 13 (continued): 2002 Statewide Biogenic Source Emission Inventory**

**by County and Pollutant**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| County | **PM10**  **Tons per Year** | **PM2.5**  **Tons per Year** | **SO2**  **Tons per Year** | **NH3**  **Tons per Year** |
| Atlantic | 0 | 0 | 0 | 329 |
| Bergen | 0 | 0 | 0 | 863 |
| Burlington | 0 | 0 | 0 | 520 |
| Camden | 0 | 0 | 0 | 518 |
| Cape May | 0 | 0 | 0 | 130 |
| Cumberland | 0 | 0 | 0 | 203 |
| Essex | 0 | 0 | 0 | 762 |
| Gloucester | 0 | 0 | 0 | 274 |
| Hudson | 0 | 0 | 0 | 572 |
| Hunterdon | 0 | 0 | 0 | 164 |
| Mercer | 0 | 0 | 0 | 347 |
| Middlesex | 0 | 0 | 0 | 746 |
| Monmouth | 0 | 0 | 0 | 651 |
| Morris | 0 | 0 | 0 | 544 |
| Ocean | 0 | 0 | 0 | 616 |
| Passaic | 0 | 0 | 0 | 505 |
| Salem | 0 | 0 | 0 | 89 |
| Somerset | 0 | 0 | 0 | 309 |
| Sussex | 0 | 0 | 0 | 235 |
| Union | 0 | 0 | 0 | 501 |
| Warren | 0 | 0 | 0 | 153 |
| Total in State | 0 | 0 | 0 | 9,032 |

# 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., 2002 point source emissions were reported by applicable facilities to the NJDEP through the Emission Statement Program. All applicable facilities, with the exception of two, reported their 2002 emissions in electronic format. The NJDEP Bureau of Air Quality Planning staff performed data entry of the two paper submittals.

### ii. Completeness Checks & Reasonableness Checks

All the 662 Emission Statements submitted by applicable facilities in 2002 were checked for completeness. The checklist in Attachment 23 was used for emission statement review. NJDEP staff accessed data from both the New Jersey Environmental Management System 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.

### iii. Comparison Checks

Two reports were created usingBusiness Objects softwareto conduct quality assurance checks on the emissions data collected in 2002 compared to the emissions data collected in 1999, 2000 and 2001. In addition, the Emission Statement contractor conducted further evaluations. The details of the reports are described in Attachment 23.

Table 14 presents the comparison of the Summer 1999 “actual” point source emission inventory to the Summer 2002 “projected” and “actual” point source inventory, without RE. The inventories are compared without RE so that base line reported emissions can be compared, because RE is not applied to all baseline emissions as discussed above in Section II. The 2002 “actual” point source emissions show an increase in emissions for VOC and carbon monoxide in comparison to the 1999 "actual" emissions. This increase is attributed to growth. There is a slight decrease in NOx emissions, due to a decrease from the NOx Budget Program, which is greater than the increase due to growth. The difference between the 2002 “actual” and “projected” point source emissions is due to the growth factors used to project out the 1999 “actual” point source emissions, which overestimated projected emissions. In addition, the 2002 “actual” inventory has fifty-nine less facilities than the 1999 “actual” point source inventory due to facility closures and nonapplicability to the emission statement rule.

Table 14 also shows the comparison of the Annual 1999 “actual” point source emission inventory to the Annual 2002 “projected” and “actual” point source inventory, without RE. Again, the inventories are shown without RE so that any methodological differences are not a factor in comparing the base line emissions. As discussed above, the 2002 “actual” inventory has less facilities than the 1999 “actual” inventory, which is the cause for the decrease in emissions between the two years.

Table 14 also shows the comparison of 1999 USEPA NEI data, the 2002 USEPA NEI v1 data and the 2002 “actual” point source inventory. The 2002 “actual” point source emissions for SO2, PM10, PM2.5, and ammonia are slightly higher than the USEPA 2002 NEI v1 emissions but are very close considering that emissions data are from different sources.

A review of the 2002 “actual” point source inventory in Attachment 4 shows that the Chemical Manufacturing General Process SCC is a top VOC emitter during the summer but not annually. This difference in emissions appears to be because the majority of the activity occurs in the summer and also due to the reporting of summer emissions in pounds and converting them to tons and then applying rule effectiveness.

A series of graphs showing the top 15 pollutants by SCC code for each pollutant and source sector can be found in Attachment 1. The graphs comparing the 1996 and 2002 inventories show a large discrepancy in emissions by SCC code. This discrepancy is because in 2002, facilities were required to submit SCC codes for each of their emission units. This is different than in 1996, when facilities were not required to submit SCC codes, and SCC codes were assigned to the units by the NJDEP. When the facility assigns the SCC codes, it is a more accurate representation of the emission units due to their specific knowledge of the source. However, due to the large variety of SCC codes to choose from, when the facilities choose SCC codes, it also leads to a much higher variability in the SCC code chosen for a similar source by each facility. For example, the SCC code used by one facility may not match the SCC code used by another facility for the same source. Another example shows that there were 471 SCC codes used for 1996 VOC inventory compared to 698 SCC codes used for the 2002 VOC inventory. For the purposes of the comparison in creating the graphs, Standard Industrial Classification Codes numbers 4-06-002-98 & 4-06-002-99 were added together as the source descriptions are the same.

Another discrepancy noted was that some of the PM2.5 emissions are higher than PM10 emissions. This is because the PM10 data was reported by the facilities and may or may not contain condensable PM. The PM2.5 emissions were calculated by the NJDEP using the PM10 reported emissions (and total suspended particulates if PM10 was not reported) in the USEPA PM2.5 calculator. Two calculations were made, one for filterable and one for condensable emissions. These emissions were added together to show the final PM2.5 emissions. It appears as though the condensable emissions were not included in the PM10 emissions reported by the facilities for 2002.

