

Appendix A



Maryland
Department of
the Environment

Wes Moore, Governor
Aruna Miller, Lt. Governor

Serena McIlwain, Secretary
Suzanne E. Dorsey, Deputy Secretary

APPENDIX A-1A

Baltimore Moderate Nonattainment Area 2017 Base Year Emission Inventory Methodologies

Prepared for:

U.S. Environmental Protection Agency

Prepared by:

Maryland Department of the Environment



Baltimore, MD Ozone Moderate Nonattainment Area Emission Inventory Methodologies

© Maryland Department of the Environment
Air and Radiation Administration
1800 Washington Boulevard, Suite 730
Baltimore, Maryland 21230
Phone 410.537.3240 • Fax 410.631.3202

Table of Contents

1.0	INTRODUCTION	1
2.0	POINT SOURCES	2
2.1	Point Description	2
2.2	Compiling the Point Source List.....	2
2.3	Emission Reporting Requirements for Major Sources	3
2.4	Emission Calculations and Verification	4
2.5	EPA Clean Air Market (CAMD) Reporting Requirements	4
2.6	MDE ARA Point Source Submittal.....	5
2.6.1	MDE ARA EEMS-TEMPO.....	5
2.6.2	EPA CAMD	5
3.0	QUASI-POINT SOURCES	6
3.1	Introduction	6
3.2	ABERDEEN PROVING GROUNDS.....	6
3.3	BALTIMORE-WASHINGTON INTERNATIONAL AIRPORT (BWI)	12
3.4	PORT OF BALTIMORE	16
4.0	NONPOINT/AREA SOURCES.....	19
4.1	EMISSION ESTIMATION METHOD BY CATEGORY	19
4.1.1	PETROLEUM DISTRIBUTION LOSSES	19
4.1.2	STATIONARY SOURCE SOLVENT APPLICATION.....	47
4.1.3	BIOPROCESS EMISSIONS SOURCES.....	94
4.1.4	CATASTROPHIC/ACCIDENTAL RELEASES	101
4.1.5	SOLID WASTE DISPOSAL, TREATMENT, AND RECOVERY	105
4.1.6	Publicly Owned Treatment Works (POTWs)	106
4.1.7	SMALL STATIONARY SOURCE FOSSIL FUEL USE	126
4.1.8	FUGITIVE SOURCES.....	156
4.2	FIRE SOURCES.....	181
4.3	AMMONIA SOURCES.....	187
4.3.1	INTRODUCTION	187
4.3.2	Emission Calculations Methodology.....	187
4.3.3	Ammonia SOURCE EMISSION CATEGORIES	187
5.0	NONROAD SOURCES-DONE 02-22	194
5.1	Introduction NONROAD Vehicles/Engines	194
5.2	MOVES3.0 Model.....	195
5.3	MOVES-Nonroad Emission Calculation Methodologies.....	195
5.4	Emissions Estimation Approach	195
5.5	NONROAD MOVES Model Categories.....	196
5.5.1	Lawn and Garden Equipment.....	196
5.5.2	Airport Service Equipment	198
5.5.3	Recreational Land Vehicles	199
5.5.4	Pleasure Craft Equipment	201
5.5.5	Commercial Equipment	203
5.5.6	Industrial Equipment	205
5.5.7	Construction and mining Equipment.....	206
5.5.8	Agricultural Equipment	208
5.5.9	Logging Equipment.....	210

5.5.10	Railway Maintenance	212
5.7	Railroads.....	215
5.8	Aircraft	218
5.8.1	Commercial Aircraft.....	220
5.8.2	General Aviation.....	222
5.8.3	Military Aircraft	224
5.9	Marine Vessels	225
6.0	ONROAD MOBILE SOURCES	234
6.1	INTRODUCTION	234
6.1.1	Highway Vehicle Emissions Inventory	234
6.1.2	Periodic Inventory Methodology.....	235
6.1.3	Data Sources	238
6.2	DESCRIPTION OF INPUT DATA.....	239
6.2.1	Roadway Data and VMT	239
6.2.2	Other Supporting Traffic Data	240
6.2.3	HPMS VMT Adjustments.....	240
6.2.4	Seasonal Adjustments.....	241
6.2.5	Hourly Patterns	241
6.2.6	Vehicle Mix Inputs	241
6.2.7	Vehicle Type Processing.....	241
6.2.8	VMT Fractions	242
6.2.9	Month VMT Fractions	242
6.2.10	Day VMT Fractions	242
6.2.11	Hour VMT Fractions.....	243
6.2.12	Average Speed Distribution	243
6.2.13	Road Type Distribution	243
6.2.14	Ramp Fractions.....	244
6.2.15	Source Type Age Distribution.....	244
6.2.16	Source Type Population	244
6.3	METEOROLOGY	245
6.4	I/M PROGRAM.....	245
6.4.1	Pollutant Process ID.....	245
6.4.2	Source Type and Fuel Type IDs.....	245
6.4.3	Inspection Frequency	246
6.4.4	Test Standards and I/M Program ID	246
6.4.5	Beginning and End Model Years.....	246
6.4.6	Compliance Factor	247
6.4.7	Compliance Rate.....	248
6.4.8	Waiver Rate.....	248
6.4.9	Regulatory Class Coverage Adjustment.....	248
6.5	FUELS	248
6.5.1	Regional Fuels	249
6.5.2	Fuel Supply	251
6.5.3	Fuel Formulation	253
6.5.4	Fuel Usage Fraction	257
6.5.5	Alternate Vehicle Fuel Technology (AVFT).....	258
6.5.6	Fuel Wizard	259
6.6	OTHER VEHICLE TECHNOLOGY AND CONTROL STRATEGY DATA	260
6.6.1	Federal Programs	260
6.6.2	State Vehicle Technology Programs	260

6.7	POST-PROCESS SUITE (PPSUITE).....	261
6.7.1	Other PPSUTE Inputs	261
6.7.2	Speed/Capacity Lookup Information	261
6.7.3	Running the Air Quality Process in Central	261
6.7.4	Directory and File Structure	262
6.7.5	Zone/Area Equivalency	262
6.7.6	Names Database File	262
6.7.7	Running the CENTRAL Process	263
6.8	ANALYSIS METHODOLOGY	263
6.8.1	VMT Preparation	263
6.8.2	Speed Estimation.....	266
6.8.3	Developing the MOVES Traffic Input Files	267
6.8.4	MOVES Runs.....	268
6.9	FUEL CONSUMPTION ESTIMATES.....	268
6.10	RESOURCES	270
6.11	HIGHWAY VEHICLE INVENTORY GLOSSARY	272
7.0	BIOGENIC SOURCES	273
7.1	INTRODUCTION	273

1.0 INTRODUCTION

The 2017 Emissions Inventory and Methodologies is being prepared for the purpose of describing the Scope of Work required to prepare an emission inventory of sulfur dioxide (SO₂), nitrogen dioxide (NO₂), ammonia (NH₃), particulate matter (PM₁₀ and PM_{2.5}), and volatile organic compounds (VOC) emissions for the State of Maryland. 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 federal ambient air quality standards. These federal standards are designed to protect the public health and welfare from these six criteria pollutants. These standards are referred to as the National Ambient Air Quality Standards (NAAQS). Areas that meet the NAAQS are referred to as “attainment areas”; those that do not are referred to as “nonattainment areas.” The document will provide an outline for content and organization review of the inventory. The goal is to provide guidance on the development of a reliable inventory, the quality of emissions data collected and provide for acceptable documentation and reporting of this information. The Maryland Department of the Environment Air and Radiation Administration (MDE-ARA), the Maryland Department of Transportation (MDOT), and the Metropolitan Washington Council of Government (MWCOCG) will be involved in preparing various portions of the inventory by contributing information that is necessary for developing emissions estimates.

The final inventory document will include emissions from point sources, quasi-point sources, mobile sources, biogenic emissions, non-road mobile sources, and area sources. MDE-ARA will use the MOVES NOROAD Model for small engine emissions. MDE-ARA will supply emissions for major point sources and area sources, and will accept EPA estimates for biogenic emissions. Mobile source emissions will be estimated using the MOVES Model.

The applications for emissions inventory data include use of the data in annual trends reports, State Implementation Plans (SIPs), compliance demonstrations, emissions trading, emissions fees programs, and in modeling activities designed to evaluate ambient air concentrations encountered by the general public. For the SIP program, the air emission inventory is a fundamental building block in developing an air quality control and maintenance strategy. Section 172, Part C, of the Clean Air Act (CAA) as amended in 1990, which addresses SIP requirements, states that “. . . plan provisions shall include a comprehensive, accurate, current inventory of actual emissions from all sources or the relevant pollutants or pollutants in such area . . .”. Regulatory agencies and industrial facilities rely on emission inventories on an ongoing basis 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. They are the foundation of air quality decisions. Inventory quality is critical to defining realistic regulations and attainment strategies. Deficiencies and inconsistencies in existing compilation processes accentuate the need for developing and implementing more uniform and systematic approaches to collecting and reporting data. One of the primary goals of the document is to improve the quality of inventory data collection so that it is a reliable source of information for sound decision-making.

The intent of this report is to describe how the inventory was prepared and what information was considered in the inventory development.

This document is comprised of six sections, one section for each source category type.

2.0 POINT SOURCES

2.1 POINT DESCRIPTION

The Maryland Department of the Environment Air and Radiation Administration (ARA) is the lead agency responsible for compiling the point source emissions inventory, including identification of sources, documenting the method used to calculate emissions from each source, and presenting the findings. Emissions and emissions data are collected and calculated annually for facilities and businesses that fit the criteria to be a point source.

The Maryland stationary point source inventory is the result of efforts to characterize air emissions sources since the early 1970's. This section describes data collection, verification and emission estimation methods used to estimate point source emissions from stationary sources.

For the 2017 Periodic Emissions Inventory a point source located within a designated ozone nonattainment area is defined as a stationary commercial or industrial facility that operations and emits more than 10 tons per year of volatile organic compounds (VOC); or a 100 tons per year of carbon monoxide (CO), sulfur oxides (SO_x), particulate matter with an aerodynamic diameter less than 10 micrometers (PM₁₀), diameter less than 2.5 micrometers (PM_{2.5}), and total suspended particulates (TSP); or 25 tons per year of oxides of nitrogen (NO_x). These emissions criteria are more commonly refer to as “emissions thresholds” or simply, “thresholds.” Areas of the state classified as unclassifiable/attainment for ozone have the same thresholds except for oxides of nitrogen (NO_x), where the threshold is 100 tons per year NO_x.

2.2 COMPILING THE POINT SOURCE LIST

Maryland has a substantial database of both small and large air emission sources compiled over the last eighteen years. Since the thirteen central counties of Maryland and Baltimore City have been nonattainment for ozone since before 1982 and 80% of the state's population and major industrial sources lie within these counties, the database of over 10,700 sources (both above and below the point source thresholds) is reasonably complete. The list of point sources in this inventory was developed by applying the appropriate thresholds to the emission levels in the database to differentiate between point and area stationary sources. Sources with emission levels greater than the threshold or sources previously included in PEI submittals are by definition point sources while sources with emissions levels less than the thresholds are by definition area sources.

Several methods of source identification are used by ARA to ensure the point source inventory is as complete as possible. The primary data source is the Permitting Program, which oversees the registration requirements found in Title 26, Subtitle 11, Chapter 02, Code of Maryland Regulations (COMAR). The Compliance Program identifies other point sources through annual facility inspections and through investigations conducted in response to citizen complaints.

The primary means of new source identification is the steady influx of permit applications and equipment registrations. Many sources are required by COMAR 26.11.02, Permits, Approvals and Registration, to register with ARMA. From 700 to 1,000 new sources are registered with the Department each year.

Most of these sources are not considered to be point sources as defined for inventory purposes, even though they require permits. As an example, emissions from some sources can be less than one ton per

year. However, all sources that are registered with the Department are tracked until the Department receives notification that the equipment or emission source has ceased operations. An emissions source or its equipment is not permanently deleted from the registration database until the installation is demolished.

A secondary means of new source identification are the emission sources identified by Compliance Program staff during annual field inspections of major point sources. During these inspections, unregistered equipment is sometimes discovered. Statewide response to the Air Pollution Report and the Air Quality Complaint Hotline, has also led to the discovery of previously unidentified emissions sources. Sources discovered in this manner may be the result of the citizen complaints, or the result of further investigation of visual evidence such as buildings, storage yards, visible emissions, etc., sighted elsewhere during the response.

Maryland includes in its 2017 SIP submittal point sources that meet or are greater than threshold levels, and sources with emissions levels less than the thresholds are considered to be Area/Non-point sources.

ARA monitors and collects emissions thru its Compliance and Permitting Programs, which oversees the registration requirements found in Title 26, Subtitle 11, Chapter 02, Code of Maryland Regulations (COMAR), and its Compliance Program which identifies other point sources through annual facility inspections and through investigations conducted in response to citizen complaints.

Facility and business permit applications and equipment registrations are constantly tracked, updated, and monitored.

2.3 EMISSION REPORTING REQUIREMENTS FOR MAJOR SOURCES

Facilities are required by Maryland air quality regulations COMAR 26.11.01.05-1 and 26.11.02.19D to certify the air emissions for the past calendar year. The certified emissions are used for inventory and planning purposes as well as to form a basis for billing of Permit-to-Operate fees.

The air pollutants to be certified fall into the categories of criteria air pollutant, toxic air pollutant or greenhouse gas air pollutant. Criteria pollutants are particulate matter (reported as PM₁₀, PM_{2.5}, and total particulate), sulfur oxides (SO_x), nitrogen oxides (NO_x), carbon monoxide (CO), lead (Pb), and volatile organic compounds (VOC). All forms of particulate matter must be broken down and reported as follows:

- (1) Primary PM, PM₁₀ and PM_{2.5}: Particles that enter the atmosphere as a direct emission from a stack or an open source. It is comprised of two components: Filterable PM and Condensable PM. (these two PM components are the components measured by a stack sampling train such as that specified by EPA Method 5 and have no upper particle size limit.)
- (2) Filterable PM, PM₁₀ and PM_{2.5}: Particles that are directly emitted by a source as a solid or liquid at stack or release conditions and captured on the filter of a stack test train.
- (3) Condensable PM, PM₁₀ and PM_{2.5}: Material that is in a vapor phase at stack conditions, but which condenses and/or reacts upon cooling and dilution in the ambient air to form solid or liquid PM immediately after discharge from the stack.

