

2011 BASE YEAR EMISSIONS INVENTORY

FOR THE
WASHINGTON DC-MD-VA
2008 OZONE NAAQS NONATTAINMENT AREA

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and
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**on behalf of the
Metropolitan Washington Air Quality Committee**

July 9, 2014

TABLE OF CONTENTS

1.0 INTRODUCTION	1-1
1.1 Overview and Background	1-1
1.2 8-Hour Ozone Nonattainment Geographic Area	1-2
1.3 Temporal Resolution.....	1-2
1.4 Quality Assurance Policy and Objectives.....	1-3
1.5 Plan Information Sources.....	1-3
1.6 Summary of the Base Year Emissions Inventory	1-4
1.7 Document Contents.....	1-4
 2.0 POINT SOURCES.....	 2-1
2.1 Introduction.....	2-1
2.2 Compilation and Documentation of Point Source Emissions.....	2-1
 3.0 AREA AND NONROAD SOURCES	 3-1
3.1 Introduction and Scope	3-1
3.2 Area Sources	3-1
3.2.1 Emission Estimation Approach.....	3-1
3.2.2 Summary of Emission Results	3-1
3.3 Nonroad Sources	3-3
3.3.1 Non-Nonroad Model Sources	3-3
3.3.1.1 Emission Estimation Approach.....	3-3
3.3.1.2 Summary of Emission Results	3-3
3.3.2 Nonroad Model Sources	3-4
3.3.2.1 Emission Estimation Approach.....	3-4
3.3.2.2 Summary of Emission Results	3-5
 4.0 ONROAD MOBILE SOURCES	 4-1
4.1 Introduction.....	4-1
4.2 Summary of Onroad Mobile Source Emissions.....	4-1
 5.0 QUALITY ASSURANCE PROCEDURES	 5-1
5.0 Quality Assurance Procedures	5-1
5.1 Reality Check/Peer Review Check	5-1
5.2 Sample Calculations.....	5-1
5.3 Sensitivity Analysis	5-1
5.4 Standard Range Checks	5-2
5.5 Corrective Action Plan.....	5-2

List of Tables

1-1	2011 Base Year SIP Emission Inventories	1-4
2-1	2011 Base Year SIP Point Source Emission Inventories	2-2
3-1	2011 Base Year SIP Area Source Emission Inventories	3-2
3-2	2011 Base Year SIP Non-Nonroad Model Source Emission Inventories	3-3
3-3	2011 Base Year SIP Nonroad Model Source Emission Inventories	3-5
4-1	2011 Base Year SIP Onroad Source Emission Inventories	4-2

List of Appendices

- A. Point Source Inventory Files
- B1. Area and Nonroad (Marine Vessels, Airport, Railroad Locomotives) Source Inventory Development Document (Maryland)
- B2. Area and Nonroad (Marine Vessels, Airport, Railroad Locomotives) Source Inventory Development Documents (Virginia)
- B3. Area and Nonroad (Marine Vessels, Airport, Railroad Locomotives) Source Inventory Development Documents (District of Columbia)
- B4. Area and Nonroad (Marine Vessels, Airport, Railroad Locomotives) Source Inventory Files
- C. NMIM2008 (NONROAD Model) Input & Output Files
- D1. Onroad Mobile Source Development Document
- D2. MOVES2010a (Onroad Mobile Model) Input & Output Files
- E. Public Hearing Notices, Comments, and Responses

1.0 Introduction

1.1 Overview and Background

This document contains a detailed explanation of the 2011 base year emissions inventory for stationary, area, nonroad, and mobile anthropogenic sources as well as biogenic sources in the Washington, DC-MD-VA 2008 ozone National Ambient Air Quality Standards (NAAQS) nonattainment area. The inventory will be included as part of the region's State Implementation Plan (SIP) to meet the above NAAQS. Annual anthropogenic emissions were estimated for volatile organic compound (VOC), nitrogen oxide (NO_x), carbon monoxide (CO), fine particles (PM_{2.5}-Pri), sulfur dioxide (SO₂), and ammonia (NH₃). Typical ozone season day emissions were developed for VOC, NO_x, and CO.

The federal Clean Air Act (CAA), 42 U.S.C.A § 7401 *et seq.*, as amended by the Clean Air Act Amendments of 1990, P.L. 101-549, (referred to hereafter as the Act), requires all areas of the nation to attain and maintain compliance with the NAAQS. These federal standards are designed to protect the public health and welfare from six criteria pollutants, one of which is ozone.

