2017 BASE YEAR EMISSIONS INVENTORY

FOR THE
WASHINGTON DC-MD-VA
2015 OZONE NAAQS NONATTAINMENT AREA

Prepared by:

District Department of Energy and Environment,
Maryland Department of the Environment,
Virginia Department of Environmental Quality,
and
Metropolitan Washington Council of Governments

on behalf of the
Metropolitan Washington Air Quality Committee

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1.0 Introduction

1.1 Overview and Background

This document contains a detailed explanation of the 2017 base year emissions inventory for stationary, nonpoint, nonroad, and onroad anthropogenic sources as well as biogenic sources in the Washington, DC-MD-VA 2015 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. Anthropogenic emissions were estimated for volatile organic compound (VOC), nitrogen oxide (NO_X), and carbon monoxide (CO) for a typical ozone season workweek day.

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 purpose of this document is to fulfill the emission inventory requirements of Section 182(a) CAA for the Washington, DC-MD-VA Marginal Ozone Nonattainment Area under the 2015 8-hour ozone NAAQS. Section 182(a) of the CAA specifically addresses the SIP submissions and requirements for ozone nonattainment areas classified as Marginal. This is the only Section 182(a) element that has not been addressed in other plan submissions.

The Washington, DC-MD-VA 2015 ozone NAAQS nonattainment area was designated as a marginal nonattainment area for the 2015 ozone NAAQS (0.070 parts per million) by the United State Environmental Protection Agency (EPA) effective August 3, 2018 (Federal Register, Vol. 83, No. 107, June 4, 2018). 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 MOVES2014b model to develop both onroad and nonroad inventories (except for commercial marine vessels, aircraft, and locomotives, which were developed separately).

Air quality staff of the District Department of Energy and Environment (DOEE), 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 nonpoint and point source emissions estimates.

EPA's estimates for biogenic emissions for the NEI 2014 effort were accepted for the purposes of submission of the base year 2017 biogenic inventories. Methodology for developing biogenic inventories is described in detail in the Technical Support Document (Ver 2) for the NEI 2014 effort.[1] These 2014 inventories will be replaced by biogenic emissions for 2017 published as part of the NEI 2017 effort, if they become available in time for this submittal.

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 2015 Ozone NAAQS Nonattainment Area Geography

Effective August 3, 2018, EPA designated the following jurisdictions in the Washington, DC-MD-VA area as nonattainment for the 2015 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
- Fairfax County, Virginia
- Loudoun County, Virginia
- Prince William County, Virginia
- City of Alexandria, Virginia
- City of Fairfax, Virginia
- City of Falls Church, Virginia
- City of Manassas, Virginia
- City of Manassas Park, Virginia

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

[1] EPA NEI2017 Web-site - https://www.epa.gov/sites/production/files/2018-07/documents/nei2014v2_tsd_05jul2018.pdf

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 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 workweek day emissions (ozone season tons per day).

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: 2017 National Emissions Inventory (NEI) for VOC, NO_X, and CO. Any discrepancies (data outliers) must be verified or corrected.

Representativeness: Actual 2017 typical ozone season workweek 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 2017 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 for the Washington, DC-MD-VA 2015 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
2017 Base Year SIP Emission Inventories
Washington, DC-MD-VA 2015 Ozone NAAQS Nonattainment Area
(Tons per ozone season day)

Source Category	VOC	NOx	CO
Point	**5.19**	**79.55**	**25.13**
Quasi-Point[2]	**0.39**	**0.19**	**0.28**
Nonpoint	**127.61**	**23.12**	**68.69**
Nonroad Model	**37.68**	**30.87**	**710.87**
MAR[3]	**1.85**	**12.82**	**16.82**
Onroad	**49.58**	**93.42**	**673.21**
Anthropogenic Total	**222.31**	**239.97**	**1,494.99**
Biogenic[4]	**442.62**	**3.67**	**38.23**

[2] Quasi-point sources are generally considered part of the nonpoint or nonroad emissions sectors but are included in the point source emissions inventory for a particular reason. Such reasons include, but are not limited to, federal guidance (such as in the case of certain airports) or to facilitate future general conformity determinations (such as in the case of military bases, ports, and other similar facilities).