There are 192 toxic air pollutants. A copy of the air toxics list is available on the MDE website. Greenhouse gas air pollutants include carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons

(HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF₆). Fuel burning sources emit CO₂, CH₄, and N₂O. Only certain industrial sources emit HFCs, PFCs, and SF₆.

The emissions certification must be submitted in hard copy to the Air and Radiation Administration (ARA) offices annually by April 1st. Copies of the forms needed to complete the certification are located on the Maryland Department of the Environment website at <https://mde.maryland.gov/programs/Air/AirQualityCompliance/Pages/index.aspx>.

MDE's Compliance Program staff performs field inspections of major point sources. During these inspections, unregistered equipment is listed and registered equipment is checked to see if they are working properly and operating according to state guidelines.

2.4 EMISSION CALCULATIONS AND VERIFICATION

Major source facilities certify that the emission estimates that are submitted to the Department are accurate to the best of their knowledge. Typically technical staff use one of the following methodologies to calculate criteria pollutant emissions:

- EPA-supplied emission factors
- Material balances
- Emissions based on source test data
- Continuous emissions monitoring data
- Agency or company-generated emission factors

After receiving the emission certification reports for major sources the staff review the reports for completeness and correctness. MDE ARA staff review the reports to verify emission estimation calculations. Of particular importance are the estimation of emissions and the documentation of calculations. Accuracy and consistency will be checked. Any errors in calculation will be corrected before data is entered into the state data system.

After verifying the accuracy of the emission estimates and methodology, the results are then entered into MDE's Enterprise Environmental Management System (EEMS). The primary vehicle to integrate data collection is Tools for Environmental Management and Protection Organizations (TEMPO) developed by AMS, now called CGI. TEMPO is an Oracle-based relational database management system that uses Sybase Powerbuilder multi-tier client/server based modules. Along with TEMPO, the Department is incorporating Information Builder's WebFOCUS, fully integrated enterprise business intelligence and reporting platform.

When all discrepancies are resolved to the satisfaction of MDE, the final emissions estimates are then submitted as an update to MDE's EEMS-TEMPO state database system. All sources are checked to ensure data has been correctly reported. Plant level emissions in the emission certification reports will be compared to the reported level in the state system. Discrepancies will be corrected. The total facility estimate is used to determine whether the facility satisfies the criteria for classification of as a point source.

2.5 EPA CLEAN AIR MARKET (CAMD) REPORTING REQUIREMENTS

The Clean Air Markets Division (CAMD) was developed by EPA to fulfill obligations under Part 75 of Volume 40 of the Code of Federal Regulations. The purpose was to establish continuous emission monitoring (CEM) and reporting requirements for electric generating units (EGUs) that burn fossil fuels and that serve a

generator greater than 25 megawatts. Facilities that meet this requirement must submit hourly emissions data via the Emissions Collection and Monitoring Plan System (ECMPS).

ECMPS is a desktop tool that sources must use to submit monitoring plans, QA data, and emission data to EPA to comply with the Acid Rain Program, Cross-State Air Pollution Rule (CSAPR), and the Mercury and Air Toxics Standards (MATS).

For this select group of sources in Maryland, MDE ARA chose to collect emissions data from the CAMD Air Markets Program Data. MDE ARA selected this dataset over the MDE certified annual or daily reported emissions because the temporal profile of the data generated an ozone season daily emission estimate that was more precise.

2.6 MDE ARA POINT SOURCE SUBMITTAL

2.6.1 MDE ARA EEMS-TEMPO

Maryland's EEMS-TEMPO emissions database system records annual and peak ozone season daily emissions (when supplied).

In cases where the facilities did not provide peak ozone season emission estimates, the peak ozone season emissions were calculated by the following method and are included in the emissions summary tables, by county, at the end of this section:

- 1) Annual emissions in tons per year were converted into tons per day emissions by dividing annual emissions by operating days,
- 2) Tons per day emissions were then multiplied by a seasonality factor,
- 3) The seasonality factor was based on the quarterly percentage of operations estimated by the company adjusted for June, July, and August.
- 4) The ratio obtained in Step 3 was multiplied by the daily emissions calculated in Step 1 to generate the seasonally adjusted emissions.

2.6.2 EPA CAMD

For CAMD reporting sources MDE averaged the daily ozone season pollutant emissions (in tons).

3.0 QUASI-POINT SOURCES

3.1 INTRODUCTION

The Maryland Department of the Environment Air and Radiation 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.

3.2 ABERDEEN PROVING GROUNDS

Description

Aberdeen Proving Ground (APG) occupies more than 72,500 acres in Harford County, Md. Its northernmost point is marked by the confluence of the Susquehanna River and the Chesapeake Bay. On the south the Gunpowder River borders it.

The installation comprises two principal areas, separated by the Bush River. The northern area is known as the Aberdeen Area, and the southern sector, formerly Edgewood Arsenal (established in November, 1917 - as a chemical weapons research, development and testing facility), is the Edgewood Area. The two areas were administratively combined in 1971.

Aberdeen Proving Ground is home to 66 tenants and a host of satellite activities. Among the major tenants are the U.S. Research, Development and Engineering (RDECOM), U.S. Army Ordnance Center and Schools, U.S. Army Developmental Test Command, U.S. Army Aberdeen Test Center, U.S. Army Center for Health Promotion and Preventive Medicine, Northeast Region Civilian Personnel Operations Center, U.S. Army Medical Research Institute of Chemical Defense, Program Manager for Chemical Demilitarization and major elements of the Army Research Laboratory.

As a center for Army materiel testing, laboratory research and military training, the post is a key element in the nation's defense. All tanks and wheeled vehicles which have served U.S. forces for the past 50 years have been tested for performance and durability at APG - from the M4 Sherman tank of World War II to the M1 tank and High Mobility Multipurpose Wheeled Vehicle and Family of Stryker Vehicles of today.

Known as the "Home of Ordnance," APG has been training Army ordnance personnel since 1918. The Army's ordnance training was consolidated at the proving ground during World War II, and today the U.S. Army Ordnance Center and School provides mechanical maintenance training for more than 20,000 U.S. and foreign personnel each year. APG is the regimental headquarters for the Army's Chief of Ordnance.

APG's Edgewood Area has been a center for chemical warfare research and development since it was established. From the trenches of France and Belgium in World War I to the desert battlefields of Iraq nearly 80 years later, the work done at APG has contributed to the defense and safety of American forces threatened by chemical weapons.

More than 7,500 civilians work at Aberdeen Proving Ground, and more than 5,000 military personnel are assigned there. In addition, there are nearly 3,000 contractors and private business employees working on the proving ground.

There are 2,148 military family members living on the post and another 155 off post. The post supports more than 16,000 military retirees and retiree family members. The post is Harford County's largest employer and one of the largest employers in the state of Maryland.

U.S. Army Garrison, Aberdeen Proving Ground, provides general, administrative and logistical support to the post's tenants and satellite activities, and is responsible for the management and operation of the entire installation, which in many ways is like a small city.

Environmental stewardship is an essential component of all activity at APG. The installation and its tenants are actively involved in a wide variety of environmental compliance, pollution prevention, conservation, and restoration programs. In FY 2004 APG spent a total of \$31 million on environmental programs, installation programs and installation restoration activities.

Pollutants

VOC, NO_x, CO, PM, SO₂, Toxics

Emission Source Categories

MDE staff reviewed emission estimates prepared for Aberdeen Proving Grounds by a private contractor. These emission estimates included data for the following source categories:

- Mobile On-Road Source Emissions
 - Mobile - LDGV Emissions
 - Mobile - LDGT 1&2 Emissions
 - Mobile - LDGT 3&4 Emissions
 - Mobile - HDGV
 - Mobile - LDDT 1-4
 - Mobile - HDDV
 - Mobile - HDDV Exhaust
 - Mobile - HDDB
 - Mobile - HD CNG Trucks
 - Mobile - LD CNG Trucks

- Mobile Nonroad Source Emissions
 - 2-Stroke Gas Eng; Lawn & Garden Equip; Other Equipment
 - 4-Stroke Gas Eng; Recreational Equip; Golf Carts
 - 4-Stroke Gas Eng; Recreational Equip; Specialty Vehicles/Carts
 - 4-Stroke Gas Eng; Construction & Mining Equip; Off-Highway Trucks
 - 4-Stroke Gas Eng; Industrial Equip; Forklifts
 - 4-Stroke Gas Eng; Lawn & Garden Equip; Chain Saws
 - 4-Stroke Gas Eng; Lawn & Garden Equip; Leaf blowers/Vacuums
 - 4-Stroke Gas Eng; Lawn & Garden Equip; Rear Eng Riding Mowers
 - 4-Stroke Gas Eng; Lawn & Garden Equip; Front Mowers
 - 4-Stroke Gas Eng; Lawn & Garden Equip; Other Lawn & Garden Equip
 - 4-Stroke Gas Eng; Commercial Equip; Generator Sets
 - LPG Eng; Construction & Mining Equip; Off-Highway Trucks
 - Diesel Eng; Construction & Mining Equip; Rollers
 - Diesel Eng; Construction & Mining Equip; Cranes
 - Diesel Eng; Construction & Mining Equip; Graders
 - Diesel Eng; Construction & Mining Equip; Off-highway Trucks

- Diesel Eng; Construction & Mining Equip; Tractors/Loaders/Backhoes
 - Diesel Eng; Construction & Mining Equip; Other Construction Equip
 - Diesel Eng; Industrial Equip; Forklifts
 - Diesel Eng; Industrial Equip; Sweepers/Scrubbers
 - Diesel Eng; Lawn & Garden Equip; Front Mowers
 - Diesel Eng; Agricultural Equip; Agricultural Tractors
 - Diesel Eng; Commercial Equip; Generator Sets
 - Recreational marine 4-stroke gasoline equipment
 - Recreational marine diesel compression ignition equipment
 - Aircraft
- Area Source Emissions
 - Emissions from aircraft refueling.
 - Construction Welding
 - Solvent-based architectural surface coatings.
 - Water-based architectural surface coatings.
 - Cold cleaning solvents.
 - Solvent Utilization - Miscellaneous
 - Commercial/consumer solvents.
 - Open Burning Detonation
 - Landfills - All Categories
 - Munitions Detonation
 - Firefighting Training
 - Industrial Process - Miscellaneous
 - Commercial/institutional distillate oil combustion.
 - Commercial/institutional natural gas combustion.
- Point Source Emissions
 - MDE staff also reviewed and included emission estimates from emission certification reports prepared by Aberdeen Proving Grounds and submitted on an annual basis to MDE's Compliance and Enforcement Program. These emission estimates include major sources.

Emission Estimation Methodologies

Emission estimation methodologies varied by source category. A brief synopsis of the methodologies is presented below.

Mobile On-Road Source Emissions

Information on the privately owned vehicles for APG was estimated from a traffic study conducted for all gates at both Aberdeen and Edgewood.

Emissions for the on-road vehicles were calculated only for the estimated miles and hours of on-base vehicle operation. Miles traveled off the base were not included in the emission calculations. *AP-42, Volume 11, Fifth Edition* includes the emission factors for NO_x, CO, and VOC, which were calculated using EPA's MOVES2014a model for gasoline and diesel operated vehicles. AP-42 has been updated with NO_x, CO, and VOC emission factors from the latest version of EPA's MOVES2014a model, which

also includes emission factors for PM-10, PM-25, SO₂, and HAPS. Therefore, the emission factors for on-road vehicles were obtained by running the MOVES2014a model.

APG government-owned vehicles were grouped into vehicle categories according to vehicle type, gross vehicle weight (GVW), and fuel type. The CY 2017 mileage for each vehicle, came from a 2017 traffic study provided by the APG Department of Public or was an estimate of on-base mileage or a percentage of the total miles per vehicle that were driven on the base

Emission estimates for privately owned vehicles (POVs) are based on traffic studies for CY 2017. Each traffic study tracked incoming vehicles at all gates over a single day. The POV miles traveled were determined by using the distance from each gate to a central location. Each POV that entered a specific gate was assumed to drive that distance each day. The daily on-base mileage was determined by multiplying the number of POVs by the round-trip distance to a specific gate. The daily miles driven were multiplied by 5 working days per week and then multiplied by 50 working weeks per year (APG 2014). POV vehicles from the traffic study were conservatively estimated to be in the above-referenced vehicle categories.

Emissions from daily employee and POVs were estimated by multiplying the annual on-base mileage of each vehicle category with the emission factors obtained from the MOVES2014a. The emission factors were used in the following equation to estimate annual emissions:

$$E = V * F * C$$

Where:

E = Annual emissions of particular pollutant from each vehicle category (lb/yr)

V = Vehicle miles traveled on-base per year for each vehicle category (mi/yr)

F = Average model year emission factor in the applicable vehicle category (g/mi)

C = Conversion factor (2.205 x 10⁻⁶ lb/g)

The information on the vehicles tested and miles driven on unpaved test tracks at APG was obtained from 2017 logs for each track. The test vehicles were divided equally into the HDDV and HDGV vehicle classes.

Mobile Nonroad Mobile Source Emissions

APG gathered information about the number of vehicles, model year, horsepower rating, fuel type, engine cycle type, and estimated operating hours for CY 2017. In the majority of instances, horsepower ratings and operating hours were not readily available and have been assumed based on the typical horsepower of similar types of equipment.

Diesel engine factors were obtained from *Exhaust and Crankcase Emission Factors for Nonroad Engines Modeling-Compression-Ignition (USEPA, 2010a)* and gasoline engine factors were obtained from *Exhaust Emission Factors for Nonroad Engines Modeling-Spark-Ignition (USEPA, 2010b)*.