The Washington, DC-MD-VA 2008 ozone NAAQS nonattainment area was designated as a marginal nonattainment area by the United State Environmental Protection Agency (EPA) effective July 20, 2012 (Federal Register, Vol. 77, No. 98, May 21, 2012). This base year inventory is required by the Act at §7502(c)(3):

(3) **Inventory** – Such plan provisions shall include a comprehensive, accurate, current inventory of actual emissions from all sources of the relevant pollutant or pollutants in such area, including such period revisions as the Administrator may determine necessary to assure that the requirements of this part are met.

The Metropolitan Washington Council of Governments (MWCOG) prepared the nonroad and onroad portions of the inventory. MWCOG used EPA's nonroad mobile emissions model, NONROAD2008a (embedded in NMIM2008) to develop all nonroad emissions except for commercial marine vessels, aircraft, and locomotives. These three sectors were developed separately. MWCOG developed the 2011 onroad mobile inventory using EPA's MOVES2010a model.

Air quality staff of the District Department of the Environment (DDOE), Maryland Department of the Environment (MDE), and Virginia Department of Environmental Quality (VDEQ), herein referred to as "state air agencies," in collaboration with MWCOG, supplied area and point source emissions estimates.

EPA's estimates for biogenic emissions for the NEI2011 effort were accepted for the purposes of submission of the base year 2011 biogenic inventories. Methodology for

developing biogenic inventories is described in detail in the Technical Support Document for the NEI2011 effort.¹

Emissions inventory data is used in annual trends reports, SIP submittals, compliance demonstrations, emissions trading, emissions fee programs, and in modeling activities designed to evaluate ambient air concentrations encountered by the general public. For the SIP program, the emission inventory is a fundamental building block in developing an air quality control and maintenance strategy. Regulatory agencies rely on emission inventories as indicators of air quality changes and for setting permit requirements.

The end use of emission inventories requires that they be of the highest quality obtainable. These data are the foundation of air quality decisions. Inventory quality is critical to defining realistic regulations and attainment strategies.

1.2 2008 Ozone NAAQS Nonattainment Area Geography

Effective July 20, 2012, EPA designated the following jurisdictions in the Washington, DC-MD-VA area as nonattainment for the 2008 ozone NAAQS.

- District of Columbia
- Calvert County, Maryland
- Charles County, Maryland
- Frederick County, Maryland
- Montgomery County, Maryland
- Prince George's County, Maryland
- Arlington County, Virginia
- Alexandria City, Virginia
- Fairfax County, Virginia (includes the independent cities of Fairfax and Falls Church)
- Loudoun County, Virginia
- Prince William County, Virginia (includes the independent cities of Manassas and Manassas Park)

1.3 Temporal Resolution

Another step of inventory development is the temporal allocation of emissions. The temporal allocation is an accounting of emission variations over time. The simplest temporal allocation is for a steady-state emissions source that continually releases emissions at the same rate throughout the year. Under actual conditions, however, steady-state emission sources are quite rare. Instead, under actual conditions, emissions sources may operate only in the winter, not operate on Sundays, or their activity may peak during certain hours of the day. The temporal allocation of emissions must reflect as accurately as possible the reality of emissions occurring to the atmosphere. Ozone formation depends on the presence of ozone precursors as well as the amount of sunlight and other

¹ EPA NEI2011 Web-site - <http://www.epa.gov/ttnchie1/net/2011inventory.html>

meteorological impacts. Since ozone is typically a summertime pollutant, emissions during the summer months are more important to air quality than are emissions during other times of the year. For these reasons, ozone precursor base year emissions are represented as typical ozone season daily emissions (ozone season tons per day). The planning period for the 2008 ozone NAAQS emissions inventory covers the ozone season defined as May through September. For the purpose of submitting the base year 2011 SIP inventory to EPA, annual emissions are estimated for VOC, NO_x, CO, PM_{2.5}-Pri, SO₂, and NH₃. Ozone season day emissions are estimated for the ozone precursors of VOC, NO_x, and CO.

1.4 Quality Assurance Policy and Objectives

In order to provide data of sufficient quality for attainment and maintenance planning needs, quality assurance (QA) and quality control (QC) procedures are part of the inventory process. The procedures address data quality objectives of accuracy, completeness, comparability, and representativeness. The target goals for each objective are listed below.