Table 14: Statewide Point Source Emissions Inventory Comparison before Application of Rule Effectiveness

|  |  |  |  |
| --- | --- | --- | --- |
| **Summer Controlled Emissions (Tons per Day)** | **New Jersey**  **1999**  **Actual**  **wo/RE** | **New Jersey**  **2002 Projected wo/RE** | **New Jersey**  **2002**  **Actual**  **wo/RE** |
| **VOC** | 89.45 | 175.99 | 100.94 |
| **NOx** | 281.67 | 272.8 | 280.35 |
| **CO** | 75.26 | 62.06 | 88.77 |

|  |  |  |  |
| --- | --- | --- | --- |
| **Annual Controlled Emissions (Tons per Year)** | **New Jersey**  **1999**  **Actual**  **wo/RE** | **New Jersey**  **2002 Projected wo/RE** | **New Jersey**  **2002**  **Actual**  **wo/RE** |
| **VOC** | 22,777 | 30,507 | 17,408 |
| **NOx** | 55,749 | 60,421 | 51,642 |
| **CO** | 14,964 | 15,485 | 12,398 |

|  |  |  |  |
| --- | --- | --- | --- |
| **Annual Controlled Emissions (Tons per Year)** | **USEPA**  **1999**  **NEI** | **USEPA**  **2002**  **NEI v1** | **New Jersey**  **2002**  **Actual**  **wo/RE** |
| **SO2** | 135,256 | 60,927 | 61,231 |
| **PM10\*** | 17,846 | 4,585 | 5,555 |
| **PM2.5\*** | 14,337 | 3,713 | 4,868 |
| **NH3** | 539,304 | 38 | 38 |

\* The 2002 actual totals include adjusted emissions from fugitive dust categories. See Attachment 2 of this report forfurther discussion.

## B. Area Sources

The VOC, NOx, carbon monoxide, SO2, PM2.5, and PM10 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 2002 VOC, NOx, and carbon monoxide area source inventories were compared to the 1996 inventories and to the projected 2002 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. The 1996 inventory was chosen for comparison, because the 1999 inventory was a projection of the 1996 base year inventory, and therefore is also a reflection of the growth factors chosen, in addition to the methodologies used to calculated emissions. A summary of the inventory comparison is included in Attachment 25. The comparison shows summer and annual estimated emissions, differences from 1996 to 2002, and explanations for significant differences. An overall summary of statewide emission differences is shown in Table 15 below.

As shown in Table 15, summer and annual VOC and carbon monoxide estimated emissions have increased significantly from the 1996 inventory. The reasons for these increases are varied. The estimated emissions for residential wood combustion have increased due to an error in the calculations in the 1996 inventory. The estimated emissions for consumer products have increased more than projected due to a larger increase in population than projected. Metal containers surface coating estimated emissions have increased due to a change in reporting methodology. Previously, employment figures obtained from the Department of Labor were reported by Standard Industrial Classification codes, whereas for 2002, employment figures were reported by North American Industry Classification System codes. Several area source categories that use employment to calculate estimated emissions were affected by this change. Some emissions increased due to this change and some decreased. Two new categories were included into the VOC inventory that increased VOC emissions significantly, industrial adhesives and portable fuel containers. The permeation, diurnal and transport portions of emissions from portable fuel containers were included in the area source inventory. (Diurnal emissions are when stored fuel vapors escape to the outside of a gas can through any possible openings.) The refueling (spillage and vapor displacement) emissions are included in the nonroad inventory because they are part of the nonroad model. The 1996 balanced submerged filling emissions were revised to reflect the New Jersey rule in place prior to 2003, N.J.A.C. 7:27-16.3, which required ninety percent efficiency for this type of gasoline loading. Rule amendments effective June 2003 have increased the efficiency requirement from ninety percent to ninety-eight percent, which will be reflected in future year inventories. Large forest fires in Ocean County in the summer of 2002 significantly increased wildfire emissions.

Some decreases in emissions were also noted in individual categories. The reasons for these decreases are varied. Industrial natural gas combustion showed a decrease in emissions due to changes in point source reporting. Point source fuel use is subtracted from total statewide fuel use to determine area source emissions. Therefore, an increase in the reporting of natural gas use in the point source inventory resulted in a decrease in the area source emissions for this category. Bakery emissions decreased due to the change in employment reporting discussed above. Managed burning emissions decreased due to a decrease in managed burning. Gasoline refueling (stage II) emissions were removed from the area source inventory because they are a mandatory part of the mobile model emission reporting and are therefore now included in the onroad mobile inventory.

The 2002 VOC, NOx, carbon monoxide, SO2, PM2.5, and PM10 area source inventories were compared to the 1999 USEPA NEI inventories and the 2002 preliminary USEPA NEI 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. A summary of the inventory comparison is included in Attachment 25. The comparison shows annual emissions and differences. An overall summary of statewide emission differences is shown in Table 15. The USEPA NEI for the most part shows higher emissions than the New Jersey inventory for all pollutants. The reasons for these differences is not entirely clear, but appears to be due to outdated data in the NEI and the use of state specific data in the New Jersey inventory. There are numerous differences between the VOC inventories, with one of the largest being the addition of the portable fuel container category in the New Jersey area source inventory. The largest discrepancies in the carbon monoxide and PM (without fugitive dust) inventories are open burning and wildfires. The largest discrepancies in the PM fugitive dust inventories (the 2002 actual totals include adjusted emissions from fugitive dust categories, see Attachment 2 of this report for further discussion) are paved roads, construction and agricultural tilling. The largest discrepancy in the SO2 inventory is the industrial bituminous coal category. The industrial and commercial residual oil categories also have large discrepancies.