Emission factors for stationary internal combustion engines were used to estimate criteria pollutant emissions for the non-mobile equipment. Emissions were calculated by multiplying the power output by the emission factors applicable to the type of fuel used by the non-mobile equipment, either

gasoline or diesel. The power output was calculated by multiplying the power of the equipment in horsepower times the estimated hours of operation.

The total emissions for all non-road vehicles and equipment were separated into emissions for Aberdeen and Edgewood. In cases where vehicles were used at both Aberdeen and Edgewood the total emissions were divided equally.

Aircraft operations are conducted at Phillips Airfield at Aberdeen and Weide Heliport at Edgewood. These operations include landings and takeoffs (LTOs), touch and go's (T&Gs), low approaches (LAs), and trim and power checks (T&Ps). Emissions from aircraft operations were estimated using the EDMS (version 5.1) model.

Emissions of criteria pollutants for watercraft were calculated using factors for diesel engines obtained from (*USEPA, 2010a*) and factors for gasoline engines obtained from (*USEPA, 2010b*) based on the size and horsepower of engine.

The inventory of watercraft includes APG vessels, privately owned boats, and patrol boats. The inventory included the size of vessels, whether the boat has an inboard or outboard motor, whether the boat uses gasoline or diesel, on-site fuel usage, and on-site estimated usage.

Area Source Emissions

Emissions from the various area source categories were estimated using a variety of methods, including population based, fuel consumption, and mass balance. Emission factors were derived from the EPA document titled 'Emission Inventory Improvement Program', and AP-42. Landfill losses as VOC were calculated for Michaelsville landfill using *Landfill Gas Emissions Model (LandGEM) version 3.02* available through the EPA. LandGEM is based on a first-order decomposition rate equation for quantifying emissions from the decomposition of waste in municipal solid waste landfills.

Activity

An activity level of 7 days a week with no seasonal adjustment factor was used.

Emission Factors

Emission factors were derived from the Emission Inventory Improvement Program (EIIP); AP-42, Volume 11, Fifth Edition; EPA's NMIM model; EPA's MOVES2010b model; and the Landfill Gas Emissions Model (LandGEM).

Point Source Adjustments

Collecting all emissions estimates under one facility effectively creates a single point source for all of the emissions. Some point sources were subtracted from the area source inventory to avoid double counting.

Adjustment for Controls

Controls were applied when applicable to a particular source category.

Spatial and Temporal Allocations

Spatial

Spatial allocation of the emission estimates to specific areas within APG is not available.

Temporal

Since this activity is year round annual emissions were divided by 365 to estimate daily emissions.

3.3 BALTIMORE-WASHINGTON INTERNATIONAL AIRPORT (BWI)

Description

Baltimore-Washington International Airport (BWI) is located in Anne Arundel County, Maryland, approximately 9 miles south of the City of Baltimore and approximately 30 miles northeast of Washington, D.C. BWI Airport is generally bounded on the north, east, and west by Aviation Boulevard (MD Route 170 and MD Route 162) and on the south by Dorsey Road (MD Route 176). Interstate 195 (I-195) is a four-lane divided highway that serves as the primary access point to the airport terminal area. Elm Road and Aviation Boulevard provide secondary access to the terminal and cargo facilities.

BWI is operated by the Maryland Aviation Administration, Maryland Department of Transportation. BWI Airport encompasses 3,596 acres of land. The passenger terminal contains 1.4 million square feet; 4 concourses (3 domestic, 1 international/swing); 69 jet gates with 12 gates dedicated to commuter aircraft.

The emission sources at BWI include aircraft, aircraft ground support service equipment, motor vehicles (on roadways, in parking facilities, and at terminal curbsides), the heating plant, fuel storage and handling, and training fires.

Pollutants

VOC, NO_x, CO, PM, SO₂, Toxics

Emission Source Categories

MDE staff reviewed emission estimates prepared for BWI Airport by a private contractor. These emission estimates included data for the following source categories:

- Mobile Onroad Source Emissions
 - Mobile - LDGV Emissions
 - Mobile - Parking Facility Emissions
 - Mobile - LDGT 1&2 Emissions
 - Mobile - LDDT 1-4
 - Mobile – HDDV
- Mobile Nonroad Source Emissions
 - Emissions from airport service diesel compression ignition equipment
 - Emissions from military aircraft LTOs
 - Emissions from commercial aircraft LTOs
 - Emissions from general aviation aircraft LTOs
 - Emissions from aircraft auxiliary power units
- Mobile Nonroad Source Construction Equipment Emissions
 - 2-Stroke Gas Eng; Construction & Mining Equip; Paving Equip
 - 4-Stroke Gas Eng; Construction & Mining Equip; Plate Compactors
 - 4-Stroke Gas Eng; Construction & Mining Equip; Concrete/Industrial Saws
 - Diesel Eng; Construction & Mining Equip; Pavers

- Diesel Eng; Construction & Mining Equip; Rollers
 - Diesel Eng; Construction & Mining Equip; Scrapers
 - Diesel Eng; Construction & Mining Equip; Signal Boards/Light Plants
 - Diesel Eng; Construction & Mining Equip; Trenchers
 - Diesel Eng; Construction & Mining Equip; Excavators
 - Diesel Eng; Construction & Mining Equip; Cranes
 - Diesel Eng; Construction & Mining Equip; Graders
 - Diesel Eng; Construction & Mining Equip; Off-highway Trucks
 - Diesel Eng; Construction & Mining Equip; Rubber Tire Loaders
 - Diesel Eng; Construction & Mining Equip; Tractors/Loaders/Backhoes
 - Diesel Eng; Construction & Mining Equip; Crawler Tractor/Dozers
 - Diesel Eng; Industrial Equip; Aerial Lifts
 - Diesel Eng; Industrial Equip; Forklifts
 - Diesel Eng; Industrial Equip; Sweepers/Scrubbers
 - Diesel Eng; Commercial Equip; Generator Sets
 - Diesel Eng; Commercial Equip; Air Compressors
 - Diesel Eng; Commercial Equip; Welders
- Mobile Onroad Source Emissions
 - Firefighting Training
 - Point Source Emissions
 - MDE staff also reviewed and included emission estimates from emission certification reports prepared by BWI and submitted on an annual basis to MDE's Compliance and Enforcement Program. These emission estimates include major sources.

Emission Estimation Methodologies

Emission estimation methodologies varied by source category. A brief synopsis of the methodologies is presented below.

Emissions and Dispersion Modeling System (EDMS) Version 5.1

- **Aircraft**

FAA's EDMS computer program contains a database of aircraft engine emission factors based on engine make and model and four engine operation modes (taxi/idle, takeoff, climb out, and approach). EDMS also contains a database of emission factors for an aircraft's auxiliary power units (APUs). Time-in-mode data is also used as an input into the emission inventory. EDMS time-in-mode data include the time that aircraft spend in each of the four operating modes.

- **Ground Support Equipment**

FAA's EDMS computer program contains a database of the ground support equipment (GSE) used to service specific types of aircraft. Also included in the database are the emission factors for each piece of GSE, as well as the time that each piece of equipment spends servicing the aircraft.

- **Roadways**

FAA's EDMS computer program uses EPA's MOVES2010b model to estimate on-road mobile vehicle emissions.

- **Parking Facilities**

FAA's EDMS computer program uses EPA's MOVES2010b model to estimate on-road mobile vehicle emissions from parking facilities.

- **Training Fires**

FAA's EDMS computer program contains a database of emission factors for five fuel types (JP-4, JP-5, JP-8, Tekflame and Propane). Training fire emissions are estimated by choosing the fuel type and specifying the amount of fuel consumed in the training exercise.

Nonroad Mobile Source Emissions

- **Construction Equipment**

Emissions from construction activities were estimated based on the construction activity schedule, including the number and types of construction vehicles and equipment units and their utilization rates. Emission rates were taken from EPA's NONROAD2008a program, AP-42 guidance, and MOVES2010b. Emissions from several components of construction activities were calculated, specifically: onsite construction equipment (backhoes, bull dozers, graders, etc.), haul vehicles idling onsite (cement trucks, dump trucks, etc.), and haul vehicles and construction worker vehicles accessing the site. An industry-wide, representative mix of the number and types of construction equipment, average power rating (horse power), and equipment load factors was used in the analysis. Construction-related motor vehicles (dump trucks, pick-up trucks, etc.) were assumed to travel a round trip on-site distance of 5 miles while on the Airport construction site.

Activity

An activity level of 7 days a week with no seasonal adjustment factor was used.

Emission Factors

Emission factors were derived from FAA's EDMS computer program (Version 5.1.3). Vehicular emission factors contained in EDMS are obtained from the EPA's MOVES2010b model. Construction emission factors were derived from EPA's NONROAD2008a Model.

Point Source Adjustments

Collecting all emissions estimates under one facility effectively creates a single point source for all of the emissions. No other point sources were subtracted from the area source inventory to avoid double counting.

Adjustment for Controls

Controls were applied when applicable to a particular source category.

Spatial and Temporal Allocations

Spatial

Spatial allocation of the emission estimates to specific areas within Baltimore Washington International Airport is not available.

Temporal

Since this activity is year round annual emissions were divided by 365 to estimate daily emissions.

3.4 PORT OF BALTIMORE

Description

The Maryland Port Administration (MPA) works hand and hand with the Port of Baltimore to help the marine terminal in there day to day operations. Maryland has seven main terminals and several tenant port terminals. The main terminals are:

Dundalk Marine Terminal
South Locust Point
Masonville Marine Terminal

Seagirt Marine Terminal
North Locust Point
Fairfield Marine Terminal

The Maryland Port Authority provided the following descriptions.

Dundalk Marine Terminal:

With 13 berths, nine container cranes, and direct rail access, the 570-acre (230 ha) Dundalk Marine Terminal remains the largest and most versatile general cargo facility at the Port of Baltimore.

Dundalk handles containers, automobiles, farm equipment, construction and other Roll-on/Roll-off (RORO) equipment, wood pulp, steel, break-bulk, project cargo, and other various types of equipment.

Ports America operates a private container terminal within Dundalk. Baltimore's proximity to the Midwest's major farm and construction equipment manufacturers has helped the Port become the leading U.S. port for combines, tractors and hay balers, and in importing excavators and backhoes.

The terminal is one of the top RORO ports in the U.S. Baltimore recently signed a 20-year, 150-acre agreement to serve as the East Coast hub for the largest RORO carrier in the world.

Seagirt Marine Terminal:

Opened in 1990, Seagirt features the latest in cargo-handling equipment and systems. Seagirt is operated by Ports America Chesapeake under a 50-year public-private partnership signed in 2010 with the MPA. Under the agreement, Ports America is constructing a new 50-foot container berth to be accompanied by four state-of-the-art super Post Panamax cranes. At that point, the Port of Baltimore will be only the second East Coast port with both a 50-foot channel and a 50-foot berth, allowing it to accommodate some of the largest container ships in the world.

South Locust Point:

South Locust Point has Interstate 95 – which is direct access to the East Coast bypassing its entrance. In 1988, the MPA completed a major expansion of South Locust Point, doubling the size of the terminal to almost 80 acres. In 2005, MPA created a 300,000-foot paper shed and a 100,000-foot shed.

In 2006, the MPA opened its new, dedicated 60,000-foot Cruise Ship terminal at the South Locust Point terminal. The structure used for the passenger terminal was formerly a paper-shed building situated on 14 acres of land with easy access from either side of I-95.

North Locust Point:

North Locust Point was used in the past to welcome immigrants, served as a cargo pier for the Baltimore & Ohio Railroad, and handled many different types of break-bulk, as well as liquid and drybulk cargoes. Today, the 90-acre (36.1 ha) terminal has been redeveloped to enhance the Port's forest products capabilities. The addition of a 45-long-ton (45.7 mt) container crane, coupled with on-dock rail access, allows for the smooth loading and discharge of steel directly between vessel and rail car.

Masonville Marine Terminal – (Connected to Fairfield Marine Terminal):

Located near Maryland's 1895 Masonville Terminal specializes in the import, export, and processing of automobiles. It covers 61 acres, with a trucks loading inside the terminal. It also has two piers (Pier 4 – 832 ft (253.6 m); Depth: 49 ft. (14.9 m), and CSX spur adjacent. Entire terminal leased to ATC Logistics.

Fairfield Marine Terminal:

Located also near Maryland's 1895 Fairfield Marine Terminal specializes in the import, export, and processing of automobiles. It is over 104 acres load truck inside and outside fenced terminal. Fairfield has two piers; Pier 4 - 832 ft. (253.6 m) / Depth - 49 ft. (14.9 m), and an and CSX spur adjacent. Entire terminal leased to Daimler-Chrysler (Mercedes-Benz).

Pollutants

VOC, NOx, CO, PM, SO2, Toxics

Emission Source Categories**Mobile Nonroad Source Emissions:**

1. Included in the Cargo Handling Equipment (CHE) category are:

- Ship to shore (STS) and other mobile cranes
- Rubber-tired gantry (RTG) cranes
- Forklifts
- Top loaders
- Side loaders
- Yard tractors
- Rubber-tired loaders
- Skid steer loaders
- Roll-on, roll-off (RoRo) equipment (e.g., self-propelled construction equipment, motorized farm equipment, and trailered items; e.g., watercraft)
- Vehicle cargo (automobiles, SUVs, and trucks that are driven off and onto ships)
- Auto processing (i.e., paint booths used for minor repairs)
- Maintenance, construction vehicles, and similar equipment
- Conveyor systems for dry bulk material
- Yard vehicles (unlicensed trucks and/or autos used for transportation purposes on port property only)
- Generators
- Employee traffic on site (includes cruise passenger vehicle traffic on site)

Emissions Calculation

1. Nonroad emissions were calculated using emission factors and load factors for non-road equipment developed by EPA and are available by their SCC code through the NMIM model).
2. Heavy Duty Diesel Vehicles (HDDVs): are the on-road semi-trailer trucks that pick up and deliver cargo to the terminals.
3. Rail locomotive: Switching engine operations
4. Marine Vessels Port: Port vessel emissions are calculated for each port as described in section 5.6 Marine Vessels. The ports within the Baltimore Nonattainment Area (BNAA) are used in this section and represent a quazi point as a whole. Hoteling, maneuvering, cruise, and slow cruise emissions are estimated for all non-ocean going activity and movement within the waterways surrounding the BNAA ports.