Accuracy: All estimates must be calculated and documented using acceptable methods. Individual source requirements and availability of data and resources will affect the estimation method selection.

Completeness: Completeness is addressed by ensuring that all applicable source categories are included in the inventory and that all information required to estimate emissions is present.

Comparability: Data will be compared to the most recent base year inventory: 2011 National Emissions Inventory (NEI) for VOC, NO_x, and CO. Any discrepancies (data outliers) must be verified or corrected.

Representativeness: Actual 2011 annual and the typical ozone season day emissions will be calculated for the base year inventory. Local data will be used in inventory calculations wherever possible.

1.5 Plan Information Sources

This plan draws upon inventory, quality assurance, and emissions projections guidance available from state and federal agencies and partnerships. The effort also draws upon experience gained during previous emission inventory reviews.

A primary source of emissions inventory data is the 2011 NEI, which was submitted to EPA by the state air agencies.

1.6 Summary of the Base Year Emissions Inventory

Summaries of the ozone precursor emissions in tons per day (TPD) and tons per year (TPY) for the Washington, DC-MD-VA 2008 ozone NAAQS nonattainment area are shown in Table 1-1. Summaries relating to the individual sections of the inventory, such as point sources, may be found at the beginning of the respective section. Slight differences between the executive summary table and the section tables are due to rounding.

Table 1-1
2011 Base Year SIP Emission Inventories
Washington, DC-MD-VA 2008 Ozone NAAQS Nonattainment Area

Source Category	VOC (TPD)	NO_x (TPD)	CO (TPD)	VOC (TPY)	NO_x (TPY)	CO (TPY)	PM_{2.5}-Pri (TPY)	SO₂ (TPY)	NH₃ (TPY)
Point	6.96	151.57	32.21	1,223.23	14,134.09	4,189.84	1,669.61	14,393.80	53.21
Area	134.86	2.39	31.67	46,333.16	8,827.77	42,671.86	11,582.23	3,910.64	3,573.82
Nonroad	70.80	77.08	841.96	18,661.42	24,036.39	215,002.54	2,018.93	961.98	25.55
On-road	82.35	205.48	894.98	28,981.19	71,099.71	355,846.05	2,771.45	420.83	1,625.23
Anthropogenic Subtotal	294.98	436.52	1,800.82	95,199.00	118,097.96	617,710.29	18,042.21	19,687.25	5,277.81

1.7 Document Contents

- Chapter 2 Presents the methodology for developing the 2011 ozone precursor emissions from point sources.
- Chapter 3 Presents the methodology for developing the 2011 ozone precursor emissions from area and nonroad sources.
- Chapter 4 Presents the methodology for developing the 2011 ozone precursor emissions from onroad mobile sources.
- Chapter 5 Presents the QA/QC plan for the 2011 ozone precursor emissions inventory.

The point, area, nonroad, and onroad source emissions inventory development documentation; detailed emissions by source classification code (SCC); and nonroad and onroad model input and output files are presented in Appendices A through D of this document.

2.0 Point Sources

2.1 Introduction

This section documents the development of the Washington, DC-MD-VA 2008 ozone NAAQS nonattainment area stationary point source emissions inventory. This section characterizes the point source component of the emissions inventory by describing the 2011 ozone season day and annual emissions estimation techniques. The point source inventory consists of actual emissions for a typical ozone season day and for the entire period in the year 2011. The inventory includes sources located within the Washington DC-MD-VA 2008 ozone NAAQS nonattainment area.

The state air agencies are responsible for developing point source emissions inventories and maintaining the data. MWCOG compiled the ozone season day and annual emissions data provided by the state air agencies for inclusion in this emissions inventory document.

2.2 Compilation and Documentation of Point Source Emissions

The state air agencies maintain substantial databases of both small and large air emission sources. The list of point sources in this inventory was developed by applying the appropriate thresholds to the emission levels in the databases to differentiate between point and area stationary sources. Sources with emission levels greater than the threshold or sources previously included in Periodic Emissions Inventory submittals are by definition point sources while sources with emissions levels less than the thresholds are by definition area sources.

