Maryland
Department of
the Environment

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2015 8-Hour Ozone NAAQS
(0.070 ppm)
Marginal Area State Implementation Plan
for the
Baltimore, MD Nonattainment Area
SIP Number: 20-08

June 29, 2020

Prepared for:

U.S. Environmental Protection Agency

Prepared by:

Maryland Department of the Environment

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Table of Contents

List of Tables

List of Figures

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 Baltimore, MD 2015 ozone National Ambient Air Quality Standard (NAAQS) nonattainment area (Baltimore 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 (NOX), 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) of the Clean Air Act (CAA) for the Baltimore Area under the 2015 8-hour ground level ozone National Ambient Air Quality Standard (NAAQS). Section 182(a) of the CAA specifically addresses the State Implementation Plan (SIP) submissions and requirements for ozone nonattainment areas classified as Marginal. One of the main elements of Marginal Plans is CAA Section 182(a)(1) requiring the State to submit a comprehensive, accurate, current inventory of actual emissions from all sources within two years after designation. This plan submittal satisfies Maryland's obligations for the Baltimore Area under the 2015 ozone NAAQS.

On October 1, 2015, the U.S. Environmental Protection Agency (EPA) promulgated a revision to the National Ambient Air Quality Standards (NAAQS) for ozone (O_3) and on October 26, 2015 published the final rule in the *Federal Register* [80 FR 65292]. This revision lowers the ozone standard to 0.070 ppm (or 70 ppb).

The Baltimore Area was designated as a marginal nonattainment area for the 2015 ozone NAAQS (0.070 parts per million) by 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.

In coordination with EPA staff, the Maryland Department of the Environment (MDE) has developed a complete ozone season day emission inventory for the year 2017 of the actual

emissions of the pollutants that contribute to ozone formation in the Baltimore nonattainment area: volatile organic compounds (VOC), oxides of nitrogen (NOx), and carbon monoxide (CO). The year 2017 corresponds to the most recent triennial statewide emissions inventory conducted for the National Emissions Inventory (NEI) pursuant to the federal Air Emissions Reporting Requirements (AERR) rule [73 FR 76539; December 17, 2008]. This inventory conforms to EPA's latest guidance: Emissions Inventory Guidance for Implementation of Ozone and Particulate Matter National Ambient Air Quality Standards (NAAQS) and Regional Haze Regulations [November 2005].

The methodology used to compile the 2017 ozone season daily emissions inventory for the Baltimore, MD nonattainment area is presented in Appendix A. The documentation includes emissions from stationary point and area sources, onroad mobile, nonroad, event (i.e. wildfire), and biogenic sources within the six regional jurisdictions. Appendix A also outlines the methodology and calculations used to convert the annual emission rates from the 2017 NEI into ozone season daily emission rates. The ozone season daily emissions in Appendix A apply to emissions occurring during a typical weekday of the high ozone season, which is June through August.

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

With a revised NAAQS, the CAA requires states to review air quality monitoring data and submit ozone boundary designation recommendations. In March 2017, Maryland submitted its original boundary recommendation for the 2015 ozone NAAQS to EPA, based on the ozone air quality monitoring data for the three years of 2014–2016. More information on Maryland's boundary designation recommendations is located here:

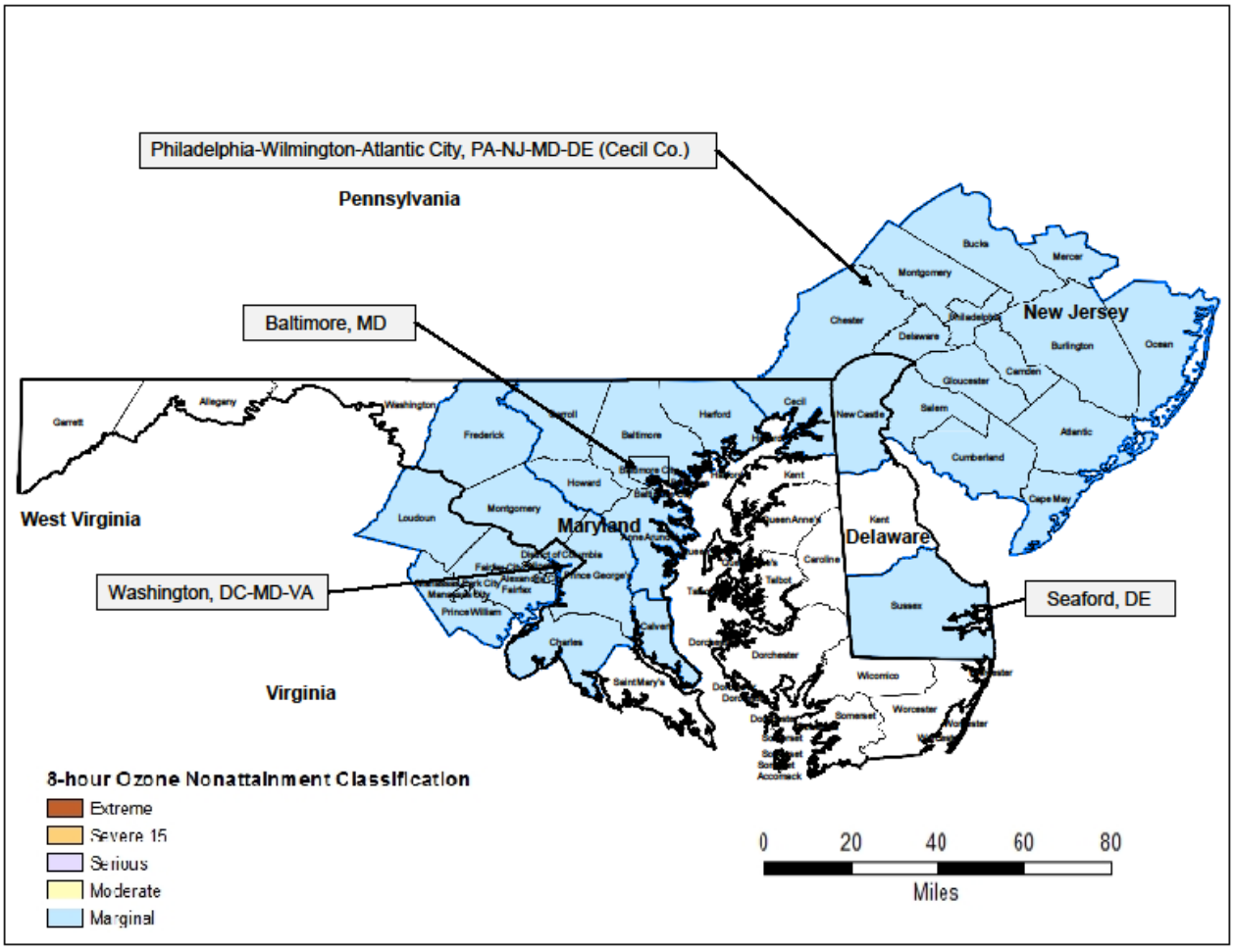
https://www.epa.gov/sites/production/files/2017-05/documents/md_recommendations.pdf

When the Baltimore Area was classified as marginal for the 2015 ozone standard, the boundaries remained the same as for the 2008 ozone.

The following is a list of the six areas contained in the Baltimore, MD 2015 8- hour Ozone Marginal Nonattainment Area (see attached map):

- Anne Arundel County, MD
- Baltimore County, MD
- Carroll County, MD
- Harford County, MD
- Howard County, MD
- Baltimore City, MD

Figure 1: Maryland/Washington, DC/Virginia/Delaware 8-Hour Ozone Nonattainment Areas (2015 NAAQS)



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 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 and Policy 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, NOX, 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 Baltimore 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 Inventory

Baltimore, MD 2015 Ozone NAAQS Nonattainment Area
Tons per Ozone Season Day

Source Category	VOC	NOx	CO
Point	5.729	47.530	18.902
Quasi-Point[1]	1.310	7.274	6.549
Nonpoint	72.233	10.931	26.954
Nonroad Model	21.314	13.164	330.888
MAR[2]	0.930	7.440	3.848
Onroad	25.860	53.720	365.010
Anthropogenic Total	127.379	140.060	752.152
Biogenic[3]	227.640	2.740	24.550

[1] 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).