Mobile Onroad Source Emissions:

1. LDGV and LDDV - Vehicle cargo (Autos, SUVs, and Trucks) SCC: 2201001250 and 2230001250
2. LDGV and LDDV - Employees SCC: 2230001250 and 2201001250
3. LDGV, HDGV, LDDT, and LDGT - Yard vehicles SCC: 2270003070, 2201070250, 2230060250, 2201020250, and 2201001250.

Emissions Calculation

Mobile emissions were calculated use EPA's MOVES2014b Model.

Spatial and Temporal Allocations

Spatial

Divided cruise emissions out to counties along travel route.

Temporal

Since this activity is year round annual emissions were divided by 365 to estimate daily emissions.

Emissions Calculation

On-road emissions were estimated for vehicles moving and idling. Emission factors from EPA's MOVES2014b Model were used to calculate emissions. Emission factors for on-road vehicles are represented in units of grams per mile (g/mi), while idling emission factors are expressed in grams per hour (g/hr). Distance or vehicle miles traveled (VMT) was used to calculate emissions for moving vehicles, and time, hours running, was used to estimate idling emissions.

4.0 NONPOINT/AREA SOURCES

4.1 EMISSION ESTIMATION METHOD BY CATEGORY

4.1.1 PETROLEUM DISTRIBUTION LOSSES

Evaporative emissions occur at all points in the gasoline distribution process. These operations, generally inventoried as area sources, are gasoline dispensing outlets and gasoline tank trucks in transit. Bulk terminals and gasoline bulk plants, which are intermediate distribution points between refineries and outlets, have been inventoried as point sources. Most gasoline dispensing outlets emit less than 10 tons of VOC per year and therefore have been inventoried using area source methods.

VOC emissions from gasoline dispensing outlets result from vapor losses during tank truck unloading into underground storage tanks, vehicle fueling (boat fueling at marinas), and underground storage tank breathing. Evaporative losses from each activity in this source category have been tabulated separately so that various emission reduction control measures could be easily evaluated.

Emissions from vehicle fueling, including spillage during fueling, were calculated with the MOVES model and the methodology is described in Section 5.0 Mobile Sources. Tank truck unloading, underground tank breathing, tank trucks in transit and aircraft refueling were calculated using emissions factors from AP-42 and EIIP.

4.1.1.1 Tank Truck Unloading

SCC: 25 01 060 053
25 01 060 051

Description:

Emissions from tank truck unloading are affected by whether the service station tank is equipped for submerged, splash or balance filling. Therefore calculations were based on the filling method used and gallons sold.

Pollutants

VOC and HAPs

Method and Data Sources:

The method used to calculate emissions (all VOC), is presented in EIIP¹, Chapter 11, Gasoline Marketing, which extracts the emission factors from AP-42, Volume I, Table 5.2-7.

Activity

The Maryland Comptroller of the Treasury, Gasoline Tax Division (see Appendices) provided annual gallons of gasoline and diesel fuel sold. This data includes taxable and non-taxed gasoline purchased by the U.S. Government. State and local government sales are included in the taxable sales data. The statewide total of gallons of fuel sold was allocated to the county level proportional to the number of registered vehicles within the county. Vehicle registration data was collected from the Maryland Department of Transportation, Motor Vehicle Administration that supplied the data to MDE's Mobile Sources Control Program. Diesel fuel powered vehicle totals were subtracted from the Maryland and county registration numbers.

Percentages of submerged, balanced submerged and splash-fill tanks were determined with the assistance of MDE Waste Management. MDE staff reported no splash filling at Maryland service stations in 2017. All underground storage tanks within the nonattainment areas of the State of Maryland are required to use vapor-balance submerged filling methods. Waste Management's underground tank inspection program and regulations concerning underground storage tanks have eliminated splash-fill tanks in the state. A SSCD study determined that the rule effectiveness factor for vapor balance controls was 91%.

An activity level of 7 days per week was used, based on observations by MDE staff of unloading at Maryland retail gas stations. A rule effectiveness of 91% was determined from a study of Stage I compliance performed in Regions III and IV by the MDE/ARA enforcement program in 1991. In the attainment counties outside of Regions III and IV, a default rule effectiveness of 80 % was used. This survey data was used to determine the penetration of each filling technology. The total fuel sales in the county were multiplied by the fraction using each filling technology. The AP-42 technology-

¹ Emission Inventory Improvement Program

specific emission factors were then used to estimate emissions from submerged filling and balanced submerged filling. The emissions from each filling technology were summed to estimate total emissions.

Filling Method	Non-Attainment Area	Transport Region	Attainment Area
Submerged	9%	9%	20%
Balanced Submerged	91%	91%	80%
Splash	0%	0%	0%

Emission Factors

Emission factors are affected by true vapor pressure and temperature. Emissions from loading petroleum liquid can be estimated (with a probable error of ±30 percent) using the following expression²:

$$L_L = 12.46 * \frac{S * P * M}{T}$$

where:

- L_L = loading loss, pounds per 1000 gallons (lb/10³ gal) of liquid loaded
(The loading loss is equivalent to an emission factor)
- S = a saturation factor (see AP-42 Table 5.2-1)
- P = true vapor pressure of liquid loaded, pounds per square inch absolute (psia)
- M = molecular weight of vapors, pounds per pound-mole (lb/lb-mole)
- T = temperature of bulk liquid loaded, °R (°F + 460)

Table 5.2-1 from AP-42 shows that the saturation factor (S) is a constant for a specific petroleum liquid, carrier and type of loading service

The true vapor pressure (P) can be estimated from the Reid vapor pressure using the following equation:

$$P = \exp \left\{ \left[0.7553 - \left(\frac{413.0}{T + 459.6} \right) \right] S^{0.5} * \log_{10}(RVP) - \left[1.854 - \left(\frac{1042}{T + 459.6} \right) \right] S^{0.5} + \left[\left(\frac{2416}{T + 459.6} \right) - 2.013 \right] \log_{10}(RVP) - \left(\frac{8742}{T + 459.6} \right) + 15.64 \right\}$$

The molecular weight varies slightly with temperature and pressure, however for this analysis it is assumed to be constant.

Proportioning the loading factors yields

$$\frac{LL_2}{LL_1} = \frac{12.46 * S_2 * P_2 * M_2 / T_2}{12.46 * S_1 * P_1 * M_1 / T_1} = \frac{P_2 * T_1}{P_1 * T_2} \qquad LL_2 = LL_1 * \frac{P_2 * T_1}{P_1 * T_2}$$

² AP42, Chapter 5.2: Transportation and Marketing of Petroleum Liquids

The loading factor or emission factor is directly proportional to true vapor pressure and inversely proportional to temperature in degrees Rankin.

LL1 = 0.3 at RVP of 10 and 60 F; this yields LL1 = 0.3; P = 5.186; T = 520 R

To calculate LL2 at RVP of 6.7 and 81.8 F or P = 5.094; T = 541.8 R

$$LL2 = LL1 * \frac{P2 * T1}{P1 * T2} = 0.3 * \frac{5.094 * 520}{5.186 * 541.8} = 0.2828$$

Initial emission factors of 0.3 lb_{VOC} per 1000 gallons throughput for balanced submerged filling and 7.3 lb_{VOC} per 1000 gallons throughput for submerged filling were used in all Maryland counties. These factors were then adjusted with county-specific monthly average temperature and true vapor pressure values using the above technique.

Filling Method	Base Emission Factor Lb. VOC per 1,000 gallon
Balanced Submerged	0.3
Submerged	7.3
Diesel Fuel Unloading	0.014

Point Source Adjustments

Emissions from Andrews Air Force Base were subtracted from Prince Georges County emission totals and put in the Quazi Point.

Adjustment for Controls

Controls for this source category are reflected in the emission factors.

Spatial and Temporal Allocations

Spatial

Spatial allocation source data was based on vehicle registration data that was provided through the Maryland Department of Transportation, Motor Vehicle Administration and source data supplied to MDE's Mobile Sources Control Program. Diesel fuel powered vehicle totals were subtracted from the Maryland and county registration numbers.

Temporal

Monthly temporal allocation activity data was provided through the Maryland Comptroller of the Treasury, Gasoline Tax Division (see Appendices) provided annual gallons of gasoline and diesel fuel sold. This data includes taxable and non-taxed gasoline purchased by the U.S. Government. State and local government sales are included in the taxable sales data. The statewide total of gallons of fuel sold was allocated to the county level proportional to the number of registered vehicles within the county. Also, a SAF was applied to emissions and were averaged according to period of operation to a daily estimate. See section 2.2.1.1

Emissions Calculation

The equation for estimating emissions from tank truck unloading is:

$$E_{ij} = \frac{(G_i \times F_{i(fm)} \times EF_{fm}) + (G_i \times F_{i(fm)} \times EF_{fm})}{2000} \quad \text{Where:}$$

E_{ij} = Emissions of VOC in tons per day from tank truck unloading per county i

G_i = Gallons of gasoline sold in county i during 2014

$F_{i(fm)}$ = Fraction of gasoline dispensed per county i per filling method (balanced submerged or submerged) during 2014

EF_{fm} = Emission factor per filling method for tank truck unloading adjusted by RVP and temperature:
(0.3 lb. VOC/1000 gallon throughput or 7.3 lb. VOC/1000 gallon throughput)

Tank Truck Unloading Sample Calculation (Howard County)

To calculate fuel usage for Howard County:

Filling Method	Howard County
	Adjusted Emission Factor Lb. VOC per 1,000 gallon
Balanced Submerged	0.3131
Submerged	7.6196
Diesel Fuel Unloading	0.014

Total fuel sold in Maryland in 2017³ = 2,786,302,192 gallons

Allocate gallons of fuel sold to the county level by the 2017 county vehicle registration proportion:

$$\frac{\text{Howard County vehicle registration}^4}{\text{Total MD vehicle registration}} = \frac{262,702}{4,707,857} = 0.0558$$

$G = 2,786,302,192 \times 0.0558 = 155,477,781$ gallons sold in **Howard County**

$EM = (G * \text{Market \%} * EF \text{ adjusted} / 1000) / 2000$

EMbs = balanced submerged emissions

EMs = submerged emissions

$EMbs = (155,477,781 * 91\% * 0.3131 / 1000) / 2000 = \mathbf{22.15 \text{ tons}_{VOC} \text{ per year}}$

$EMs = (155,477,781 * 9\% * 7.6196 / 1000) / 2000 = \mathbf{53.31 \text{ tons}_{VOC} \text{ per year}}$

Tank Truck Unloading was found to have a

³ Annual sales of gasoline from Maryland Comptroller of the Treasury, Gasoline Tax Division

⁴ State of Maryland Motor Vehicle Administration and MDE Mobile Sources Control Program

SAF = seasonal adjustment factor of 0.262525702

POS = peak ozone period of 0.25

Days of the Period 365

Daily adjusted EMda = $(EM / 365) * (SAF / POS)$

EMbsda = $(22.15 / 365) * (0.262525702 / 0.25) = 0.06 \text{ VOC tons/day}$ balanced submerged

EMsda = $(53.31 / 365) * (0.262525702 / 0.25) = 0.15 \text{ VOC tons/day}$ submerged

4.1.1.2 Auto Refueling

Description

SCC: 25 01 060 100

Emissions from Auto refueling are substantially less than those from Stage I because gasoline vapors that ordinarily might have escaped during vehicle fueling are re-circulated by each vehicle's on-board vapor recovery system. Emissions were calculated from estimated gallons sold per county.

Pollutants

VOC

Method and Data Sources

EPA recommends that the MOVES model be used to generate refueling emission factors for highway vehicle emission inventories (EPA, 2003). The model, designed to support the evaluation of air pollution from gasoline- and diesel-fueled vehicles, generates emission factors for tailpipe emissions and refueling activities. If you are running MOVES in rates mode, you will need to use the results from both the rate per distance output table and the rate per vehicle output table. The rates for emissions processes 18 and 19 by source type in the rate per distance table should be multiplied by the local VMT by source type. In addition, the rates for emission processes 18 and 19 by source type in the rate per vehicle need to be multiplied by the local vehicle population by source type. The sum of these two values is the total refueling emissions.

Activity

Input activity data such as VMT, vehicle registration, and gasoline sales are collected by MDE's Mobile section from the Maryland Department of Transportation and the Maryland State Comptroller's Office, Tax Motor Unit Division.

Emission Factors

ARA mobile sources staff ran the MOVES2014 model to estimate the refueling emissions using the grams per mile (g/mile) methodology described above. The emission estimates were converted from grams to tons.

Point Source Adjustments

No subtraction of emissions from point sources is necessary.

Adjustment for Controls

Controls for this source category include Onboard Refueling Vapor Recovery (ORVR) systems. The controls are reflected in the emission estimates produced by the (MOVES2014) model.

Spatial and Temporal Allocations

Spatial

The MOVES2014 model spatially allocates input files specify state county-level gasoline sales data to spatially allocate emission estimates.

Temporal

The MOVES2014 model allocates monthly activity data per state county-level and national level estimates.

Emissions Calculation

A sample equation for estimating emissions from auto refueling is:

$$E_{StII} = \frac{(G_i \times EF_{StII} \times MPG \times SAF)}{2000} \quad \text{Where:}$$

E_{StII} = emissions of VOC in tons per day from auto refueling

G_i = gallons of gasoline sold in county i during 2017

EF_{StII} = emission factor for auto refueling from the MOVES2014 model (grams/mile)

MPG = average fuel economy (miles/gallon)

SAF = seasonal adjustment factor to reflect summer weekday emissions

Auto Refueling Sample Calculation

Since all calculations are included in the MOVES2014 model output, a sample calculation is not available for this source category.