For Virginia units, temporal allocation of emissions from annual to ozone season day was accomplished using EPA's generally accepted emissions calculation techniques for all point sources other than those units reporting emissions and activity data to the Clean Air Markets Division (CAMD) database under 40 CFR Part 75. For units reporting to CAMD, the hourly average NO_x emission rate for hours operated during the summer months of 2011 (May through September) was multiplied by 24 hours per day to calculate a typical ozone season daily rate in tons per day.

Full documentation on point sources and emissions in individual states are maintained by the respective state air agency responsible for the state in which the facility or source is located.

Appendix A provides a detailed description of the total point source emissions for the Washington, DC-MD-VA 2008 ozone NAAQS nonattainment area.

Table 2-1
2011 Base Year SIP Point Source Emission Inventories
Washington, DC-MD-VA 2008 Ozone NAAQS Nonattainment Area

Point Source Emissions – Base Year 2011 SIP Emission Inventory																	
Metropolitan Washington NAA ¹																	
Pollutant	Calvert County	Charles County	Fredrick County	Montgomery County	Prince George's County	Arlington County	Fairfax County	Fairfax City	Fairs Church City	Loudoun County	Prince William County	Manassas City	Alexandria City	District Of Columbia	MD Total	VA Total	NAA Total
Tons per ozone season day																	
VOC	0.07	0.76	0.49	0.36	1.34	0.07	1.37	0.36	0.0002	1.02	0.73	0.14	0.06	0.19	3.02	3.75	6.96
NO _x	1.28	28.15	0.68	14.53	50.05	0.87	18.83	0.04	0.01	10.02	12.96	1.03	11.74	1.39	94.70	55.48	151.57
CO	0.43	2.41	0.80	3.28	6.88	0.36	12.12	0.05	0.0005	2.46	1.61	0.29	0.55	0.98	13.79	17.44	32.21
Tons per year																	
VOC	6	103	125	44	194	9	243	131	0.003	89	156	41	11	70.84	472.42	679.96	1,223.23
NO _x	48	1,421	87	2,611	5,020	75	2,149	7	0.07	216	724	21	1,052	702.88	9,187.12	4,244.09	14,134.09
CO	9	698	127	490	942	49	800	16	0.01	207	252	24	136	438.86	2,266.33	1,484.65	4,189.84
PM _{2.5} -Pri	4	595	22	146	578	0.09	28	0.04	-	2	178	10	50	55.44	1,344.75	269.42	1,669.61
SO ₂	0.25	5,715	14	1,275	5,811	16	141	0.04	0.01	13	320	3	515	569.92	12,815.23	1,008.65	14,393.80
NH ₃	-	1	-	2	1	-	-	-	-	-	43	6	0.23	0.00	4.12	49.09	53.21

¹ There are no VOC, NO_x, CO, PM_{2.5}-Pri, SO₂, and NH₃ emissions for the Virginia Independent City of Manassas Park.

3.0 Area and Nonroad Sources

3.1 Introduction and Scope

This document contains a detailed explanation of how the 2011 emissions inventory for area and nonroad sources of VOC, NO_x, CO, PM_{2.5}-Pri, SO₂, and NH₃ was developed. Emissions inventories for area and a few nonroad sources - marine vessels, airport, railroad locomotives (MAR) - for a typical ozone season day and the entire year in 2011 were prepared by the state air agencies. The MWCOC staff developed emissions for remaining nonroad sources using NMIM2008 software. The MWCOC staff also compiled this information for inclusion in this base year inventory document.

Area sources include stationary sources not part of the states' point source inventories, usually because the source type is too small to be tracked individually and is instead tracked as a group or category. Nonroad sources include equipment that draws power from engines for purposes other than movement on the highway system. Examples include lawn and garden equipment, construction equipments, recreational boating, etc.

All questions or comments regarding the area and MAR emissions in this document should be directed to the respective state air agency.

3.2 Area Sources

3.2.1 Emission Estimation Approach

The state air agencies provided detailed documentation regarding the development of emissions for area sources. This information is located in Appendix B1, B2, and B3 respectively.

3.2.2 Summary of Emission Results

Table 3-1 lists emissions for the counties and cities in the Washington, DC-MD-VA 2008 ozone NAAQS nonattainment area. Appendix B4 is an electronic attachment that provides the detail of these emissions data.