[3] MAR refers to commercial marine vessels, airport, and railroad emissions sources.

[4] Biogenic emissions are not part of the anthropogenic emissions and therefore not included in the anthropogenic total. Emissions in Table 1 are taken from EPA's NEI 2014 database. Total emissions for July were divided by 31 days to develop average ozone season day emissions for each jurisdiction in the region and then added together to develop the regional total.

1.7 Document Contents

Chapter 2 Presents the methodology for developing the 2017 ozone precursor emissions from point sources.

Chapter 3 Presents the methodology for developing the 2017 ozone precursor emissions from quasi-point, nonpoint and nonroad sources.

Chapter 4 Presents the methodology for developing the 2017 ozone precursor emissions from onroad mobile sources.

Chapter 5 Presents the QA/QC plan for the 2017 ozone precursor emissions inventory.

The point, quasi-point, nonpoint, 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 different appendices of this document (See list of appendices on Page 3).

2.0 Point Sources

2.1 Introduction

This section documents the development of the Washington, DC-MD-VA 2015 ozone NAAQS nonattainment area stationary point source emissions inventory. This section characterizes the point source component of the emissions inventory by describing the 2017 ozone season workweek day emissions estimation techniques. The point source inventory consists of actual emissions for a typical ozone season workweek day in the year 2017. The inventory includes sources located within the Washington DC-MD-VA 2015 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 work weekday emissions data provided by the state air agencies for inclusion in this emissions inventory document.

2.2 Compilation and Documentation of Point & Quasi-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 generally correspond to facilities contained within the EPA's Emissions Inventory System (EIS), which is the basis for NEI point source estimates. These types of facilities are typically large industrial or commercial complexes such as municipal waste combustors, electric generating stations, governmental organizations, and manufacturing facilities.

Methodologies used by state air agencies to convert annual emissions to ozone season work weekday emissions are described in Appendix A1a (District of Columbia), Appendix A1b (Virginia) and Appendix B1b (Maryland).

Full documentation of 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 A2a (District of Columbia), Appendix A2b (Virginia) and Appendix B2b (Maryland) are electronic attachments that provide detailed descriptions of point source emissions for the Washington, DC-MD-VA 2015 ozone NAAQS nonattainment area.

Appendix B1b (Maryland) provides the methodology for developing emissions for quasi-point sources, which only exist in the Prince George's County, Maryland in the Washington, DC-MD-VA 2015 ozone NAAQS nonattainment area.

Table 2-1
2017 Base Year SIP Point Source Emission Inventories
Washington, DC-MD-VA 2015 Ozone NAAQS Nonattainment Area
(Tons per ozone season day)

Jurisdiction	VOC	NO_X	CO
District of Columbia	**0.17**	**0.78**	**0.52**
Calvert County	0.11	2.66	0.88
Charles County	0.32	6.47	2.19
Frederick County	0.76	1.75	1.73
Montgomery County	0.33	13.85	4.32
Prince George's County	0.99	24.68	5.43
Maryland Total	**2.51**	**49.41**	**14.55**
Arlington County	0.02	0.25	0.13
Fairfax County	0.81	10.39	4.04
Fairfax City	0.30	0.01	0.02
Falls Church City			
Loudoun County	0.71	10.44	3.32
Prince William County	0.52	6.36	2.07
Manassas City	0.13	0.54	0.25
Manassas Park City			
Alexandria City	0.02	1.37	0.23
Virginia Total	**2.51**	**29.36**	**10.06**
Region Total	**5.19**	**79.55**	**25.13**

Note: There are no point source VOC, NO_X, and CO emissions for the Virginia Independent Cities of Falls Church and Manassas Park.

Table 2-2
2017 Base Year SIP Quasi-Point Source Emission Inventories
Washington, DC-MD-VA 2015 Ozone NAAQS Nonattainment Area
(Tons per ozone season day)

Jurisdiction	VOC	NO_X	CO
Prince George's County	0.39	0.19	0.28
Maryland Total	**0.39**	**0.19**	**0.28**
Region Total	**0.39**	**0.19**	**0.28**

Note: Quasi-point sources only exist in the Prince George's County, Maryland. Emissions for these sources were provided by MDE.