4.1.1.3 Underground Tank Breathing

SCC: 25 01 060 201

Description:

Underground tank breathing occurs when gasoline is drawn out of the tanks and into the pump lines. During this process air moves into the tank evaporating gasoline and emitting vapors.

Pollutants

VOC and HAPs

Method and Data Sources:

The method used to calculate emissions (all VOC), is presented in EIIP⁵, Chapter 11, Gasoline Marketing, which extracts the emission factors from AP-42, Volume I, Table 5.2-7.

Activity

The Maryland Comptroller of the Treasury, Gasoline Tax Division provided annual gallons of gasoline and diesel fuel sold. This data includes taxable and non-taxed gasoline purchased by the U.S. Government. State and local government sales are included in the taxable sales data. The statewide total of gallons of fuel sold was allocated to the county level proportional to the number of registered vehicles within the county. Vehicle registration data was collected from the Maryland Department of Transportation, Motor Vehicle Administration that supplied the data to MDE's Mobile Sources Control Program. Diesel fuel powered vehicle totals were subtracted from the Maryland and county registration numbers.

Emission Factors

An emission factor of 1.0 lbs. VOC per 1000 gallons throughput was used. The emission factor was taken from EIIP, Chapter 11, Gasoline Marketing, which extracts the emission factors from AP-42, Volume I, Table 5.2-7. Factors were adjusted with county-specific monthly average temperature and true vapor pressure values.

MDE used the same sources for gasoline sales and car registration as in tank truck unloading.

Point Source Adjustments

No subtraction of emissions from point sources is necessary.

Adjustment for Controls

Controls for this source category are reflected in the emission factors.

⁵ Emission Inventory Improvement Program

Spatial and Temporal Allocations

Spatial

Spatial allocation source data was based on vehicle registration data that was provided through the Maryland Department of Transportation, Motor Vehicle Administration and source data supplied to MDE's Mobile Sources Control Program. Diesel fuel powered vehicle totals were subtracted from the Maryland and county registration numbers.

Temporal

Monthly temporal allocation activity data was provided through the Maryland Comptroller of the Treasury, Gasoline Tax Division provided annual gallons of gasoline and diesel fuel sold. This data includes taxable and non-taxed gasoline purchased by the U.S. Government. State and local government sales are included in the taxable sales data. The statewide total of gallons of fuel sold was allocated to the county level proportional to the number of registered vehicles within the county. Also, a SAF was applied to emissions and were averaged according to period of operation to a daily estimate. See section 2.2.1.1

Emissions Calculation

The equation used to estimate emissions from underground tank breathing is:

$$E_{\text{utb}} = \frac{(G_i \times EF_{\text{utb}})}{2000} \quad \text{Where:}$$

E_{utb} = emissions of VOC in tons per day from underground tank breathing and emptying

G_i = gallons of gasoline sold in county i during 2017

EF_{utb} = emission factor for underground tank breathing (1.0 lbs. $\text{VOC}/1000$ gallon throughput)

Underground Tank Breathing Sample Calculation (Harford County)

To calculate fuel usage for Harford County:

Total fuel sold in Maryland in 2017⁶ = **2,786,302** kgallons

Allocate gallons of fuel sold to the county level by the 2017 county vehicle registration proportion:

⁶ Annual sales of gasoline from Maryland Comptroller of the Treasury, Gasoline Tax Division

$$\frac{\text{Harford County vehicle registration}^7}{\text{Total MD vehicle registration}} = \frac{227,702}{4,707,857} = 0.0484$$

Gcarr = **2,786,302** x 0.0484 = **134,763** kgallons sold in **Harford County** in 2017.

$$EF_{\text{utb}} = 0.9267 \text{ lbs.}_{\text{VOC}}/1000 \text{ gallon}$$

$$E_{\text{utb}} = \frac{(134,763 \times 1000 \times 0.9267 / 1000)}{2000}$$

$$E_{\text{utb}} = 62.44 \text{ tons}_{\text{VOC}} \text{ per year}$$

Underground Tank Breathing was found to have a

SAF = seasonal adjustment factor of 0.262525702

POS = peak ozone period of 0.25

Days of the Period 365

Daily adjusted $E_{\text{utbda}} = (E_{\text{utb}} / 365) * (\text{SAF} / \text{POS})$

$$E_{\text{utbda}} = (62.44 / 365) * (0.262525702 / 0.25) = 0.18 \text{ VOC tons/day}$$

⁷ State of Maryland Motor Vehicle Administration and MDE Mobile Sources Control Program.

4.1.1.4 Gasoline Tank Trucks in Transit

SCC: 25 05 030 120

Description

Breathing losses from tank trucks during the transport of gasoline are caused by leaking delivery trucks, pressure in the tanks, and thermal effects on the vapor and on the liquid. A worst case situation arises if a poorly sealed tank has been loaded with gasoline and pure air becomes saturated. During the vaporization process, pressure increases and venting occurs. Emissions from this source category include the evaporation of petroleum vapor from:

- loaded tank trucks during transportation of gasoline from the bulk plant/terminal to the service station or other dispensing outlet, and
- from empty tank trucks returning from service stations to bulk plant/terminals

Pollutants

VOC

Method and Data Sources

The method used to calculate emissions (all VOC), is presented in EIIP⁸, Chapter 11, Gasoline Marketing (Stage I & Stage II), and dated September 1997.

Activity

Emission Factors

EPA documents the emission factors in AP-42, Table 5.2-5 and EIIP states the emission factors within the above-referenced document in AP-42 Table 11.3-1. The AP-42 emission factors represent a typical range of values. EIIP averages the “typical range values” within AP-42 and arrives at average emission factor values of 0.055 and 0.005 lbs. _{VOC} per 1000-gallon gasoline, respectively for emissions from empty tank trucks and emissions from full tank trucks.

Emission Source	EIIP Table 11-3.1 Lb/1000 gallon “Average”	AP-42 Table 5-2.5 Lb/1000 gallon “Typical Range”
Gasoline Tank Trucks in Transit		
Empty Tank Trucks	0.055	0 - 0.11
Full Tank Trucks	0.005	0 - 0.01

Spatial and Temporal Allocations

⁸ Emission Inventory Improvement Program

Spatial

Data for spatial allocation is not available for this source.

Temporal

SAF was applied to emissions and were averaged according to period of operation to a daily estimate. See section 2.2.1.1

MDE used the same sources for gasoline sales and car registration as in tank truck unloading. Emission factors came from EIIP, Volume I, and Table 5.2-5, of 0.06 pounds VOC per 1000 gallons throughput (combines 0.005 lb_{VOC}/1000 gallon full tank truck delivery, and 0.055 lb_{VOC}/1000 gallon empty tank return). MDE also used a bulk facility throughput adjustment factor of 1.09 and calculated throughput by a ratio of county retail sales and state retail sales times state fuel sales.

Emission Factors:

- Full tank truck delivery 0.005 lbs. VOC per 1000 gallons
- Empty tank truck return 0.055 lbs. VOC per 1000 gallons
- Combined (full & empty) 0.060 lbs. VOC per 1000 gallons

Bulk Facility Throughput Adjustment Factor: 1.09

Equation:

$$E_{tt} = \frac{(G_i \times 1.09 \times EF_{tt})}{2000} \quad \text{Where:}$$

E_{tt} = emissions of VOC in tons per day from tank trucks in transit

G_i = thousand gallons of fuel sold in county i

EF_{tt} = Combined (full & empty) tank trucks in transit emission factor

2017 Gasoline Tank Trucks in Transit Sample Calculation (Harford County)

To calculate fuel usage for Harford County:

Total on-road and non-road fuel sold in Harford County = **134,763** kgallons

G = **134,763** kgallons sold in Harford County

$$E_{tt} = \frac{(134,763 \times 1.09 \times 0.06)}{2000}$$

E_{tt} = **4.41** tons_{VOC} per year emitted from tank trucks in transit in **Harford County**.

Underground Tank Breathing was found to have a

SAF = seasonal adjustment factor of 0.262525702

POS = peak ozone period of 0.25

Days of the Period 312

Daily adjusted $E_{ttda} = (E_{tt} / 312) * (SAF / POS)$

$E_{ttda} = (4.41 / 312) * (0.262525702 / 0.25) = \mathbf{0.0148 \text{ VOC tons/day}}$

4.1.1.5 Aviation Gasoline Distribution Stage 1 and Stage 2

SCC: 25 01 080 050
25 01 080 100

Description

In Stage I aviation gasoline (also called “AvGas”) used in small reciprocating piston-engines is shipped to airports for use in civil aviation. AvGas is first placed into bulk terminals, and then into tanker trucks. These filling processes will cause the displacement of vapors into the atmosphere during the transfer of gasoline from tank trucks to storage tanks, and vice versa.

Stage II is the transfer of fuel from the tanker trucks into general aviation aircraft; during this process vapors are also displaced into the atmosphere.

Pollutants

VOC, Pb (Lead), and HAPs

Point Source Adjustments

No subtraction of emissions from point sources is necessary.

Adjustments for Controls

No adjustments for controls.

Spatial and Temporal Allocations

Spatial

County-level AvGas fuel distributions reported through Energy Information Administration -EIA was spatial allocated for this sources.

Temporal

Annual county-level emissions from PAD-level AvGas consumption from EIA, Petroleum Supply Annual 2017 reports were temporally allocated for this sources. SAF was applied to emissions and were averaged according to period of operation to a daily estimate. See section 2.2.1.1

Method and Data Sources

MDE staff used the methodology developed from the PECHAN/ERTAC Study, 2007, base on terminals using AvGas fuel activity assumptions data.

Activity

MDE used selected data from the Department of Energy’s State Energy Data System obtain fuel consumption data. MDE used airport survey data and the Maryland Aviation Administration’s 2016 Operations Count for Public-Use Airports to obtain operational counts. A few airports, such as Andrews Air Force Base, provided their own operations count.

Fuel Type	Fuel Consumption
	(1,000 Gallons)
Commercial Jet	64,974
Aviation Gasoline	1,428
Military Jet	649.74

Emission Factors

Emission factors for AvGas distribution from came from the (TRC Environmental Corporation’s **Estimation of Alkylated Lead Emissions, Final Report**, U.S EPA, Office of Air Quality Planning and Standards. RTP,NC 1993.

The emissions factors are separated by emissions source such as

- EFtf = Aviation Gasoline from Tank Fill
- EFst = Aviation Gasoline from Storage Tank
- EFc = Aviation Gasoline from Composite
- EFbl = Aviation Gasoline from Breathing Losses

Factors Not Used:

- EFv = Aviation Gasoline from Valves (There are NO AvGas Facilities/Tank Farms in MD)
- EFp = Aviation Gasoline from Pumps (There are NO AvGas Facilities/Tank Farms in MD)

EF Type	VOC Emission Factors	Units
Tank Fill	0.009021383	LB/GALLON AvGas
Storage Tank	0.003605215	LB/GALLON AvGas
Composite	0.010306575	LB/GALLON AvGas
Breathing Losses	0.001694117	LB/GALLON AvGas
Valves Not Used	0.573201882	LB/VALVE*DAY
Pumps Not Used	5.952481079	LB/SEAL*DAY
EFsum (Sum of Factors Used)	0.024627290	LB/GALLON AvGas
Tanker to Truck Transfer Stage II	0.0136	LB/GALLON AvGas

Emission Estimate Equation: County Level

$$EM = EF_{sum} \times \text{Fraction of LTOs} \times \text{Amount of Aviation Gasoline}$$

$$EM_i = EF_{sum} \times (CA_i / SA_i) \times F_i$$

Where:

F_i = County aircraft fuel use

CA_i = County aircraft activity (LTO)

SA_i = State aircraft activity (LTO)

EF_{sum_i} = **Sum of Factors Used**

EM_i = specific county (i) emissions from aircraft refueling in tons VOC per year

2017 Sample Calculation for Stage I AvGas Distribution (Harford County)

$F_{\text{Harford}} = 1,428,000$ gallons

$$\text{Fraction of LTOs} = \frac{CA_{\text{Harford}}}{SA} = \frac{17,964}{331,051} = 0.054264$$

$EF_{sum_Harford\ Stage\ I} = 0.0246272899$ lb/gal. AvGas

$EM_{\text{Harford Stage I}} = (0.0246272899 \times 0.054264 \times 1,428,000) / 2000 = \mathbf{0.9542\ tons\ voc / year}$

Stage I AvGas Distribution was found to have a

SAF = seasonal adjustment factor of 0.26

POS = peak ozone period of 0.25

Days of the Period 300

Daily adjusted $EM_{\text{Harford Stage I daily}} = (EM_{\text{Harford Stage I}} / 300) * (SAF / POS)$

$EM_{\text{Harford Stage I daily}} = (0.9542 / 300) * (0.26 / 0.25) = \mathbf{3.31E-03\ VOC\ tons/day}$

2017 Sample Calculation for Stage II AvGas Distribution (Harford County)

$F_{\text{Harford}} = 1,428,000$ gallons

$$\text{Fraction of LTOs} = \frac{CA_{\text{Harford}}}{SA} = \frac{17,964}{331,051} = 0.054264$$

$EF_{sum_Harford\ Stage\ II} = 0.0136$ lb/gal AvGas

$EM_{\text{Harford Stage II}} = (0.0136 \times 0.054264 \times 1,428,000) / 2000 = \mathbf{0.5269\ tons\ voc / year}$

Stage I AvGas Distribution was found to have a

SAF = seasonal adjustment factor of 0.26

POS = peak ozone period of 0.25

Days of the Period 300

Daily adjusted $EM_{\text{Harford Stage II daily}} = (EM_{\text{Harford Stage II}} / 300) * (SAF / POS)$

$EM_{\text{Harford Stage II daily}} = (0.5269 / 300) * (0.26 / 0.25) = \mathbf{1.83E-03\ VOC\ tons/day}$

4.1.1.6 Petroleum Vessel Unloading Losses

SCC:	2505020030	crude oil
	2505020090	distillate oil
	2505020120	Gasoline
	2505020150	Jet naphtha
	2505020060	residual oil
	2505020180	kerosene

Description

Petroleum liquids are transported via ships and barges, and on-land transportation. The procedures discussed below relate to marine transport of petroleum liquids. This category does not include emissions from fuel consumed by vessels while in transit or in port. Evaporative VOC emissions from ocean going ships and barges carrying petroleum liquids result from loading losses, ballasting losses and transit losses. Petroleum liquids are classified into groups which are represented by crude oil, gasoline, jet naphtha, distillate oil/kerosene, or residual oil. Loading and ballasting losses do not occur with pipeline transport of petroleum products ([AP-42](#), Section 5.2).