Table 3-1
2011 Base Year SIP Area Source Emission Inventories
Washington, DC-MD-VA 2008 Ozone NAAQS Nonattainment Area

Jurisdiction	VOC (TPD)	NO_x (TPD)	CO (TPD)	VOC (TPY)	NO_x (TPY)	CO (TPY)	PM_{2.5}-Pri (TPY)	SO₂ (TPY)	NH₃ (TPY)
District of Columbia	12.98	0.01	0.25	4,212.49	1,357.18	867.30	381.41	981.52	147.06
Calvert County	2.09	0.06	1.93	679.34	94.11	1,024.79	253.26	91.97	45.79
Charles County	3.78	0.16	5.38	1,248.73	227.22	2,622.87	536.67	183.29	69.93
Frederick County	6.59	0.16	5.46	2,141.56	399.37	3,129.81	1,042.75	284.57	1,489.06
Montgomery County	23.03	0.04	1.94	7,458.41	1,555.02	4,869.65	1,867.42	379.72	344.29
Prince George's County	20.24	0.08	2.57	6,592.32	1,271.14	4,721.60	1,261.01	361.60	296.99
Maryland Total	55.73	0.50	17.29	18,120.37	3,546.87	16,368.72	4,961.11	1,301.15	2,246.06
Arlington County	5.50	0.09	0.35	2,130.12	402.11	2,643.68	567.74	158.45	54.56
Fairfax County	30.55	0.89	3.23	11,102.29	1,955.18	11,216.08	2,657.38	802.35	413.07
Fairfax City	1.20	0.02	0.05	399.62	52.38	243.70	82.71	20.39	15.17
Falls Church City	0.43	0.01	0.02	153.61	26.41	142.47	51.63	10.17	10.94
Loudoun County	9.50	0.37	2.73	3,414.28	532.15	3,653.13	1,273.07	225.16	391.60
Prince William County	13.10	0.32	7.25	4,754.46	585.35	6,107.55	1,245.42	258.13	242.86
Manassas City	1.31	0.05	0.12	467.47	75.62	371.29	105.04	31.79	13.52
Manassas Park City	0.44	0.01	0.04	159.42	19.62	125.14	27.05	8.86	4.44
Alexandria City	4.11	0.12	0.34	1,419.04	274.90	932.79	229.67	112.68	34.55
Virginia Total	66.15	1.88	14.13	24,000.30	3,923.72	25,435.84	6,239.71	1,627.97	1,180.71
Region Total	134.86	2.39	31.67	46,333.16	8,827.77	42,671.86	11,582.23	3,910.64	3,573.82

3.3 Nonroad Sources

Emissions for nonroad sources other than MAR were estimated using EPA's NONROAD2008 model embedded in the NMIM2008 software. Emissions estimation approaches for both categories of nonroad sources are described below.

3.3.1 Marine Vessels, Airport, Railroad Locomotives

3.3.1.1 Emission Estimation Approach

Detailed documentation for the development of MAR emissions were provided by the state air agencies. The state-specific documentation may be found in Appendix B1, B2, and B3, respectively.

3.3.1.2 Summary of Emission Results

Table 3-2 lists emissions for counties and cities in the Washington, DC-MD-VA 2008 ozone NAAQS nonattainment area. Detailed emissions breakdowns may be found in electronic format in Appendix B4 of this document.

Table 3-2
2011 Base Year SIP MAR Emission Inventories
Washington, DC-MD-VA 2008 Ozone NAAQS Nonattainment Area

Jurisdiction	VOC (TPD)	NO_x (TPD)	CO (TPD)	VOC (TPY)	NO_x (TPY)	CO (TPY)	PM_{2.5}-Pri (TPY)	SO₂ (TPY)	NH₃ (TPY)
District of Columbia	0.23	3.01	2.52	25.64	330.63	62.86	8.67	13.28	0.002
Calvert County	0.09	2.54	0.29	31.94	925.76	105.68	-	500.74	-
Charles County	0.04	0.08	0.66	15.41	30.72	241.69	0.78	2.23	-
Frederick County	0.22	1.25	4.39	80.80	456.17	1,603.02	12.16	10.51	-
Montgomery County	0.09	0.96	1.31	33.00	351.36	478.24	9.95	3.12	-
Prince George's County	0.24	1.17	1.44	86.38	427.36	525.66	8.54	15.68	-
Maryland Total	0.68	6.00	8.09	247.54	2,191.37	2,954.29	31.43	532.27	-
Arlington County	0.57	3.73	6.33	209.40	1360.76	2309.77	34.81	159.37	0.01
Fairfax County	0.06	0.99	0.26	22.61	359.65	95.43	10.38	6.51	0.09
Loudoun County	0.76	5.20	8.47	279.17	1898.57	3089.74	50.08	194.12	-
Prince William County	0.04	0.80	0.15	15.98	291.55	55.63	8.78	3.67	0.10
Manassas City	0.02	0.04	0.66	8.34	16.21	240.13	5.02	0.95	0.01
Manassas Park City	0.0002	0.004	0.0006	0.08	1.48	0.24	0.05	0.02	0.0007
Alexandria City	0.02	0.39	0.10	8.90	141.97	35.14	4.18	1.78	0.03
Virginia Total	1.49	11.15	15.96	544.48	4,070.20	5,826.08	113.31	366.42	0.24
Region Total	2.40	20.16	26.58	817.65	6,592.20	8,843.22	153.41	911.97	0.24