3.0 Nonpoint and Nonroad Sources

3.1 Introduction and Scope

This document contains a detailed explanation of how the 2017 emissions inventory for nonpoint and nonroad sources of VOC, NO_X, and CO was developed. Emissions inventories for nonpoint and a few nonroad sources – commercial marine vessels, airport, railroad locomotives (MAR) - for a typical ozone season workweek day were prepared by the state air agencies. The MWCOG staff developed emissions for remaining nonroad sources using MOVES2014b model. The MWCOG staff also compiled this information for inclusion in this base year inventory document.

Nonpoint 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. For example, small fossil fuel fired boilers used for comfort purposes located at residential, commercial, and governmental locations fall into this 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 equipment, recreational boating, etc.

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

3.2 Nonpoint Sources

3.2.1 Emission Estimation Approach

The nonpoint source category is quite diverse, and the emission calculation techniques used for each subsector in this category vary significantly. Moreover, the category contains numerous subsectors. The state air agencies provided detailed documentation regarding the development of emissions for nonpoint sources. This information is located in Appendix B1a (District of Columbia), B1b (Maryland), and B1c (Virginia).

Refueling Emissions

Stage II Refueling emissions were developed by the National Capital Region Transportation Planning Board (TPB) at MWCOG in association with the Metropolitan Washington Air Quality Committee (MWAQC) staff and state air agencies using EPA's MOVES2014b model as part of the onroad emissions development. Though these emissions are developed as part of the onroad emissions development process, they are considered as nonpoint sources and as such emissions associated with them are included in the nonpoint sector inventory. See Appendix D1 titled "Onroad Mobile Source Inventory Development Overview" for details of the onroad emissions development.

3.2.2 Summary of Emission Results

Table 3-1 lists emissions for the counties and cities in the Washington, DC-MD-VA 2015 ozone NAAQS nonattainment area. Appendix B2a (District of Columbia), B2b (Maryland), and B2c (Virginia) are electronic attachments that provide detailed descriptions of nonpoint source emissions for the Washington, DC-MD-VA 2015 ozone NAAQS nonattainment area.

Table 3-1
2017 Base Year SIP Nonpoint Source Emission Inventories
Washington, DC-MD-VA 2015 Ozone NAAQS Nonattainment Area
(Tons per ozone season day)

Jurisdiction	VOC	NOx	CO
District of Columbia	**9.95**	**2.26**	**2.29**
Calvert County	2.33	0.24	3.31
Charles County	4.42	1.05	9.77
Frederick County	7.18	1.27	10.13
Montgomery County	22.70	4.14	4.32
Prince George's County	21.28	3.30	5.84
Maryland Total	**57.90**	**10.00**	**33.36**
Arlington County	4.90	0.88	1.12
Fairfax County	26.02	4.74	7.42
Fairfax City	1.02	0.21	0.34
Falls Church City	0.43	0.09	0.15
Loudoun County	10.48	2.19	14.38
Prince William County	11.46	1.66	7.94
Manassas City	1.18	0.32	0.61
Manassas Park City	0.93	0.11	0.18
Alexandria City	3.35	0.65	0.89
Virginia Total	**59.76**	**10.86**	**33.03**
Region Total	**127.61**	**23.12**	**68.69**

* Small discrepancies may result due to rounding.

3.3 Nonroad Sources

Emissions for nonroad sources were estimated using EPA's MOVES2014b model. This model also provides emissions for a few MAR sources (railway maintenance, airport ground support equipment, and aircraft auxiliary power units), some of which were used by the District of Columbia and Maryland. Virginia used emissions developed as part of the NEI 2014 v2 effort for these sources (See Section 3.3.1.1 and Section 3.3.2.1 for details). Emissions from other MAR sources are estimated using sector specific techniques, including industry data, industry-specific modeling tools, and other information. 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 B1a (District of Columbia), B1b (Maryland), and B1c (Virginia).