Loading losses occur as organic vapors in “empty” cargo tanks are displaced to the atmosphere by the liquid being loaded into the tanks. These vapors are a composite of vapors formed in three ways:

- Vapors which are formed in the “empty” tank by evaporation of residual product from previous loads;
- Vapors transferred to the tank from a vapor balance system that was used when the previous load was being unloaded; and
- Vapors generated in the tank as the new product is being loaded.

Loading losses are usually the largest source of evaporative emissions from petroleum vessels (EPA, 1996).

Ballasting losses are associated with the unloading of petroleum liquids at marine terminals and refinery loading docks. It is common practice to load several cargo tank compartments with sea water after the cargo has been unloaded. This water, called “ballast,” improves the stability of the empty tanker during the subsequent voyage. Ballasting emissions occur as vapor-laden air in the empty cargo tank is displaced to the atmosphere by ballast water being pumped into the tank.

Transit losses are similar to breathing losses associated with petroleum storage. Transit loss is the expulsion of vapor from a vessel compartment through vapor contraction and expansion, which are the result of changes in temperature and barometric pressure. This loss may be accompanied by slight changes in the level of the liquid in the tank due to liquid expansion or contraction due to the temperature change. Some ships are equipped with controls for these losses.

Pollutants

VOC

Method and Data Sources

Activity

The method used to calculate emissions (all VOC) is presented in EIIP⁹, Chapter 12, Marine Vessel Loading, Ballasting and Transit, dated May 1998.

A significant part of the emissions from this source are from the Eastern Shore of Maryland because petroleum products are delivered to this area by barge rather than by pipeline as in the rest of the state. To compile emissions MDE used guidance in EIIP, Chapter 12, Marine Vessel Loading, Ballasting and Transit and emissions factors from EIIP Table 12.4-5, Waterborne Commerce of the United States, Waterways and Harbors Atlantic Coast, Part 1, 2016 data, and AP-42, Table 7.1-2 liquid densities. Waterborne Commerce supplied tonnage and type of petroleum products delivered to the various ports in Maryland for the year 2016. Tonnages of petroleum delivered were converted into Kgals (1000 gallons) and then used to calculate emissions.

Factors

UNCONTROLLED VOC EMISSION FACTORS FOR PETROLEUM CARRYING MARINE VESSELS (EPA, 1996)				
Petroleum Liquid	Ship/Ocean Vessel Loading (Lbs. voc per 1,000 gallons Transferred)	Barge Loading (Lbs. voc per 1,000 gallons Transferred)	Ballasting (Lbs. voc per 1,000 gallons Transferred)	Transit (Lbs. voc per 1,000 gallons Transferred)
Crude Oil	0.61	1	1.1	1.3
Gasoline	1.8	3.4	0.8	2.7
Jet Naphtha / Other	0.5	1.2	NA	0.7
Distillate Oil / Kerosene	0.005	0.012	NA	0.005
Residual Oil	4×10^{-5}	9×10^{-5}	NA	3×10^{-5}

Spatial and Temporal Allocations

Spatial

Data for spatial allocation is not available for this source.

⁹ Emission Inventory Improvement Program

Temporal

SAF was applied to emissions and were averaged according to period of operation to a daily estimate. See section 2.2.1.1

Data obtained from sources such as the *Waterborne Commerce of the United States* are typically provided in terms other than 1,000 gallons (Mgal) as is required in EIIIP Equation 12.4-1 and must be converted. Equation 12.4-3 can be used to convert units from 1,000 ton (Mtons) to Mgal.

Where:

$$PP_V = (PP_M / d) \times (2,000 \text{ lb/ton}) \times (\text{Mgal}/1,000 \text{ gallons}) \times (1,000 \text{ tons}/\text{Mtons})$$

PP_V = Amount of petroleum liquid (Mgal)

PP_M = Amount of petroleum liquid (Mtons)

d = Density of petroleum liquid; see Table 7.1-2 in AP-42 (lb/gallon)

	Density ¹⁰ (lb/gal)
Distillate Oil	7.10
Residual Oil	7.90
Gasoline	5.60
Kerosene	7.00
Crude Oil	7.10
Jet Naphtha	6.40

If controls exist, then control efficiency can be calculated:

$$PP_C = PP_U \times (1 - CE/100)$$

Where:

PP_C = Controlled emissions (tons)

PP_U = Uncontrolled emissions (tons)

CE = Control efficiency (%)

Equation:

$$PV_p = \frac{[(SOEF_p \times PP_{S,p}) + (BREF_p \times PP_{B,p}) + (BLEF_{p,U} \times 0.20 \times PP_{BL,p}) + (TREF_p \times PP_{T,p})]}{2000}$$

¹⁰ AP-42, Table 7.1-2

Where:

- PV_p : Total VOC emissions from petroleum vessel loading, ballasting, and transit for each of the petroleum liquids (p) transported: crude oil, gasoline, kerosene, distillate oil, and residual oil (tons)
- SOEF_p: Ship/ocean vessel loading emission factor (pounds VOC per 1,000 gallons transferred)
- PP_{s,p}: Amount of petroleum liquid (p) loaded into ships and ocean vessels in the inventory region (1,000 gallons)
- BREF_p: Barge vessel loading emission factor (pounds VOC per 1,000 gallons transferred)
- PP_{B,p}: Amount of petroleum liquid (p) loaded into barges in the inventory region (1,000 gallons)
- BLEF_{p,U} : Ballasting emission factor (pounds VOC per 1,000 gallons water ballasted)
- PP_{BL,p}: Amount of petroleum liquid (p) unloaded from vessels that are ballasted (1,000 gallons)
- TREF_p : Vessel transit emission factor (pounds VOC per week per 1,000 gallons transferred)
- PP_{T,p}: Amount of petroleum liquid (p) transported by marine vessels in the inventory region (1,000 gallons)

2016 Petroleum Vessel Unloading Losses Sample Calculation (Gasoline – Baltimore City)

Gallons (in Thousands) of Petroleum Shipped in Baltimore Harbor						
	Crude Oil	Distillate Oil	Gasoline	Jet Naphtha	Residual Oil	Kerosene
Baltimore City	1,127	74,366	467,857	4,063	300,000	200,000

Tonnage of distillate oil shipped in Baltimore Harbor (from Waterborne Commerce of the U.S., 2016) were converted in thousands of gallons (Kgal) and then used to calculate emissions.

Vessel Loading Emissions

For vessel loading operations, 90 percent of the total throughput was loaded at terminals with a control system of 95 percent efficiency. According to the local port authorities, transit time in the inventory area is two days (2/7 of a week). Emissions for each emission point are calculated using Equation 12.4-1 and the emission factors from EIIP Table 12.4-5. In this example, emissions for each emission point are calculated separately and then totaled. Note that CE is applied to vessel loading emissions, and transit emissions are apportioned to two days per week by multiplying emissions by 2/7.

Baltimore City:

Vessel Loading gas = 0.00 Kgal

Barge Loading gas = 0.00 Kgal

Ballasting gas = 0.00 Kgal

Transit gas = 467,857 Kgal

Baltimore gas Total = (0.00 + 0.00 + 0.00 + 328,571) = **467,857 Kgal**

Vessel Loading (gasoline) emissions are calculated:

$$PV_{GAS} = [(1.8 \text{ lbs}_{VOC}/\text{Kgal}) \times (0.00 \text{ Kgal}/\text{yr}) \times \{0.10 + [0.9 (1 - 95/100)]\}] \div 2,000 \text{ lb}/\text{ton}$$

$$PV_{GAS} = 0.00 \text{ tons}/\text{year}$$

Barge Loading emissions are calculated:

$$PV_{GAS} = [(3.4 \text{ lbs}_{VOC}/\text{Kgal}) \times (0.00 \text{ Kgal}/\text{yr})] \div 2,000 \text{ lb}/\text{ton}$$

$$PV_{GAS} = \mathbf{0.00} \text{ tons}/\text{year}$$

Ballasting emissions are calculated:

$$PV_{GAS} = [(0.8 \text{ lbs}_{VOC}/\text{Kgal}) \times (0.00 \text{ Kgal}/\text{yr}) \times (0.20)] \div 2,000 \text{ lbs}/\text{ton}$$

$$PV_{GAS} = \mathbf{0.00} \text{ tons}/\text{year}$$

Note that the calculation for ballasting emissions in the equation includes a correction term of 0.20. This correction term reflects the practice of loading a ship or barge at some fraction of *capacity* when *ballasting*.

Transit emissions are calculated:

According to the Maryland Port Authorities transit time is 6 hours out of 24 or 25% during a week (7 days).

$$PV_{GAS} = (2.7 \text{ lbs}_{VOC}/\text{Kgal}) \times (467,857 \text{ Kgal}/\text{yr}) \times (0.25/7\text{wk}) \div 2,000 \text{ lbs}/\text{ton}$$

$$PV_{GAS} = \mathbf{22.56} \text{ voc tons}/\text{year}$$

EM_{_BCitytotal} **Vessel Loading** total VOC emissions are calculated as follows:

$$EM_{_BCitytotal} = \mathbf{0.00} \text{ tons}/\text{year} + \mathbf{0.00} \text{ tons}/\text{year} + \mathbf{0.00} \text{ tons}/\text{year} + \mathbf{22.56} \text{ tons}/\text{year}$$

$$EM_{_BCitytotal} = \mathbf{22.56} \text{ tons}/\text{yr} \text{ (gasoline)}$$

Petroleum Vessel Unloading was found to have a

SAF = seasonal adjustment factor of 0.25

POS = peak ozone period of 0.25

Days of the Period 312

$$\text{Daily adjusted } EM_{_BCitytotalda} = (EM_{_BCitytotal} / 312) * (\text{SAF} / \text{POS})$$

$$EM_{_BCitytotalda} = (22.56 / 312) * (0.25 / 0.25) = \mathbf{5.08E-02} \text{ VOC tons}/\text{day}$$

4.1.1.7 Portable Fuel Containers

SCC:	25 01 011 011 (Residential – Permeation)
	25 01 011 012 (Residential – Diurnal)
	25 01 011 013 (Residential – Transport)
	25 01 012 011 (Commercial – Permeation)
	25 01 012 012 (Commercial – Diurnal)
	25 01 012 013 (Commercial – Transport)

Description

Portable fuel containers (PFCs) store and transport fuel from gasoline service stations to residential homes and businesses. Emissions from PFC use include:

- **Permeation Emissions**, which are produced after fuel has been stored long enough in a can for fuel molecules to infiltrate and saturate the can material.
- **Diurnal Emissions**, which result when stored fuel vapors escape to the outside of a gas can through any possible openings while the gas can is subjected to daily cycle of increasing and decreasing ambient temperatures. Diurnal emissions are dependent on the closed- or open-storage condition of a gas can.
- **Transport Emissions** arise when fuel escapes (e.g., spills, etc.) from gas cans that are in transit.

Both residential and commercial PFCs are included. The SCCs for PFCs are also new and are shown above.

Pollutants

VOC

Method Data Sources and

The method used to calculate emissions (all VOC), is adopted from a CARB¹¹ survey and methodology adopted by OTC¹². Portable fuel container emissions are calculated by accounting for emissions from five different components related to gas container use: permeation, diurnal, transport-spillage, refueling spillage and refueling vapor displacement emissions. The permeation, diurnal emissions (associated with storage) and transport-spillage (associated with filling the can) emissions are included in the area source inventory. The equipment refueling spillage and refueling vapor displacement emissions are calculated from the non-road model and are included in the non-road inventory.

Portable fuel container emissions are calculated by accounting for emissions from five different components related to gas container use: permeation, diurnal, transport-spillage, refueling spillage and refueling vapor displacement emissions. The permeation, diurnal emissions (associated with storage) and transport-spillage (associated with filling the can) emissions are included in the area source inventory. The

¹¹ ARB’s Mailout MSC 99-25, “Public Meeting to Consider Approval of CA’s Portable Gasoline-Container Emissions Inventory, “ (ARB, 199b)

¹² Control Measure Development Support Analysis of Ozone Transport Commission Model Rules, E.H. Pechan & Associates, Inc. 5528-B Hempstead Way, Springfield, VA 22151, March 31, 2001.

equipment refueling spillage and refueling vapor displacement emissions are calculated from the non-road model and are included in the non-road inventory

Activity

The following input data is required to calculate emissions for this source category.

1. Rather than assuming that the numbers of PFCs per household and per business were consistent across the entire State, MDE used EPA's non-road emissions model to estimate nonroad consumption of gasoline by county by source category classification (SCC) code. Each SCC code has a unique usage (commercial versus residential), a unique ratio of the percent of fuel dispensed from PFCs. The previous draft version of this report (EPA420-D-06-003) was based on estimates from the draft NONROAD2004 model (versus from fuel pumps), and a unique spillage rate (grams per gallon).
2. Number of commercial businesses¹³ 2002 expected to have at least one gas can by county, NAICS 11, 23, 31,311, 441, 447, 45299, 484, 488, 493, 53131, 5321, 532291, 5323, 5324, 54132, 54162, 54169, 56173, 71391, 71393, 7212, 811, and 81293.
3. MDE was able to estimate by county by (SCC) code the total quantity of gasoline supplied from PFCs.