Table 15: Statewide Area Source Emissions Inventory Comparison

|  |  |  |  |
| --- | --- | --- | --- |
| **Summer Controlled Emissions (Tons per Day)** | **New Jersey**  **1996**  **Actual** | **New Jersey**  **2002 Projected** | **New Jersey**  **2002**  **Actual** |
| **VOC** | 305.03 | 319.62 | 369.83 |
| **NOx** | 39.66 | 39.66 | 35.92 |
| **CO** | 26.88 | 27.14 | 66.45 |

|  |  |  |  |
| --- | --- | --- | --- |
| **Annual Controlled Emissions**  **(Tons per Year)** | **New Jersey**  **1996**  **Actual** | **New Jersey**  **2002 Projected** | **New Jersey**  **2002**  **Actual** |
| **VOC** | 97,589 | NA | 127,673 |
| **NOx** | 28,034 | NA | 26,742 |
| **CO** | 40,598 | NA | 94,067 |

|  |  |  |  |
| --- | --- | --- | --- |
| **Annual Controlled Emissions**  **(Tons per Year)** | **USEPA**  **1999**  **NEI** | **USEPA**  **2002**  **NEI v1** | **New Jersey**  **2002**  **Actual** |
| **VOC** | 174,710 1 | 142,582 1 | 127,673 |
| **NOx** | 39,472 | 39,043 | 26,742 |
| **CO** | 180,669 | 146,825 | 94,067 |
| **SO2** | 46,216 | 45,392 | 10,876 |
| **PM10 wo fugitive dust** | 43,710 | 26,300 | 15,479 |
| **PM10 fugitive dust** | 229,790 | 90,804 | 46,405 |
| **PM10 fugitive dust2** | NA | NA | 9,281 |
| **PM2.5 wo fugitive dust** | 39,168 | 24,138 | 15,210 |
| **PM2.5 fugitive dust** | 52,314 | 14,639 | 5,099 |
| **PM2.5 fugitive dust2** | NA | NA | 1,020 |
| **NH3** | NA | NA | 8,005 |

**Notes:**

1. The USEPA NEI does not include portable fuel container emissions, which would increase the NEI by 8,887 tpy.

2. Adjusted fugitive dust. See Attachment 2 of this report forfurther discussion.

## Onroad Sources

## This section outlines and discusses the various quality assurance checks performed on the onroad source emissions.

Table 16 presents the comparison of the 1999 “actual” on-road source emission inventory to the 2002 “projected” and “actual” on-road source inventory.

The 2002 “projected” inventory differs significantly from the 2002 “actual” inventory and the 1999 "actual" inventory because a different emission factor prediction model was used to calculate each inventory. The 1999 "actual" inventory was calculated after the 2002 "projected" inventory using the USEPA MOBILE6.2 model. The 2002 “projected” inventory was calculated using the USEPA MOBILE5a-h model. The 2002 “actual" inventory was calculated using the USEPA MOBILE6.2.03 model. As shown by the values in Table 16, the change from MOBILE5a-h to MOBILE6.2 results in increased emission estimates for VOC, NOx, and carbon monoxide.

Comparison of the 1999 “actual” inventory to the 2002 “actual” inventory indicates that emissions of VOC and carbon monoxide are lower. Both of these inventories were estimated using the MOBILE6 model. Even though the vehicles miles traveled increased between 1999 and 2002, the effect of lower average emission factors due to fleet turnover (emission standards for newer vehicles are lower due to the historical implementation of Federal rules) for the 2002 fleet was apparently stronger. This resulted in a decrease in the emission inventories for VOC and carbon monoxide.

The significant decrease in VOC emissions between 1999 and 2002 is also a result of the change in assumptions regarding the temperatures/humidities used in the inventory calculations. In accordance with the Consolidated Emissions Reporting Rule, the 2002 “actual” summer inventory was generated using average summer day temperatures/humidities. In previous inventories temperatures/humidities for high ozone days were used. The average summer day temperatures/humidities were significantly lower than the high ozone day temperatures/humidities. The use of lower temperatures/humidities in the model results in predictions of lower evaporative emissions of VOCs.

The significant decrease in carbon monoxide emissions between the 1999 “actual” and 2002 “actual” can, at least partially, be explained by a model change. Although both the 1999 “actual” and 2002 “actual” inventories were calculated using MOBILE6, a later version of MOBILE6 was used for the 2002 “actual” inventory. One of the differences between the two model versions is that the most recent version (MOBILE6.02.03) predicts generally lower emission factors for carbon monoxide.

The significant increase in NOx emissions for the 2002 “actual” inventory relative to the two previous inventories is primarily due to an increase in the vehicle miles traveled estimate for heavy duty diesel vehicles (HDDVs). The “actual” 2002 inventory is based on an updated distribution of vehicle miles traveled between the various vehicle types for the North Jersey Transportation Planning Authority and South Jersey Transportation Planning Organization models.

A series of graphs showing the top 15 pollutants by SCC code for each pollutant and source sector can be found in Attachment 1. Attachment 1 contains a file (Graphs3 compare96-02.xls) that consists of a series of charts that compare the 1996 and 2002 emissions by SCC for various pollutants. In some cases the 2002 emissions differ significantly from the 1996 emissions.