It is important to note here that the District of Columbia used railway maintenance emissions developed using the MOVES2014b model. Maryland used emissions for railway maintenance and airport ground support equipment developed using the above model. Details of the development of emissions for these sources along with other nonroad model sources are provided in Section 3.3.2.1. Virginia provided emissions for railway maintenance, airport ground support equipment, and aircraft auxiliary power units from the NEI2014 v2 effort.

3.3.1.2 Summary of Emission Results

Table 3-2 lists emissions for counties and cities in the Washington, DC-MD-VA 2015 ozone NAAQS nonattainment area. Appendix B2a (District of Columbia), B2b (Maryland), and B2c (Virginia) are electronic attachments that provide detailed descriptions of MAR source emissions for the Washington, DC-MD-VA 2015 ozone NAAQS nonattainment area.

Table 3-2
2017 Base Year SIP MAR Emission Inventories
Washington, DC-MD-VA 2015 Ozone NAAQS Nonattainment Area
(Tons per ozone season day)

Jurisdiction	VOC	NO_X	CO
District of Columbia	**0.06**	**0.55**	**0.11**
Calvert County	0.05	0.86	0.14
Charles County	0.02	0.02	0.19
Frederick County	0.16	0.84	1.58
Montgomery County	0.05	0.73	0.75
Prince George's County	0.04	0.52	0.52
Maryland Total	**0.33**	**2.96**	**3.17**
Arlington County	0.56	3.43	5.47
Fairfax County	0.03	0.63	0.15
Fairfax City	0.00	0.00	0.00
Falls Church City	0.00	0.00	0.00
Loudoun County	0.79	4.40	7.09
Prince William County	0.03	0.50	0.12
Manassas City	0.03	0.07	0.64
Manassas Park City	0.00	0.00	0.00
Alexandria City	0.01	0.27	0.07
Virginia Total	1.46	9.31	13.54
Region Total	**1.85**	**12.82**	**16.82**

Note: The cities of Fairfax and Falls Church, located within the Commonwealth of Virginia, did not have any 2017 emissions from the MAR category. Small discrepancies may result due to rounding.

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 a total of 88 equipment types in the following 12 economic sectors:

- Recreational sector equipment, such as all-terrain vehicles and off-road motorcycles;
- Construction sector equipment, such as graders and backhoes;
- Industrial sector equipment, such as forklifts and sweepers;
- Lawn and garden sector equipment, such as leaf and snow blowers;
- Agricultural sector equipment, such as tractors;
- Commercial sector equipment, such as compressors;
- Logging sector equipment, such as chain saws;
- Airport support sector equipment, such as airport ground support equipment;
- Underground mining sector equipment, such as, mining equipment;
- Oil field sector equipment, such as oil field equipment;
- Pleasure craft sector equipment, such as personal watercraft; and
- Railroad sector equipment, such as railway maintenance equipment.

3.3.2.1 Emission Estimation Approach

The inventory for nonroad mobile sources along with a few MAR sources (railway maintenance, airport ground support equipment, and aircraft auxiliary power units) for VOC, NOx, and CO was developed using EPA's MOVES2014b model. This model includes 88 types of nonroad equipment from 12 economic sectors described above in Section 3.3.2 and further stratifies equipment types by horsepower rating. Fuel types include gasoline, diesel, compressed natural gas (CNG), and liquefied petroleum gas (LPG).

The MOVES2014b model estimates emissions at the county level based on default assumptions of county-level nonroad equipment populations and activity. Nonroad equipment population growth rates in MOVES2014b are based on state and regional growth estimates. Equipment populations and activity are then allocated to the state and county level based on surrogates such as construction activity, acreage farmed, etc.

The MOVES2014b 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 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 MOVES2014b model was run for a weekday in July 2017 to develop average ozone season workweek day nonroad model source emissions for the cities and counties in the Washington, DC-MD-VA 2015 ozone NAAQS nonattainment area. All emissions sources in the model were included for the District of Columbia and Maryland. Three specific sources namely, railway maintenance, airport ground support equipment, and aircraft auxiliary power units were not included for Virginia. Instead, Virginia provided emissions for these three sources from the NEI2014 v2 effort. Model inputs (temperature and fuel) used in this analysis were the same as the ones used in developing the average ozone season work weekday emissions for 2017 for onroad sources (Refer to Appendix D1 for details).