Emission Factors

Separate emission factors were developed for permeation, diurnal, transport and spillage emissions for PFC (both for commercial and residential PFCs). These emission factors were derived from CARB's survey data (CARB, 1999).

Point Source Adjustments

No subtraction of emissions from point sources is necessary.

Adjustment for Controls

Maryland's COMAR 26.11.13.07 rule regulates control adjustments of VOC emissions from portable fuel containers (PFC's) that requires performance standards for PFCs and/or spouts that will reduce emissions do to storage, transport, and refueling activities. (2017 control efficiency of 55% and a control factor of 83.3%). COMAR weblink: http://www.dsd.state.md.us/comar/title_search/Title_List.aspx

Spatial and Temporal Allocations

Spatial

For the residential PFC SCCs, emissions were allocated to the local area level based on a housing surrogate. Commercial PFC emissions were allocated to the local area level based on commercial and industrial business location.

Temporal

Temporal allocation in part due to the number of days in a month with greater than or equal to 0.1 inch of precipitation, but > 0.01 inches a day as part of the emission estimations and seasonal adjustments.

¹³ Total 2017 employment and business establishments by 6 digit NAICS code and by county, County Business Patterns

Emissions Calculation

The equation used to estimate emissions from portable fuel containers is:

Equation:

The residential-gas-can population is calculated as follows:

$$\text{Pop}_R = (N)*(A)*(\text{Count}_R) \quad (\text{Eq. 1})$$

where:

Pop _R	=	Statewide Residential-Gas-Can Population
N	=	Number of Occupied-Housing Units in OTC State
A	=	Percentage of Households with Gas Cans (46%)
Count _R	=	Average Number of Residential-Gas Cans per Household

Statewide residential-gas-can-permeation emissions are computed as follows:

$$\text{HC}_{PR} = \sum (\text{Pop}_R)*(S)*(EF_P)*(B_R)*(Size_R)*(Level)*CF \quad (\text{Eq. 2})$$

where:

HC _{PR}	=	Permeation Emissions in tons per day (tpd)
Pop _R	=	Statewide Residential-Gas-Can Population
EF _P	=	Appropriate Permeation-Emission Factor (g/gal-day)
S	=	Percentage of Gas Cans Stored with Fuel (70%)
B _R	=	Percentage of Cans Stored in Closed Condition with respect to Material (Plastic 53%; Metal 13%)
Size _R	=	Weighted Average Capacity of Residential-Gas Cans (2.34 gal.)
Level	=	Weighted Average Amount of Stored Fuel (49%)
CF	=	0.002204623 lbs/g conversion factor

Diurnal emissions from both open- and closed-system-residential-gas cans are calculated as follows:

$$\text{HC}_{DR} = (\text{Pop}_R)*(S)*(EF_D)*(B_R)*(Size_R)*(Level) \quad (\text{Eq. 3})$$

where:

HC _{DR}	=	Diurnal Emissions (tpd) for Residential-Gas Cans with respect to Storage Condition (Open or Closed) and Material (Plastic or Metal)
Pop _R	=	Statewide Residential-Gas-Can Population
S	=	Percentage of Gas-Can Population Stored with Fuel (70%)
EF _D	=	Appropriate Diurnal-Emission Factor with respect to Storage Condition and Material (g/gal-day or g/day)
B _R	=	Percentage of Gas-Can Population with respect to Storage Condition and Material
Size _R	=	Weighted Average Capacity of Residential-Gas Cans (2.34 gal.)
Level	=	Weighted Average Amount of Stored Fuel (49%)
CF	=	907,184.5844 g/ton

Residential-transport-spillage emissions are determined as:

$$HC_{TR} = (Pop_R) * (S) * (Refill_R) * (EF_T) * (B_R) \quad (\text{Eq. 4})$$

where:

HC_{TR}	=	Residential-Gas-Can-Transport-Spillage Emissions (tpd)
Pop_R	=	Statewide Residential-Gas-Can Population
S	=	Percentage of Gas Cans Stored with Fuel (70%)
$Refill_R$	=	Average Number of Residential-Gas-Cans-Pump-Refills per Day per Can (refill/day from survey)
EF_T	=	Transport-Emission Factor with respect to Storage Condition (g/refill)
B_R	=	Percentage of Gas Cans with respect to Storage Condition and Material
CF	=	0.002204623 lbs/g conversion factor

The commercial-gas-can population is calculated as follows:

$$Pop_C = (N_C) * (Count_C) \quad (\text{Eq. 5})$$

where:

Pop_C	=	Statewide Commercial-Gas-Can Population
N_C	=	Number of Occupied Businesses in State
$Count_C$	=	Average Number of Gas Cans per Business

Statewide commercial-gas-can-permeation emissions are computed as follows:

$$HC_{PC} = \sum (Pop_C) * (S) * (EF_P) * (B_C) * (Size_C) * (Level) \quad (\text{Eq. 6})$$

where:

HC_{PC}	=	Permeation Emissions (tpd)
Pop_C	=	Statewide Commercial-Gas-Can Population
EF_P	=	Appropriate Permeation-Emission Factor (g/gal-day)
S	=	Percentage of Gas Cans Stored with Fuel (70% for Residential Survey)
B_C	=	Percentage of Applicable Gas Cans Stored in Closed Condition
$Size_C$	=	Weighted Average Capacity of Commercial-Gas Cans (3.43 gal)
$Level$	=	Weighted Average Amount of Stored Fuel (49% from Residential Survey)
CF	=	0.002204623 lbs/g conversion factor

The amount of diurnal emissions from both open- and closed-system commercial-gas cans is calculated as follows:

$$HC_{DC} = (Pop_C) * (S) * (EF_D) * (B_C) * (Size_C) * (Level) \quad (\text{Eq. 7})$$

where:

HC_{DC}	=	Diurnal Emissions (tpd) for Commercial-Gas Cans with respect to Storage Condition (Open or Closed) and Material (Plastic or Metal)
Pop_C	=	Statewide Commercial-Gas-Can Population
EF_D	=	Appropriate Diurnal-Emission Factor with respect to Storage Condition and Material (g/gal-day or g/day)

S	=	Percentage of Gas Cans Stored with Fuel (70% from Residential Survey)
B _C	=	Percentage of Gas Cans with respect to Storage Condition and Material
Size _C	=	Weighted Average Capacity of Commercial-Gas Cans (3.43 gal.)
Level	=	Weighted Average Amount of Stored Fuel (49% from Residential Survey)
CF	=	0.002204623 lbs/g conversion factor

The non-lawn-and-garden-equipment commercial-gas-can refills at the pump are derived as follows:

$$REFILL_c = \left[\frac{(\sum Fuel)}{(SIZE_c) * (POP_{NON}) * (S)} \right] \quad (Eq. 8)$$

where:	Refill _C	=	Average Number of Non-Lawn-and-Garden Equipment Commercial-Gas-Cans Pump Refills per Day per Can (refill/day)
	Fuel	=	Non-Lawn-and-Garden Equipment Fuel Consumption (gal/day) for 2000
	Size _C	=	Weighted Average Capacity of Commercial-Gas Cans (3.43 gal/can-refill)
	POP _{NON}	=	Statewide Commercial-Gas-Can Population with respect to Non-Lawn-and-Garden Businesses
	S	=	Percentage of Gas Cans Stored with Fuel (70% from Residential Survey)
	CF	=	0.002204623 lbs/g conversion factor

The commercial-transport-spillage emissions are determined as:

$$HC_{TC} = (Pop_c) * (S) * (B_c) * (Refill_c) * (EF_{TC}) \quad (Eq. 9)$$

where:	HC _{TC}	=	Commercial-Gas-Can-Transport-Spillage Emissions (tpd)
	Pop _C	=	Statewide Commercial-Gas-Can Population
	S	=	Percentage of Gas Cans Stored with Fuel (70% from Residential Survey)
	B _C	=	Percentage of Gas Cans with respect to Storage Condition and Material
	Refill _C	=	Average Number of Gas-Cans Pump Refills per Day per Can
	EF _{TC}	=	Transport-Spillage Emission Factor (g/refill) with respect to Storage Condition
	CF	=	0.002204623 lbs/g conversion factor

The total area source portable fuel container emissions are summed as follows:

$$E_{PFC-A} = HC_{PR} + HC_{DR} + HC_{TR} + HC_{PC} + HC_{DC} + HC_{TC}$$

$$E_{PFC-SD} = E_{PFC-A} * SAF // AADF$$

Where:

E _{PFC-A}	=	(tons/yr) for an annual emission of pollutant by county
E _{PFC-SD}	=	(tons/day) for a typical summer day emission of pollutant
AADF	=	Annual activity day factor (SAF * 52 weeks/year)

SAF = Seasonal adjustment factor

4.1.2 STATIONARY SOURCE SOLVENT APPLICATION

4.1.2.1 Dry Cleaners

SCC: 24 20 000 000

Description

Dry-Cleaning facilities utilize solvents in their cleaning process which causes the emission of VOCs into the air.

Pollutants

VOC

Method and Data Source

Emissions from the dry-cleaning process were estimated by taking county employment and adjusted employment numbers from dry-cleaning and multiplying them by a given per capita emission factor for VOCs.

Activity

The County Business Patterns reports employment data for the counties of Maryland. Employment data is listed by the North American Industrial Classification Standard (NAICS) code(s) (81231, 81232, and 81233) that are used to determine county-level employment. Employment data collected was allocated to each county using *County Business Patterns* employment data for 2016 for the counties of Maryland. County Business Patterns internet addresses (<http://censtats.census.gov/cgi-bin/cbpnaic/cbpsel.pl>). Midpoint adjustments were determined for counties which had employment given a letter range.

Emission Factor

Emission factor from the Pechan/ERTAC Study, 2007, base on employment activity data. VOC = 467 lbs per person.

Point Source Adjustments

None

Adjustments for Controls

None

Spatial and Temporal Allocations

Spatial

Data for spatial allocation is not available for this source.

Temporal

SAF was applied to emissions and were averaged according to period of operation to a daily estimate. See section 2.2.1.1

Emissions Calculation

Emissions are calculated for each county using emission factors and activity as:

$$E_{xy} = EMP_x \times EF_y$$

where:

- E_{xy} = annual emissions for county x and pollutant y
- EMP_x = employment data associated with county x
- EF_y = emission factor for pollutant y

2017 Sample Calculation Dry-Cleaning Emissions (Howard County)

$$\begin{aligned} E_{\text{Howardvoc}} &= EMP_{\text{Howard}} \times EF_{\text{voc}} \\ E_{\text{Howardvoc}} &= 381 \text{ person} \times 467 \text{ lbs voc/person (in calculation in is 381.31 persons)} \\ E_{\text{Howardvoc}} &= 178,071.77 \text{ lbs. voc} \\ E_{\text{Howardvoc}} &= 89.04 \text{ tons voc per year} \end{aligned}$$

Dry-Cleaning was found to have a

SAF = seasonal adjustment factor of 0.25

POS = peak ozone period of 0.25

Days of the Period 312

Daily adjusted $E_{\text{Howardvocda}} = (E_{\text{Howardvoc}} / 312) * (\text{SAF} / \text{POS})$

$$E_{\text{Howardvocda}} = (89.04 / 312 * (0.25 / 0.25)) = \mathbf{2.85E-01 \text{ VOC tons/day}}$$

4.1.2.2 Industrial and Institutional Cleaning

SCC: 24 15 300 000

Description

Industrial and Institutional Cleaning (Cold Cleaning Degreasing) is seen primarily at auto repair stations or manufacturing facilities, where solvents at room temperature (or slightly warmed) are used to clean parts via immersion or rinsing.

Industrial and Institutional Cleaning are usually individually small emission sources and because they are widely scattered and frequently used, they are most easily treated as area sources. If they are collocated at a major source, they may be included in the point source inventory and those emissions will need to be subtracted from the area source estimate.

There are two basic types of cleaning machines: batch and in-line cleaning machines (also called continuous cleaning machines). Both of these equipment types are designed to use solvent to clean parts. The solvent is either used to clean in its non-vapor liquid form (at a temperature below the boiling point, referred to as cold cleaning), or heated to a temperature above its boiling point (referred to as vapor cleaning). Other solvent cleaning operations involve the use of solvent in wipe-cleaning and equipment cleanup. Emissions from solvent cleaning machines can also be considered to be point sources; therefore, the estimation process for the source category must take this into account to prevent double counting of emissions. Additionally, emissions from solvent cleanup may be included as a part of an industry- or process-specific emission estimate.

Pollutants

VOC and HAP (Trichloroethylene – 79016)

Method and Data Source

MDE staff used the methodology developed from the PECHAN/ERTAC Study, 2007, base on emplacement activity data and method documented in EIIP¹⁴, Chapter 6, Solvent Cleaning, dated September 1997 to emission estimation for this source category.

Activity

The County Business Patterns reports employment data for the counties of Maryland. Employment data is listed by the North American Industrial Classification Standard (NAICS) code(s) that are used to determine county-level employment. Employment data collected was allocated to each county using *County Business Patterns* employment data for 2016 for the counties of Maryland. County Business Patterns internet addresses (<https://factfinder.census.gov/faces/nav/jsf/pages/searchresults.xhtml?refresh=t>).

An activity level of 6 days a week with no seasonal adjustment factor was used as recommended in the EIIP document. Solvent storage and recycling centers are included in the point source inventory. A 2002 reduction factor (Phase II Attainment Plan for the Baltimore Nonattainment Area and Cecil County) of 53.60% was applied to the calculated emissions. This factor combines reductions from

¹⁴ Emission Inventory Improvement Program

technology rules and good housekeeping practices and the application of rule effectiveness as shown below:

Reduction factor = (control efficiency) x (rule effectiveness) x (rule penetration)

Reduction factor = 0.67 x 0.80 x 1.00

Reduction factor = 0.5360

Emission Factor

Table 6.5-2 of the EIIP document lists a total emission factor of 87 lbs. VOC per employee per year for solvent cleaning operations. The emission factor for the HAPs Trichloroethylene – 79016 was developed from the Pechan/ERTAC Study, 2007. Pechan/ERTAC Study, 2007 determine HAP Trichloroethylene emission factor base on a percent weight factor of total solvent VOC which is 0.00686. This percent weight factor of total solvent VOC was multiply by the total emission factor of 87 lbs. VOC per employee per year and divided by 100 that resulted in Trichloroethylene emission factor of 0.59685 lbs. Trichloroethylene /yr/employee.