Note: The cities of Fairfax and Falls Church, located within the Commonwealth of Virginia, did not have any 2011 emissions from the MAR category.

3.3.2 Nonroad Model Sources

Nonroad model sources include a varied collection of equipment using power from engines for purposes other than locomotion on highways. Nonroad emissions result from the use of fuel in this diverse collection, which includes vehicles and equipments in the following categories:

- Recreational vehicles, such as all-terrain vehicles and off-road motorcycles;
- Logging equipment, such as chain saws;
- Agricultural equipment, such as tractors;
- Construction equipment, such as graders and backhoes;
- Industrial equipment, such as fork lifts and sweepers;
- Residential and commercial lawn and garden equipment, such as leaf and snow blowers.

3.3.2.1 Emission Estimation Approach

Except for equipment in the MAR category, the inventory for nonroad mobile sources was developed using the most current version of EPA's NONROAD model as embedded in the National Mobile Inventory Model (NMIM). The NONROAD model includes more than 80 basic and 260 specific types of nonroad equipment and further stratifies equipment types by horsepower rating. Fuel types include gasoline, diesel, compressed natural gas (CNG), and liquefied petroleum gas (LPG).

EPA's NMIM2008 software (version NMIM20090504), the revised NMIM County Database (NCD20130531_nei2011v1), and the NONROAD2008a model (July 2009 version) were used to estimate the 2011 annual and average ozone season day emissions for VOC, NO_x, CO, SO₂, PM_{2.5}-Pri, and NH₃ for the purposes of creating the base year 2011 emissions inventory. The NONROAD2008a model estimates emissions for each specific type of nonroad equipment by multiplying the following input data estimates:

- Equipment population for the base year, distributed by age, power, fuel type, and application;
- Average load factor expressed as average fraction of available power;
- Available power in horsepower;
- Activity in hours of use per year; and
- Emission factors reflecting deterioration and/or new standards.

The emissions are then temporally and geographically allocated using appropriate allocation factors.

Several input files provide necessary information to the model. These input files include information such as: emission factors, base year equipment population, activity, load factors, average lifetime, scrappage function, growth estimates, and geographic and temporal allocations. Default values are provided for all input files. The user may replace the default data files when better information becomes available, either from EPA for national defaults or from local sources for locality-specific data.

The NMIM2008 software was run for all twelve months in 2011 to develop average ozone season day and annual emissions for the cities and counties in the Washington, DC-MD-VA 2008 ozone NAAQS nonattainment area. All emissions sources in the software (except for ground support equipment in Virginia) were included in the run. Ground support equipment emissions were provided by the VDEQ staff separately. Average ozone season day emissions were estimated by dividing total emissions in July by the total number of days (31) in July. Emissions for all twelve months in 2011 were added together to develop annual emissions. Model inputs (temperature, fuel, and other parameters) used in this analysis were included in the NMIM county database mentioned above and were the same as the inputs used in developing the 2011 NEI for the NMIM model sources. The above NMIM county database was acquired from EPA's website (file name '2011nei_supdata_nonroad.zip' under "Supporting data and summaries") for the NEI 2011(ver 1) effort.¹ The 2011 NEI Technical Support Document (ver 1) available on the above website provides details of the development of various inputs included in the database.