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

[3] 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 and quasi-point sources.

Chapter 3 Presents the methodology for developing the 2017 ozone precursor emissions from 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.

2.0 POINT SOURCES

2.1 Introduction

This section documents the development of the Baltimore 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 Baltimore Area.

2.2 Compilation and Documentation of Point & Quasi-Point Source Emissions

MDE maintains a substantial database 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.

MDE has identified several facilities that due to size and/or function are considered point sources. These establishments contain a wide variety of air emission sources, including traditional point sources, on-road mobile sources, off-road mobile sources and area sources. For each particular establishment, the emissions from these sources are totaled under a single point source and summary documents include these quasi-point sources as point sources. The Baltimore Area contains three quasi point sources: Aberdeen Proving Grounds, Baltimore Washington International Airport, and the Port of Baltimore. The Port of Baltimore quasi-point source emissions include all landside operations. Emissions from watercraft are included in the Marine Vessels portion of the inventory.

Methodologies used by MDE to convert annual emissions to ozone season work weekday emissions are described in Appendix A. Full documentation of point sources and emissions Maryland is maintained by MDE.

Table 2-1: 2017 Base Year SIP Point Source Emission Inventory

Baltimore, MD 2015 Ozone NAAQS Nonattainment Area

(Tons per ozone season day)

County Name	VOC	NO_x	CO
Anne Arundel County	0.885	13.079	5.523
Baltimore County	0.876	11.531	2.788
Carroll County	0.390	8.342	5.568
Harford County	0.471	3.110	0.422
Howard County	1.036	1.266	0.920
Baltimore City	2.070	10.202	3.682
Baltimore Area Total	**5.729**	**47.530**	**18.900**

Table 2-2: 2017 Base Year SIP Quasi-Point Source Emission Inventory

Baltimore, MD 2015 Ozone NAAQS Nonattainment Area

(Tons per ozone season day)

County Name	VOC	NO_x	CO
Anne Arundel County	0.793	4.009	4.554
Baltimore County			
Carroll County			
Harford County	0.451	2.451	1.634

Howard County			
Baltimore City	0.066	0.815	0.361
Baltimore Area Total	**1.310**	**7.274**	**6.549**

3.0 NONPOINT AND ONROAD SOURCES

3.1 Introduction

This document contains a detailed explanation of how the 2017 emissions inventory for nonpoint and nonroad sources of VOC, NOX, 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 MDE.

Nonpoint sources include stationary sources not part of Maryland's 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.

3.2 Nonpoint Sources

3.2.1 Summary of Emissions Results

Table 3-1 lists emissions for the counties the Baltimore, MD 2015 ozone NAAQS nonattainment area. Appendix provides a detailed description of nonpoint source emissions for the Baltimore Area.

Table 3-1: 2017 Base Year SIP Nonpoint Emission Inventory

Baltimore, MD 2015 Ozone NAAQS Nonattainment Area
(Tons per ozone season day)

County Name	VOC	NOx	CO
Anne Arundel County	16.532	2.090	2.836
Baltimore County	20.168	3.200	4.206
Carroll County	4.810	0.595	2.922
Harford County	9.111	1.007	12.685
Howard County	7.745	1.375	1.617
Baltimore City	13.867	2.665	2.689
Baltimore Area Total	**72.233**	**10.931**	**26.954**

3.3 Nonroad Sources

3.3.1 Nonroad Model Sources

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.

3.3.1.1 Summary of Emissions Results

Table 3-2 lists emissions for different counties and cities in the Baltimore Area. A detailed nonroad emissions estimate methodology is found in Appendix A of this document.