The chart that compares the NOx emissions for the onroad sector sources shows that the NOx emissions from HDDVs increased from 69.89 tpd for 1996 to 285.37 tpd for 2002. Also, the NOx emissions from light duty gasoline vehicles (LDGVs) decreased from 223.02 tpd for 1996 to 139.27 tpd for 2002. The large increase in NOx emissions from HDDVs is due primarily to an increase in the estimated DVMT for HDDVs. The 1996 emissions estimate was based on an activity level of 4,156,423 miles per day for HDDVs while the 2002 emissions estimate was based on an activity level of 8,065,321 miles per day. The DVMT estimates were established by the Metropolitan Planning Organizations. The decrease in NOx emissions from LDGVs between 1996 and 2002 is due to both lower emission factors and lower DVMT. The emission factors are lower because of fleet turnover to lower emitting vehicles. The DVMT is lower due to the increased preference for sport utility vehicles relative to passenger cars during the 1996-2002 period. Sport utility vehicles are generally classified as light duty gasoline trucks (LDGTs) and not LDGVs.

The chart that compares the carbon monoxide emissions for the onroad sector sources indicates that the carbon monoxide emissions from LDGVs increased from 1,182.89 tpd for 1996 to 1538.48 tpd for 2002. Also, the carbon monoxide emissions from light duty gasoline trucks less than 6,000 pounds (LDGT1s) increased from 362.97 tpd for 1996 to 837.50 tpd for 2002. The carbon monoxide estimates for LDGVs and LDGT1s are greater in 2002 than 1996 primarily because of the change in the model used to estimate emission factors from MOBILE5 for the 1996 estimates to MOBILE6 for the 2002 estimates. MOBILE6 generates higher carbon monoxide emission factors for these vehicle classes. Another reason for the significant increase in carbon monoxide emission estimates for LDGT1s is a large increase in the DVMT for 2002 relative to 1996. This is a result of the significant increase in the use of sport utility vehicles (LDGT1s) as passenger cars (LDGVs) that occurred during this period.

The USEPA 2002 NEI emissions for SO2, PM10, PM2.5, and ammonia are similar to the 2002 “actual” inventories. The differences between the USEPA NEI inventories and the 2002 “actual” inventories are significantly less for the USEPA 2002 inventories than the USEPA 1999 inventories. The USEPA 1999 NEI emissions for ammonia are less than the 2002 “actual” inventory while the USEPA 2002 NEI emissions for ammonia are slightly greater than the 2002 “actual” inventory.

Table 16: Statewide Onroad Source Emissions Inventory Comparison

|  |  |  |  |
| --- | --- | --- | --- |
| **Summer Controlled Emissions (Tons per Day)** | **New Jersey**  **1999**  **Actual (MOBILE6)** | **New Jersey**  **2002 Projected (MOBILE5)** | **New Jersey**  **2002**  **Actual (MOBILE6)** |
| **VOC** | 369.59 | 212.92 | 274.74 |
| **NOx** | 473.53 | 346.25 | 558.66 |
| **CO** | 3,538.65 | 1,374.76 | 2,856.37 |

|  |  |  |  |
| --- | --- | --- | --- |
| **Annual Controlled Emissions**  **(Tons per Year)** | **USEPA**  **1999**  **NEI** | **USEPA**  **2002**  **NEI v2** | **New Jersey**  **2002**  **Actual** |
| **SO2** | 7,535 | 3,758 | 5,793 |
| **PM10** | 5,461 | 3,864 | 4,718 |
| **PM2.5** | 4,121 | 2,592 | 3,361 |
| **NH3** | 6,562 | 7,629 | 7,469 |

## D. Nonroad Sources

### i. Nonroad Equipment Emissions From NONROAD Model

This section outlines and discusses the various quality assurance and comparison checks performed on the non-road source emissions for the categories in the NNEM. General quality assurance checks consisted of comparing the final tabulated nonroad 2002 emissions inventory against the output file data produced by the NNEM to serve as a check on calculations performed in Microsoft Access and Microsoft Excel. In addition, random manual calculations were performed to serve as a check on calculations performed in Microsoft Access and Microsoft Excel.

The 2002 VOC, NOx, and carbon monoxide nonroad inventories were compared to the 1999 inventories and to the projected 2002 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. Table 17 presents the comparison of the 1999 “actual” nonroad source emission inventory to the 2002 “projected” and “actual” nonroad source inventory.

The 2002 “actual” inventory differs significantly from the 1999 “actual” and 2002 “projected” inventories because different versions of the USEPA NNEM were used to calculate each inventory. The 2002 “actual” inventory was calculated using version 2.3c (April 2004) of the NNEM while version 2.1 (December 1998) was used to prepare the other two inventories. Also, a new methodology for calculating the emissions from commercial marine vessels was used for the 2002 “actual" inventory, as discussed below in a separate section.

Comparison of the 2002 “actual” inventory to the other inventories indicates that emissions estimates of VOCs and carbon monoxide are currently higher while emissions estimates of NOx are currently lower. The primary increase in VOCs is due to the modeled emissions from outboards and personal watercraft, which is substantially different due to revised population data as further explained below. The reductions in NOx emissions are a result of the use of the newer NONROAD version as well as the new methodology for the estimation of emissions from commercial marine vessels. In addition, there was a reduction in NOx in aircraft LTO emissions which reflects the use of the updated 2003 FAA EDMS. Previously, an older version of the NESCAUM aircraft emissions model was used to determine these emissions for just Newark and Teterboro airports because only these airports supplied fleet mix data for the emission inventory year of 1996. The 1996 LTO emissions for every other airport had to be determined by application of the USEPA default emission factors.[[17]](#footnote-17) These default emission factors generate very conservative emissions in comparison to the more accurate EDMS model.