3.3.2.2 Summary of Emission Results

Table 3-3 lists emissions for different counties and cities in the Washington, DC-VA-MD ozone nonattainment region. Detailed NMIM2008 software input and output files are being provided separately in electronic format as Appendix C of this document.

Table 3-3
2011 Base Year SIP Nonroad Model Source Emission Inventories
Washington, DC-MD-VA 2008 Ozone NAAQS Nonattainment Area

Jurisdiction	VOC (TPD)	NO_x (TPD)	CO (TPD)	VOC (TPY)	NO_x (TPY)	CO (TPY)	PM_{2.5}-Pri (TPY)	SO₂ (TPY)	NH₃ (TPY)
District of Columbia	5.28	7.52	46.75	1,250.21	2,364.45	11,995.60	203.88	6.21	2.85
Calvert County	2.56	1.51	15.48	494.70	373.37	3,249.72	30.13	0.95	0.50
Charles County	4.22	2.64	24.71	868.47	696.76	5,408.72	62.62	1.81	0.92
Frederick County	4.27	3.57	49.91	1,126.46	1,061.06	12,727.80	115.73	3.03	1.49
Montgomery County	14.37	8.87	184.54	3,858.80	2,733.86	46,762.90	333.43	8.41	4.48
Prince George's County	9.18	7.78	112.16	2,432.58	2,442.06	28,757.50	257.83	7.04	3.53
Maryland Total	34.59	24.37	386.79	8,781.01	7,307.11	96,906.64	799.74	21.23	10.92
Arlington County	1.58	3.41	19.41	437.65	1,084.95	5,081.42	98.33	2.84	1.32
Fairfax County	13.85	9.34	189.70	3,798.92	2,903.94	48,445.20	345.98	8.87	4.72
Fairfax City	0.42	0.16	6.74	110.12	49.70	1,666.93	7.45	0.18	0.11
Falls Church City	0.25	0.09	3.81	70.06	26.32	970.22	4.48	0.10	0.06
Loudoun County	6.05	6.88	84.38	1,705.36	2,104.36	21,346.70	230.58	5.92	2.96
Prince William County	4.81	4.52	54.81	1,259.37	1,390.18	13,726.70	149.29	3.91	1.96
Manassas City	0.23	0.17	3.58	66.83	60.63	1,018.76	4.84	0.19	0.08
Manassas Park City	0.23	0.08	3.56	65.52	25.71	912.24	4.29	0.10	0.06
Alexandria City	1.10	0.39	15.86	298.73	126.84	4,088.91	16.66	0.45	0.26
Virginia Total	28.53	25.03	381.85	7,812.56	7,772.63	97,257.07	861.89	22.57	11.53
Region Total	68.40	56.92	815.39	17,843.77	17,444.19	206,159.31	1,865.52	50.01	25.31

¹ EPA NEI 2011 Website - <http://www.epa.gov/ttn/chief/net/2011inventory.html#inventorydoc>

4.0 Onroad Mobile Sources

4.1 Introduction

The MOVES2010a model was used for developing the onroad mobile annual and average ozone season day base year 2011 emissions for the Washington, DC-MD-VA 2008 ozone NAAQS nonattainment area. Appendix D1 provides more detailed documentation on data sources and methodologies used to develop different inputs. MOVES2010a input files, external input files, and output files are provided separately in electronic format as Appendix D2.

Metropolitan Washington Air Quality Committee (MWAQC) staff developed meteorology inputs and coordinated with the state air agencies to acquire fuel and inspection and maintenance program inputs for the MOVES2010a model. MWAQC staff provided these inputs to the National Capitol Region Transportation Planning Board (TPB) staff who developed other transportation related inputs for the model. TPB staff developed emissions using the above model. MWAQC staff reviewed and approved these emissions, incorporating them into the base year 2011 inventories.

This on-road mobile emissions analysis process is very similar to the process used during the development of previous base year inventories.

4.2 Summary of Onroad Mobile Source Emissions

The table below summarizes the typical ozone season day emissions for VOC, NO_x, and CO and annual emissions for VOC, NO_x, CO, PM_{2.5}-Pri, SO₂, and NH₃ in the Washington, DC-MD-VA 2008 ozone NAAQS nonattainment area.