Table 3-2: 2017 Base Year SIP Nonroad Model Source Emission Inventory

Baltimore, MD 2015 Ozone NAAQS Nonattainment Area
Tons per Ozone Season Day

County Name	VOC	NOx	CO
Anne Arundel County	5.818	3.263	80.901
Baltimore County	6.421	4.725	102.577
Carroll County	1.572	0.980	26.043
Harford County	2.645	1.590	30.234
Howard County	2.712	1.500	53.191
Baltimore City	2.145	1.107	37.943
Baltimore Area Total	**21.314**	**13.164**	**330.888**

3.3.2 Marine Vessels, Airport, Railroad Locomotives

MDE used emissions for railway maintenance and airport ground support equipment developed using the above model. Emissions were calculated by collecting data directly from surveyed sources, or activity from state and federal reporting agencies. EPA emission factors were applied using EPA guidance and methodologies or the best engineering method. Details of the development of emissions for these sources along with other nonroad model sources are provided in Appendix A.

3.3.2.1 Summary of Emissions Results

Table 3-3 lists emissions the Baltimore Area.

Table 3-3: 2017 Base Year SIP MAR Source Emission Inventory

Baltimore, MD 2015 Ozone NAAQS Nonattainment Area
Tons per Ozone Season Day

County Name	VOC	NOx	CO
Anne Arundel County	0.113	1.623	0.776
Baltimore County	0.634	2.277	1.833
Carroll County	0.027	0.188	0.497
Harford County	0.031	0.469	0.321
Howard County	0.013	0.302	0.075

Baltimore City*	0.112	2.582	0.348
Baltimore Area Total	**0.930**	**7.440**	**3.848**

*Emissions from marine vessels at the Port of Baltimore are included here.
All landside emissions are part of the quasi-point inventory.

4.0 ONROAD MOBILE SOURCES

4.1 Introduction

The MOVES2014a model was used for developing the onroad mobile average ozone season work weekday base year 2017 emissions for the Baltimore Area. Inventories of highway vehicles were developed based on daily and annual Highway Performance Monitoring System (HPMS) inventories.

4.1.1 Summary of Emissions Results

Table 4-1 summarizes the typical ozone season work weekday emissions for VOC, NOX, and CO in the Baltimore Area.

Table 4-1: 2017 Base Year Onroad Mobile Source Emission Inventory

Baltimore, MD 2015 Ozone NAAQS Nonattainment Area
Tons per Ozone Season Day

County Name	VOC	NO_x	CO
Anne Arundel County	6.17	12.33	85.88
Baltimore County	8.12	17.72	117.58
Carroll County	2.13	3.10	21.86
Harford County	2.73	5.26	35.31
Howard County	3.12	8.21	54.20
Baltimore City	3.60	7.10	50.18
Baltimore Area Total	**25.86**	**53.72**	**365.01**

5.0 QUALLITY ASSURANCE PROCEDURES

Several quality assurance checks were employed by the MDE or, given resource constraints, regionally to address data quality objectives 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.

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.

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.

5.3 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 2017 base year inventory was compared to the most recent inventories. Any discrepancies (data outliers) were verified or corrected.

5.3 Corrective Action Plan

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

6.0 CONCLUSION

Through this plan submission, Maryland asserts that it has satisfied the Marginal Area Plan emission inventory submission obligation for the Baltimore, MD nonattainment area pursuant to federal Clean Air Act Section 182(a) under the 2015 ozone 8-hour National Ambient Air Quality Standard. Attached with this document is a complete, comprehensive, accurate and current inventory of ozone-precursor emissions for the Baltimore, MD nonattainment area. The MDE requests that EPA approve this plan submission for inclusion into the Baltimore, MD State Implementation Plan.

APPENDICES

Appendix A – Emission Inventory Methodology Documentation

Appendix B – Point Source Inventory Files

Appendix C – Quasi-Point Source Inventory Files

Appendix D – Area/Nonpoint Source Inventory Files

Appendix E – Nonroad Mobile Source Inventory Files

Appendix F – M-A-R (Marine Vessels, Airport, Railroad Locomotives) Source Inventory Files

Appendix G – Onroad Mobile Source Inventory Files

Appendix G1 – MOVES2010a (Onroad Mobile Model) Input & Output Files