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 MOVES2014b nonroad model input, output, and runspec files are being provided separately in electronic format as Appendix C of this document.

Table 3-3
2017 Base Year SIP Nonroad Model Source Emission Inventories
Washington, DC-MD-VA 2015 Ozone NAAQS Nonattainment Area
(Tons per ozone season day)

Jurisdiction	VOC	NO_X	CO
District of Columbia	**1.37**	**2.06**	**24.61**
Calvert County	0.96	0.58	8.73
Charles County	1.44	1.01	13.78
Frederick County	2.26	1.71	43.10
Montgomery County	8.37	4.63	163.04
Prince George's County	4.81	3.66	92.61
Maryland Total	**17.84**	**11.59**	**321.26**
Arlington County	0.75	2.32	15.73
Fairfax County	9.17	6.48	181.48
Fairfax City	0.32	0.12	6.62
Falls Church City	0.19	0.07	3.86
Loudoun County	4.33	4.74	86.35
Prince William County	2.73	3.07	50.92
Manassas City	0.13	0.10	2.87
Manassas Park City	0.18	0.06	3.63
Alexandria City	0.67	0.26	13.54
Virginia Total	**18.47**	**17.22**	**365.00**
Region Total	**37.68**	**30.87**	**710.87**

* Small discrepancies may result due to rounding.

4.0 Onroad Mobile Sources

4.1 Introduction

The MOVES2014b model was used for developing the onroad mobile average ozone season work weekday base year 2017 emissions for the Washington, DC-MD-VA 2015 ozone NAAQS nonattainment area. Appendix D1 provides a detailed description of data sources and methodologies used to develop model inputs. MOVES2014b input files, external input files, and output files are provided separately in electronic format as Appendix D2.

MWAQC staff developed meteorology inputs and coordinated with the state air agencies to acquire fuel and inspection and maintenance program inputs for the MOVES2014b model. MWAQC staff provided these inputs to the TPB staff that 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 2017 inventories.

This onroad 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 work weekday emissions for VOC, NO_X, and CO in the Washington, DC-MD-VA 2015 ozone NAAQS nonattainment area.

Table 4-1
2017 Base Year SIP Onroad Source Emission Inventories
Washington, DC-MD-VA 2015 Ozone NAAQS Nonattainment Area
(Tons per ozone season day)

Jurisdiction	VOC	NOx	CO
District of Columbia	**3.76**	**5.63**	**54.94**
Calvert County	1.28	1.81	11.70
Charles County	1.95	3.44	19.05
Frederick County	3.81	9.98	53.15
Montgomery County	8.97	15.78	119.59
Prince George's County	9.36	20.28	135.40
Maryland Total	**25.37**	**51.29**	**338.89**
Arlington County	1.51	1.92	21.97
Fairfax County	10.11	18.41	145.37
Fairfax City			
Falls Church City			
Loudoun County	3.10	6.32	41.28
Prince William County	4.55	8.45	57.69
Manassas City			
Manassas Park City			
Alexandria City	1.18	1.40	13.07
Virginia Total	**20.45**	**36.50**	**279.38**
Region Total	**49.58**	**93.42**	**673.21**

Note: Fairfax County emissions include onroad emissions from Fairfax City and Falls Church City. Prince William County emissions include onroad 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 2017 NEI; 2) relying on reviewer expertise; and 3) comparing emissions estimates to other inventory efforts, particularly the 2011 base year inventory, attainment year 2014 inventory for the 2008 ozone NAAQS, and the 2017 NEI.

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's MOVES2014b model. Rather, these data, which were generated by MWAQC and TPB modeling staff, were checked by comparing the results of similar modeling runs conducted for the transportation conformity purposes 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. Identifying the source categories that have the greatest change in emissions levels from previous emission estimates is beneficial because that information allows staff to focus resources on studying the most impactful data. By ensuring that the emissions changes reflect the latest data inputs and calculation methodologies, more confidence may be placed in the final results. All data quality objectives are addressed using these checks.

The 2017 base year inventory was compared to the most recent inventories (base year 2011, attainment year 2014 inventory for the 2008 ozone NAAQS, and the 2017 NEI. 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.