Table 4-1
2011 Base Year SIP Onroad Source Emission Inventories
Washington, DC-MD-VA 2008 Ozone NAAQS Nonattainment Area

Washington, DC-MD-VA 2008 Ozone NAAQS Nonattainment Area ¹														
Pollutant	Calvert County	Charles County	Frederick County	Montgomery County	Prince George's County	Arlington County	Fairfax County	Loudoun County	Prince William County	Alexandria City	District Of Columbia	MD Total	VA Total	NAA Total
Tons per ozone season day														
VOC	2.06	3.24	6.05	14.42	16.55	2.54	16.48	4.90	7.34	1.85	6.91	42.33	33.10	82.35
NO _x	4.02	7.15	18.54	34.19	43.75	4.98	40.92	13.57	18.77	3.79	15.79	107.65	82.04	205.48
CO	18.64	29.31	72.54	153.61	188.00	29.27	184.19	52.94	76.55	18.64	71.18	462.11	361.69	894.98
Tons per year														
VOC	709	1,112	2,065	5,085	5,678	922	5,966	1,768	2,629	675	2,374.05	14,647.98	11,959.16	28,981.19
NO _x	1,420	2,531	6,603	11,791	15,217	1,679	14,113	4,743	6,629	1,299	5,073.93	37,562.80	28,462.98	71,099.71
CO	7,335	11,387	25,397	58,166	66,022	13,002	81,863	23,816	34,050	8,919	25,889.76	168,307.25	161,649.04	355,846.05
PM _{2.5} -Pri	51	97	256	462	562	63	561	198	265	50	206.09	1,428.37	1,136.99	2,771.45
SO ₂	6	10	27	69	73	16	105	30	39	11	33.82	185.77	201.24	420.83
NH ₃	26	43	120	288	353	55	342	92	130	33	144.30	829.77	651.15	1,625.23

¹ Fairfax County emissions include onroad emissions from Fairfax City and Falls Church City. Prince William County emissions include emissions from Manassas City and Manassas Park City.

* Small discrepancies may result due to rounding.

5.0 Quality Assurance Procedures

Several quality assurance checks were employed by the Washington DC-MD-VA state air agencies or, given resource constraints, regionally to address the data quality objectives discussed in Chapter 1.4 related to accuracy, completeness, comparability, and/or representativeness: reality/peer review checks, sample calculations, sensitivity analysis, and range checks. Details on each check are provided below.

5.1 Reality Check/Peer Review Check

Independent review was conducted by knowledgeable staff to ensure that data, assumptions, and procedures are reasonable. The objective of these checks is to ensure accuracy, completeness, comparability, and representativeness.

Reasonableness of methods, assumptions, and emissions estimates was assessed by 1) comparing data sources used in the final inventory to those used for the 2011 NEI; 2) relying on reviewer expertise; and 3) comparing emissions estimates to other inventory efforts, particularly the 2002 base year inventory, 2007 attainment year inventory, and the 2011 NEI (Version 1).

5.2 Sample Calculations

Sample calculations provide verification of values by replicating calculations. The benefit is to ensure that calculations are done correctly. The objective is accuracy.

Emissions calculations were duplicated to spot check the accuracy of the arithmetic and, therefore, the resulting emissions estimates. Priority was given to those categories identified as the largest emissions contributors.

For nonroad and onroad emissions estimates, sample calculations were not used as a quality assurance mechanism. Preparing sample calculations for these sectors was not possible since the emissions estimates were generated using EPA-approved models. Rather, these data, which were generated by MWAQC and TPB modeling staff, were checked by comparing the results of similar modeling runs conducted by other agencies such as state air agencies, state transportation agencies, or MARAMA to ensure the results included herein were reasonable.

5.3 Sensitivity Analysis

Sensitivity analysis is the systematic study of how changes in parameters affect data. The benefit is to identify the parameters that have the greatest effect on data. All data quality objectives are addressed using these checks.

A sensitivity analysis in the form of source category emissions rankings by pollutant was performed. The ranking helped determine where efforts should be concentrated.

5.4 Standard Range Checks

Standard range checks address the data quality objective of comparability. The benefit is to identify the source categories that have the greatest change in emission levels from previous emission estimates. All data quality objectives are addressed using these checks.

The 2011 base year inventory was compared to the most recent inventories (base year 2002, attainment year 2007 inventory, and the 2011 NEI Version 1). Any discrepancies (data outliers) were verified or corrected.

5.5 Corrective Action Plan

Corrective and follow-up actions identified during the quality checking process were noted and referred to the appropriate staff.