The increase in carbon monoxide emissions in the 2002 “actual” inventory is attributed to changes in the NNEM. The most significant impact upon these emissions is noticed in SCCs having 4-stroke gasoline-fueled engines, where in some cases the calculated carbon monoxide values increased by 20-121 percent. This was also found to have occurred in emissions estimates for Industrial Forklifts fueled by liquefied petroleum gas. In most of these source classes, there was also an increase in population. SCCs significantly impacted in this manner include: Inboard/Sterndrive Pleasure Craft, Commercial Pumps, Commercial Rotary Tillers <6 Horsepower, Commercial Welders, Commercial Pressure Washers, Residential Lawn Mowers, Commercial Lawn and Garden Tractors, Generator Sets, Residential Lawn and Garden Tractors, Offroad Motorcycles, Commercial Turf Equipment, and Industrial Forklifts fueled by liquefied petroleum gas.

As shown in the graphs in Attachment 2, there are significant differences amongst certain SCCs for VOC and NOx emissions between the 1996 inventory and the 2002 inventory. These differences, except for watercraft as characterized below, are attributed to revisions in the newer model whereby a combination of emissions, usage, load, and other factors resulted in a net increase in estimated outputs. Since the newer versions of the NONROAD (v2.3c) draft model are generally accepted to produce more accurate accountings of emissions, it is believed that the differences found when comparing the 2002 inventory against the 1996 inventory are primarily a result of the model revisions. Also contributing to these differences is the phasing-in of emissions standards for small engines, which produces a reduction in VOC emissions. Other notable differences in the 2002 inventory are reduced VOC emissions from small 4-stroke gasoline engines caused by new engine emissions standards, increased VOC emissions from small 2-stroke engines attributed to emission factor and population revisions, and reduced NOx emissions from diesel-powered equipment attributed to model revisions.

Pollutants from watercraft powered by 2-stroke engines increased significantly. The primary cause of the increase is attributed to revised population files in the newer model versions. The NONROAD v2.3c draft model equipment population file for New Jersey contains a significantly greater population of pleasure craft with outboard 2-stroke engines and personal watercraft with 2-stroke engines when compared to the earlier NONROAD v2.1 model used to compile the 1996 inventory. The equipment population in NONROAD v2.1 for this source sector is 46,627 pleasure craft with outboard 2-stroke engines as the statewide population, whereas NONROAD v2.3c draft model population for this SCC is 305,978. The population of personal watercraft with 2-stroke engines changed from 5,552 in the NNEM to 41,364 in NONROAD v2.3c.

The 2002 VOC, NOx, carbon monoxide, SO2, PM2.5,and PM10 area source inventories were compared to the 1999 USEPA NEI inventories and the 2002 preliminary USEPA NEI 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. The USEPA 1999 NEI emissions for SO2 are significantly lower than the USEPA 2002 NEI v1 and the 2002 “actual” inventory. The reason for the difference may be that the USEPA used the “Lockdown C” draft version of the Nonroad Model (USEPA 2002) to generate emissions for SO2 for the 1999 NEI. In addition, the sulfur inputs used in the model are unknown. The differences between the 2002 NEI and 2002 “actual “ inventory are not significant.

Lastly, some SCCs for equipment powered by diesel engines may appear to have elevated emissions compared to the 1999 actual since the NONROAD v2.3c reports equipment powered by 2- and 4-stroke diesel engines without differentiation. In some instances the earlier NONROAD reported them separately in distinct SCCs. Thus, some minor elevations in emissions from diesel-powered equipment may be attributed to the lumping of 2- and 4-stroke diesel engines into singular SCCs.

Table 17: Statewide Nonroad Source Emissions Inventory Comparison

|  |  |  |  |
| --- | --- | --- | --- |
| **Summer**  **Controlled Emissions (Tons per Day)** | **New Jersey**  **1999**  **Actual** | **New Jersey**  **2002 Projected** | **New Jersey**  **2002**  **Actual** |
| **VOC** | 173.29 | 160.78 | 220.60 |
| **NOx** | 286.76 | 292.08 | 231.56 |
| **CO** | 2,081.57 | 2,050.28 | 2,497.80 |

|  |  |  |  |
| --- | --- | --- | --- |
| **Annual**  **Controlled Emissions (Tons per Year)** | **USEPA**  **1999**  **NEI** | **USEPA**  **2002**  **NEI v1** | **New Jersey**  **2002**  **Actual** |
| **VOC** | 70,740 | 79,793 | 70,407 |
| **NOx** | 57,296 | 65,864 | 66,443 |
| **CO** | 700,969 | 709,810 | 665,944 |
| **SO2** | 6,238 | 16,845 | 16,772 |
| **PM10** | 5,803 | 6,595 | 6,505 |
| **PM2.5** | 5,326 | 6,004 | 5,922 |
| **NH3** | 73 | 961 | 970 |

### ii. Aircraft Emissions

The 2002 Aircraft Fuel Combustion Emissions inventories have been reviewed for quality assurance purposes. The aircraft inventory is composed of 4 distinct inventory workbooks: Commercial Aviation Fuel Combustion, Military Fuel Combustion, Air Taxi Fuel Combustion, and General Aviation Fuel Combustion. Each inventory was reviewed as described below.

Methodology

The methodology used to prepare the 2002 actual inventory was compared against the one used to prepare the 1996 actual inventory. The 1996 inventory was chosen for comparison, because the 1999 inventory was a projection of the 1996 base year inventory, and therefore is also a reflection of the growth factors chosen, in addition to the methodologies used to calculated emissions. For non-military emission calculations, the primary difference between the two inventory methodologies was that two different models were used to generate emissions, both based on LTOs. The 1996 inventory relied upon the airport model developed by NESCAUM; the 2002 inventory used the EDMS developed by the Federal Aviation Administration. EDMS is the more advanced model and incorporates detailed factors for each specific aircraft type. EDMS also factors local fuel consumption in generating local emissions.

For military aircraft emission calculations for McGuire, the 1996 actual inventory was calculated by securing LTO and Touch and Go operation (TGO) information from McGuire as well as information on time-in-mode, number of engines and emission factors. For the 2002 actual inventory, McGuire supplied the LTO and TGO information and the remaining data was obtained from *Air Emission Inventory Guidance for Mobile Sources at Air Force Installations*, January 2002. The data contained in this report was an update for the data previously supplied directly by McGuire in 1996 and is a direct result of the Air Force’s attempt to standardize and formalize such data. What was different was a change in fleet mix that included larger aircraft with higher emission factors in 2002 then in 1996.

Calculations

The calculations were followed through their respective Microsoft Excel workbooks and the series of calculations necessary to arrive at the total inventory. Samples of each inventory component on a spreadsheet page were checked to ensure that the formulas conformed to the methodology. References to other worksheets were sampled to ensure proper referencing and correct inputs into the calculations.

Comparison of Inventories

The emissions of VOC, NOx, and carbon monoxide were totaled from the five Excel workbooks and compared against the total aircraft emissions from the 1996 actual and 2002 projected inventories. The primary factor contributing to the difference between the 2002 projected and 2002 actual emissions is believed to be the change in models used in calculating 2002 projected inventories as compared to the 2002 actual inventory. Table 18 below shows these values. In addition, LTO activity in the 2002 actual inventory as compared to the 2002 projected inventory was lower, by nearly 21%.

Table 18 also shows a comparison of the 2002 SO2, PM2.5,and PM10 inventories against the 1999 USEPA NEI inventories and the 2002 preliminary USEPA NEI inventories. The USEPA 2002 NEI v1 emissions are grown from the New Jersey 1999 actual emissions inventory submittal. This actual emission inventory relied on the same methodology conducted in 1996. Thus the New Jersey 2002 actual emission inventory is more accurate since it was based on updated methodology.

Table 18: Statewide Aircraft Emissions Inventory Comparison

|  |  |  |  |
| --- | --- | --- | --- |
| Controlled Emissions (Tons per Day) | **New Jersey**  **1996**  **Actual** | **New Jersey**  **2002 Projected** | **New Jersey**  **2002**  **Actual** |
| **VOC** | 5.80 | 7.03 | 3.81 |
| **NOx** | 10.11 | 16.99 | 8.97 |
| **CO** | 35.35 | 40.37 | 27.19 |

|  |  |  |  |
| --- | --- | --- | --- |
| **Controlled Emissions (Tons per Year)** | **USEPA**  **1999**  **NEI** | **USEPA**  **2002**  **NEI v1** | **New Jersey**  **2002**  **Actual** |
| **SO2** | 218 | 366 | 283 |
| **PM10** | 56 | 272 | 272 |
| **PM2.5** | 38 | 126 | 188 |
| **NH3** | NC(1) | NC | NC |

NOTES:

(1) NC = Not Calculated

### iii. Locomotive Emissions

The 2002 Locomotive Fuel Combustion Emissions inventory has been reviewed for quality assurance purposes. The inventory was reviewed as described below.

Methodology

The methodology used to prepare the 2002 locomotive inventory was compared against the one used for the 1996 actual inventory. The 1996 inventory was chosen for comparison, because the 1999 inventory was a projection of the 1996 base year inventory, and therefore is also a reflection of the growth factors chosen, in addition to the methodologies used to calculated emissions. The 2002 actual inventory differed from the 1996 actual in the methods used to calculate “yard” or “switch” locomotives and updated emission factors were used in 2002 and more detailed information was provided on line-haul freight locomotive operations then had been available in 1996.

The 1996 method for switching yard locomotive emissions used standard annual emissions allocations for each pollutant based on the number of locomotives operating at the yards indicated by Conrail for the 1990 inventory. For example, a single yard locomotive was considered to generate 41 tons of NOx and 2 tons of VOC emissions on an annual basis regardless of whether this locomotive may have only operated forty hours a week. The 2002 method would assess emissions of 0.32 tons of VOC and 8.64 tons of NOx for the same operation. Thus the 1996 method greatly overestimated yard-switching emissions.

The period from 1996 to 2002 reflects an emission factor increase for all line-haul freight and passenger locomotive engines of 21% for NOx, 6.3% for carbon monoxide and 4% for VOC. This difference in emission factors was offset by a 17.6% decrease in fuel consumption for all line haul locomotives from 1996 to 2002.

The 2002 method also included more detailed information concerning major line haul railroad operations conducted in New Jersey in 2002. For example, Gross Tonnage (GT) of freight transported by major line haul freight railroads along each measured mile of rail line could be determined from the detailed information provided by the major line haul railroads for the 2002 inventory. For example, CSX railroad indicated that in 2002 it transported 59,160,000 GT of freight along 16.8 miles of its River line located in Bergen and Hudson Counties. All major railroads provided similar detailed information for the majority of their rail line operations in New Jersey. In 1996, the only activity data available for major line haul freight operations was that 4,871,067 GT of freight were transported along 948 miles of rail lines within the State.

Calculations

The calculations were followed through their respective Microsoft Excel spreadsheets and the series of calculations necessary to arrive at the total inventory. Samples of each inventory component on an Excel spreadsheet page were checked to ensure that the formulas conformed to the methodology. References to other worksheets were sampled to ensure proper referencing and correct inputs into the calculations.

Comparison of Inventories

The 2002 actual emission inventory showed a very slight increase in NOx emissions and a small decrease in VOC and carbon monoxide emissions from what was projected for this year from the 1996 actual emission inventory as shown below in Table 19. The 2002 emission inventory is more accurate since it was based on the updated methodology and more detailed activity data as referenced above in the methodology section.

Table 19 also shows a comparison of the 2002 SO2, PM2.5,and PM10 inventories against the 1999 USEPA NEI inventories and the 2002 preliminary USEPA NEI inventories. The USEPA 2002 NEI v1 emissions are grown from the New Jersey 1999 actual emissions inventory submittal. This actual emission inventory relied on the same methodology conducted in 1996. Thus, the NJ 2002 actual emission inventory is more accurate since it was based on the updated methodology and more detailed activity data.

Table 19: Statewide Locomotive Emissions Inventory Comparison

|  |  |  |  |
| --- | --- | --- | --- |
| **Controlled Emissions (Tons per Day)** | **New Jersey**  **1996**  **Actual** | **New Jersey**  **2002 Projected** | **New Jersey**  **2002**  **Actual** |
| **VOC** | 0.82 | 0.82 | 0.60 |
| **NOx** | 14.44 | 13.51 | 15.70 |
| **CO** | 2.01 | 2.01 | 1.55 |

|  |  |  |  |
| --- | --- | --- | --- |
| **Controlled Emissions (Tons per Year)** | **USEPA 1999 NEI** | **USEPA 2002 NEI v1** | **New Jersey 2002 Actual** |
| **SO2** | 16 | 351 | 351 |
| **PM10** | 14 | 142 | 142 |
| **PM2.5** | 137 | 127 | 127 |
| **NH3** | NC(1) | NC | NC |

NOTES:

(1) NC = Not Calculated

### iv. Commercial Marine Vessel Emissions

The 2002 Marine Fuel Combustion emissions inventory has been reviewed for quality assurance purposes. As discussed in a previous section, it is important to note that there are two inventories for this purpose:

1. For South Jersey, the “old method”, based upon fuel consumption, was used, and
2. For North Jersey, the “new method”, based upon vessel usage, was used.

Each inventory was reviewed as described below.

Methodology

The methodology used to prepare the 2002 commercial marine vessel inventory was compared against the one used for the 1996 actual inventory. The 1996 inventory was chosen for comparison because the 1999 inventory was a projection of the 1996 base year inventory, and therefore is also a reflection of the growth factors chosen, in addition to the methodologies used to calculated emissions. The methods applied were based on fuel usage for activity conducted on the territorial waters of New Jersey in the Delaware River and vessel usage for activity conducted on the territorial waters of New Jersey in the New York Harbor system. The fuel usage method was the same one used for the 1996 actual inventory. The new methodology, based upon vessel usage, was incomparable to the 1996 method.

Calculations

The calculations (old and new methods) were followed through their respective Excel spreadsheets and the series of calculations necessary to arrive at the total inventory. Samples of each inventory component on an Excel spreadsheet page were checked to ensure that the formulas conformed to the methodology. References to other worksheets were sampled to ensure proper referencing and correct inputs into the calculations.

Comparison of Inventories

The 2002 new method showed significant reductions of forty-five percent NOx, thirty-two percent carbon monoxide and forty-seven percent VOC emissions as compared to the 1996 inventory and the 2002 projections as shown below in Table 20. This was expected as the new method is a much more accurate assessment of marine source combustion within the territorial waters of New Jersey in the New York Harbor system. The old methodology based on fuel consumption most likely included estimates of fuel combustion that did not take place in the New York Harbor system, i.e., ships refueled before setting to sea and therefore, most of the fuel purchased was not combusted in the New York Harbor system. Moreover, this geographic area generates the major portion of the commercial marine vessel emission inventory.

Table 20 also shows a comparison of the 2002 SO2, PM2.5,and PM10 inventories against the 1999 USEPA NEI inventories and the 2002 preliminary USEPA NEI inventories. The USEPA 2002 NEI v1 emissions are grown from the New Jersey 1999 actual emissions inventory submittal. This actual emission inventory relied on the same methodology conducted in 1996. Thus, the New Jersey 2002 actual emission inventory is more accurate since it was based on the updated methods.

Table 20: Statewide Commercial Marine Vessel Emissions Inventory Comparison

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Controlled Emissions**  **(Tons per Day)** | **New Jersey**  **1996**  **Actual** | **New Jersey**  **2002 Projected** | **New Jersey**  **2002**  **Actual**  **(Old Method)** | **New Jersey**  **2002**  **Actual**  **(New Method)** |
| **VOC** | 2.20 | 2.33 | 2.13 | 1.13 |
| **NOx** | 52.34 | 55.53 | 54.59 | 30.12 |
| **CO** | 5.82 | 6.17 | 5.67 | 3.90 |

|  |  |  |  |
| --- | --- | --- | --- |
| **Controlled Emissions**  **(Tons per Year)** | **USEPA**  **1999**  **NEI** | **USEPA**  **2002**  **NEI v1** | **New Jersey**  **2002**  **Actual** |
| **SO2** | 1,676 | 11,444 | 11,444 |
| **PM10** | 474 | 796 | 851 |
| **PM2.5** | 436 | 732 | 783 |
| **NH3** | NC(1) | NC | NC |

NOTES:

(1) NC = Not Calculated

## E. Biogenic Sources

The 1996 biogenic emission inventory was supplied to the NJDEP by the USEPA. They calculated the inventory using the BEIS model v2.3 and 1996 land use and meteorological data.

The 2002 biogenic emission inventory was also supplied to the NJDEP by the USEPA. They calculated the inventory using the BEIS model v3.12. The inventory was created using the following data:

1. 2001 annual meteorology
2. BEIS3.12 model via the SMOKE modeling system

3)Recently revised BEIS3.12 emission factors file (also provided as a separate

file with this spreadsheet)

4) BELD3 land use data (1-km original data aggregated to 36-km grid).

5) Post processing summation of county-total emissions from SMOKE, calculated from 36-km gridded emissions using the "land area" spatial surrogate. This means that when calculating the county-total numbers, the 36-km gridded emissions were assumed to be uniformly distributed over the grid cell for purposes of mapping to the counties.

The USEPA did not provide the NJDEP with actual data used for either the 1996 or the 2002 inventories, so it is difficult to discuss the decrease in VOC and NOx emissions in the 2002 inventory. The comparison of these two inventories can be found in Table 21.

Table 21: Statewide Biogenic Source Emissions Inventory Comparison

|  |  |  |
| --- | --- | --- |
| **Controlled Emissions** | **1996**  **Actual**  **(Tons per Day)** | **2002**  **Actual(1)**  **(Tons per Day)** |
| **VOC** | 687.52 | 371.95 |
| **NOx** | 8.81 | 3.78 |
| **CO** | NC(2) | 34.09 |
| **NH3** | NC | 24.73 |

NOTES:

(1) The USEPA only supplied Tons per Year values. In order to prepare this comparison it was assumed that biogenic emissions were constant over the year. Therefore, 2002 actual Tons per Day values were calculated by dividing the annual value by 365.24.

(2) NC = Not Calculated

## F. Emissions Comparison Summary

A comparison of the 1996 man-made emission inventory to the 2002 man-made emission inventory for New Jersey is presented in Table 22, by pollutant and source sector. The 1996 inventory was chosen for comparison, because the 1999 area source inventory and portions of the 1999 nonroad inventory were projections of the 1996 base year inventory, therefore are also a reflection of the growth factors chosen, in addition to the methodologies used to calculated emissions. This comparison shows the following:

* Total man-made VOC, summer tpd: Overall slight decrease, decreases in point and onroad, increases in area and nonroad
* Total man-made NOx summer tpd: Overall slight increase, slight decreases in point, area and nonroad, increase in onroad
* Total man-made carbon monoxide summer tpd: Overall increase, increases in point, area, nonroad and onroad.

More detailed discussions of increases and decreases were included above in the individual sector comparisons. Decreases are due primarily to federal and state rules. Increases are due primarily to changes in calculation and model methodologies and inputs, additions of new emission sources not previously included in the inventory, and growth of emissions from existing sources.

Table 22: 1996 and 2002 Statewide Emission Inventory by Source Sector and Pollutant

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **VOC** | | NOx | | **CO** | |
| **Source Sector** | **1996 Tons per Summer Day** | **2002 Tons per Summer Day** | **1996 Tons per Summer Day** | **2002 Tons per Summer Day** | **1996 Tons per Summer Day** | **2002 Tons per Summer Day** |
| Point | 173.22 | 113.15 | 291.05 | 280.36 | 78.45 | 91.33 |
| Area | 304.98 | 369.83 | 39.66 | 35.92 | 26.89 | 66.45 |
| On-road | 309.01 | 274.74 | 453.82 | 558.66 | 2,182.99 | 2,856.37 |
| Non-road | 203.73 | 220.60 | 269.24 | 231.56 | 2,152.25 | 2,497.80 |
|  |  |  |  |  |  |  |
| **Total in State** | 990.94 | 978.32 | 1,053.77 | 1106.50 | 4,440.58 | 5,511.95 |

1. 70 Fed. Reg. 44470 (August 3, 2005). [↑](#footnote-ref-1)
2. SO2 has been reported in the inventory instead of SOx as required in the Consolidated Emissions reporting Rule because the USEPA MOBILE and NON-ROAD models and the majority of USEPA guidance on emission factors is based on SO2, not SOx. In addition, the USEPA National Emissions Inventory (NEI) reports SO2. [↑](#footnote-ref-2)
3. USEPA, 2004, “Documentation for the 2002 Nonpoint Source National Emission Inventory for Criteria and Hazardous Air Pollutants (January 2004 Version)”. [↑](#footnote-ref-3)
4. 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. [↑](#footnote-ref-4)
5. USEPA, “Emissions Inventory Guidance for Implementation of Ozone and Particulate Matter National Ambient Air Quality Standards (NAAQS) and Regional Haze Regulations”, June 2003. [↑](#footnote-ref-5)
6. 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. [↑](#footnote-ref-6)
7. Ibid. page 3. [↑](#footnote-ref-7)
8. Wildfire Activity Levels:  
   National Interagency Fire Center. http://www.nifc.gov. Fax received, fall 2000.

   U.S. Environmental Protection Agency, 1998. “National Air Pollutant Emission Trends,

   Procedures Document, 1900-1996.” USEPA-454/R-98-008.

   Emission Factors:Hegg D.A., Radke, L.F., and Hobbs P.V., 1988. “Ammonia Emissions from

   Biomass Burning. "Geophysical Research Letters, Vol. 15, No. 4 Pages 335-337.

   U.S. Environmental Protection Agency, 1998. “National Air Pollutant Emission Trends, Procedures

   Document, 1900-1996”, USEPA-454/R-98-008. [↑](#footnote-ref-8)
9. E.H. Pecan & Associates, Inc., 2004, “Technical Memorandum: MANE-VU 2002 Ammonia Emissions Inventory for Miscellaneous Sources”. [↑](#footnote-ref-9)
10. USEPA, 2004, “National Emission Inventory-Ammonia Emissions from Animal Husbandry Operations-raft Report”. [↑](#footnote-ref-10)
11. USEPA, 2004, “Documentation for the 2002 Nonpoint Source National Emission Inventory for Criteria and Hazardous Air Pollutants (January 2004 Version)”. [↑](#footnote-ref-11)
12. The State of New Jersey, Department of Environmental Protection, Enhanced Inspection and Maintenance (I/M) Program for the State of New Jersey, Revised Performance Standard Modeling, SIP Revision, November 27, 2002. [↑](#footnote-ref-12)
13. Starcrest Consulting Group, LLC, 2003, “The New York, Northern New Jersey, Long Island Nonattainment Area Commercial Marine Vessel Emissions Inventory” [↑](#footnote-ref-13)
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