Factors

E_{cc} = 87 lbs_{VOC} per employee per year for cold cleaning degreasers

CE_{cc} = 67%

RE_{cc} = 80%

RP_{cc} = 100%

Note:

Conveyor degreasing operations considered point sources that are listed in the MDE/ARA registration files. Point source emissions were then subtracted from the area source inventory by taking the reported emissions and back calculating to get the number of employees, which was then subtracted from the county business total employment before final estimation.

Point Source Adjustments

Solvent cleaning emissions from facilities identified as point sources were subtracted from the area source inventory to avoid double counting.

Adjustment for Controls

Maryland has adopted a cold and vapor degreasing regulation (COMAR 26.11.19.09). The regulation mandates that all cold degreasing material must have a vapor pressure less than or equal to 1 mm Hg at 20 degrees centigrade after May 15, 1996. The regulation also requires that good operating practices be implemented to minimize VOC losses. MDE estimates a 67 percent control efficiency for this control.

Spatial and Temporal Allocations

Spatial

CBP employment data was spatial allocation for this source.

Temporal

SAF was applied to emissions and were averaged according to period of operation to a daily estimate. See section 2.2.1.1

Emissions Calculation

The equation used to estimate emissions from cold cleaning/degreasing is:

Equation:

$$E_{CC} = \left\{ \frac{EMPL_j * EF_{cc}}{2000} * [1 - (CE_{CC} * RE_{CC} * RP_{CC})] \right\} - E_{PtSourceCC}$$

Where:

- E_{CC} = Emissions of VOC in tons/day from cold cleaners
- $EMPL_j$ = 2016 employment of county j
- EF_{cc} = VOC emissions factor for cold cleaning degreasing
- CE_{cc} = Control efficiency for cold cleaning degreasing
- RE_{cc} = Rule Effectiveness for cold cleaning degreasing
- RP_{cc} = Rule Penetration for cold cleaning degreasing
- $E_{PtSourceCC}$ = Point Source Emissions from cold cleaning degreasing

2017 Sample Calculation for Cold Cleaning Degreasing Products Industrial and Institutional (Baltimore City)

Reported Point Source Emissions = 5.3786 tons VOC
 Point Source Employment = (5.3786 * 2000 tons/lb. / 87 lbs. _{VOC/employee}) = 123.65 employees
 $EMPL_{Baltimore} = (13,521^{15} - 123.65) = 13,397.28$ employees
 $EF_{cc} = 87$ lbs. _{VOC} /employee/year
 $E_{ccBaltimore} = (13,397.28 \text{ employee} \times 87 \text{ lbs. }_{VOC} / \text{employee/year}) / (\text{tons}/2000 \text{ lbs.})$
 $E_{ccBaltimore} = 582.78$ tons _{VOC} /year

To adjust for controls

$$E_{ccBaltControlled} = 582.78 \text{ tons }_{VOC} / \text{year} \times [1 - (0.67 \times 0.80 \times 1.00)] = \mathbf{270.41 \text{ tons }_{VOC} / \text{year}}$$

Cold Cleaning Degreasing was found to have a

SAF = seasonal adjustment factor of 0.25

POS = peak ozone period of 0.25

Days of the Period 312

$$\text{Daily adjusted } E_{ccBaltControlled} = (E_{ccBaltControlled} / 312) * (\text{SAF} / \text{POS})$$

¹⁵ *County Business Patterns* 2016 employment data for Maryland by Counties

$$E_{\text{ccBaltControlled}} = (270.41 / 312) * (0.25 / 0.25) = 8.67\text{E-}01 \text{ VOC tons/day}$$

4.1.2.3 Surface Coating

Surface coating includes paints, enamels, varnishes, lacquers and other product finishes. Some of those coatings contain a solvent-based liquid carrier; others use a water-based liquid carrier but still contain a small portion of solvents. Solvents are also used to clean up painting equipment. The primary types of surface coating applications are architectural coatings, automobile refinishing and traffic paints.

4.1.2.4 Architectural Surface Coating

SCC: 24 01 002 000 (Solvent-based)
SCC: 24 01 003 000 (Water-based)
SCC: 24 01 001 000 (Solvent & Water)

Description

Architectural surface coating is an area source that occurs from homeowners and contractors painting homes, buildings and signs.

Pollutants

VOC

Method and Data Sources

MDE staff used an alternative per capita emission estimation method documented in EIIP¹, Chapter 3 Architectural Surface Coating, dated November 1995. The document provides an outline for developing a per capita usage factor, and for using that usage factor with an emission factor to calculate VOC emissions.

Activity

Determine the per capita usage factor by dividing the national total architectural surface coating quantities² for solvent- and water-based coatings by the U.S. population³ for that year.

Per Capita Usage Factor Development

The table below shows a portion of Table 2 from the U.S. Bureau of Census MA325F(10)-1 - Paint and Allied Products 2010. This section of the table summarizes the market information available on architectural coatings for the year of 2010. In the table, types of paints are identified as being either solvent- or water-based paints, except for the two types listed as Architectural Lacquers and Architectural Coatings N.S.K. These latter types of paints can be assumed to be entirely solvent-

¹ Emission Inventory Improvement Program

² Total national coating usage is compiled by the Bureau of the Census, Report MA325F—Paint and Allied Products, available on the Census Bureau Bulletin Board, (301)457-2310.

³ Population data from the U.S. Bureau of the Census, Population Estimates Branch (see Appendices).

based coatings. The calculation to obtain the number of gallons of solvent based paints totals the gallons for Exterior Solvent Type, Interior Solvent Type, Architectural Lacquers and Architectural Coatings N.S.K:

Solvent-Based Paints = 113,964 thousand gallons of paints

The calculation to obtain the number of gallons of water based paints totals the gallons for Exterior Water Type and Interior Water Type:

Water-Based Paints = 510,560 thousand gallons of paints

The per capita usage factor is calculated by dividing the total usage of solvent based paints by the U.S. population, and the total usage of water based paint by the U.S. population.

$$\begin{aligned}
 \text{Per Capita Solvent Based Usage Factor} &= \frac{\text{Gallons of Solvent Based Paints}}{\text{U. S. Population}} \\
 &= \frac{113,964,000}{325,719,178} \\
 &= 0.34988
 \end{aligned}$$

$$\begin{aligned}
 \text{Per Capita Water Based Usage Factor} &= \frac{\text{Gallons of Water Based Paints}}{\text{U. S. Population}} \\
 &= \frac{510,560,000}{325,719,178} \\
 &= 1.56748
 \end{aligned}$$

Table 2. Quantity and Value of Shipments of Paint and Allied Products: 2010 and 2009

Product code	Product description	Year	Quantity
3255101	Architectural coatings	2010	643,900
		2009	634,874
3255101111	Exterior, solvent thinned paints and tinted bases, including barn and roof paints	2010	33,847
		2009	33,571
3255101115	Exterior, solvent thinned enamels and tinted bases, including exterior-interior floor enamels	2010	17,367
		2009	14,755

3255101119	Exterior, solvent thinned undercoaters and primers	2010	6,816
		2009	6,448
3255101121	Exterior, solvent thinned clear finishes and sealers	2010	4,028
		2009	4,054
3255101125	Exterior solvent thinned stains, including shingle and shake	2010	13,618
		2009	12,096
3255101129	Exterior, other solvent thinned coatings, including bituminous paints	2010	1,578
		2009	1,671
3255101131	Exterior, water thinned paints and tinted bases, including barn and roof paints	2010	92,625
		2009	93,665
3255101135	Exterior, water thinned exterior-interior deck and floor enamels	2010	10,583
		2009	10,727
3255101139	Exterior, water thinned undercoaters and primers	2010	10,587
		2009	10,725
3255101141	Exterior, water thinned stains and sealers	2010	21,501
		2009	20,678
3255101145	Exterior, other exterior water thinned coatings	2010	9,035
		2009	8,980
3255101211	Interior, flat solvent thinned wall paint and tinting bases, including mill white paints	2010	1,155
		2009	1,288
3255101215	Interior, gloss and quick drying enamels and other gloss solvent thinned paints and enamels	2010	3,983
		2009	3,389
3255101219	Interior, semigloss, eggshell, satin solvent thinned paints and tinting bases	2010	9,870
		2009	9,691
3255101221	Interior, solvent thinned undercoaters and primers	2010	21,702
		2009	(D)

3255101225	Interior, solvent thinned clear finishes and sealers	2010	(S)
		2009	(S)
3255101229	Interior, solvent thinned stains	2010	1,309
		2009	1,216
3255101231	Interior, other solvent thinned coatings	2010	(D)
		2009	(D)
3255101235	Interior, flat water thinned paints and tinting bases	2010	144,394
		2009	142,894
3255101239	Interior, semigloss, eggshell, satin, and other water thinned paints and tinting bases	2010	183,428
		2009	176,562
3255101241	Interior, water thinned undercoaters and primers	2010	38,407
		2009	42,781
3255101245	Interior, other interior water thinned coatings, stains, and sealers	2010	5,119
		2009	5,250
3255101249	Architectural lacquers	2010	4,086
		2009	4,126
3255104	Product finishes for original equipment manufacturers (OEM), excluding marine coatings	2010	329,931
		2009	285,070
3255104111	Automobile, light truck, van, and sport utility vehicle finishes	2010	43,172
		2009	31,580
3255104121	Automobile parts finishes	2010	2,792
		2009	1,929
3255104131	Heavy duty truck, bus, and recreational vehicle finishes	2010	5,757
		2009	5,352
3255104141	Other transportation equipment finishes, including aircraft and railroad	2010	5,369
		2009	4,187

3255104211	Appliance, heating equipment, and air-conditioner finishes	2010	3,990
		2009	4,266
3255104215	Wood furniture, cabinet, and fixture finishes	2010	34,578
		2009	32,500
3255104219	Wood and composition board flat stock finishes	2010	7,135
		2009	6,274
3255104221	Metal building product finishes (including coatings for aluminum extrusions and siding)	2010	36,455
		2009	35,303
3255104225	Container and closure finishes	2010	40,164
		2009	35,647
3255104229	Machinery and equipment finishes, including road building equipment and farm implement	2010	10,151
		2009	9,462
3255104231	Non-wood furniture and fixture finishes, including business equipment finishes	2010	22,155
		2009	20,710
3255104235	Paper, paper board, film, and foil finishes, excluding pigment binders	2010	(S)
		2009	10,854
3255104239	Electrical insulating coatings	2010	1,015
		2009	866
3255104241	Thermoset general decorative, appliance powder coatings 1/	2010	8,951
		2009	6,933
3255104245	Thermoset general decorative, automotive powder coatings 1/	2010	3,765
		2009	2,437
3255104249	Thermoset general decorative, architectural powder coatings (such as aluminum extrusions) 1/	2010	1,096
		2009	959
3255104251	Thermoset general decorative, lawn and garden powder coatings 1/	2010	999
		2009	890

3255104255	Thermoset general decorative, general metal finishing powder coatings 1/	2010	19,806
		2009	16,225
3255104259	Thermoset functional powder coatings (for pipe, rebar, electrical insulation, etc.) 1/	2010	(D)
		2009	(D)
3255104261	Thermoplastic powder coatings (all) 1/	2010	(D)
		2009	(D)
3255104263	Other powder coatings	2010	(D)
		2009	(D)
3255104265	Other industrial product finishes	2010	23,378
		2009	20,774
3255107	Special purpose coatings, including all marine coatings	2010	168,326
		2009	158,575
3255107111	Industrial new construction and maintenance paints, interior	2010	35,570
		2009	34,704
3255107115	Industrial new construction and maintenance paints, exterior	2010	16,571
		2009	13,886
3255107121	Traffic marking paints (all types; shelf goods and highway department)	2010	37,335
		2009	35,047
3255107131	Automotive, other transportation and machinery refinish paints and enamels, including primers	2010	55,899
		2009	52,504
3255107141	Marine paints, ship and off-shore facilities and shelf goods for both new construction and marine refinish and maintenance. Excludes spar varnish	2010	10,924
		2009	11,498
3255107151	Marine paints for yacht and pleasure craft, new construction, refinish and maintenance	2010	(D)
		2009	(D)
3255107161	Aerosol - paint concentrates produced for packaging in aerosol containers	2010	(D)
		2009	(D)

325510B	Miscellaneous allied paint products	2010	145,119
		2009	134,263
325510B111	Paint and varnish removers	2010	(D)
		2009	5,075
325510B121	Thinners for lacquers and other solvent based paint products	2010	(D)
		2009	30,249
325510B131	Pigment dispersions	2010	(D)
		2009	25,877
325510B141	Other miscellaneous allied paint products, including brush cleaners, ink vehicles, putty and glazing compounds, etc.	2010	83,708
		2009	73,062

Emission Factor

Use the emission factors for architectural surface coatings (EPA, 1993A), that are shown in Table 5-2 of the EIIP document and reproduced below:

Coating Type	VOC Content Lbs / gallon
Water-based	0.74
Solvent-based	3.87
Total	4.61

This activity occurs 7 days a week and is usually more common in the summer months as indicated by a seasonal adjustment factor of 1.3 (see Table 5.8-1 in Procedures). It should be noted that 99% of solvents in these coatings are VOC.

Point Source Adjustments

Because the application of architectural surface coating is defined as an area source, there is no need to subtract point source emissions from the total, and all emissions estimated for this source are area source emissions.

Adjustment for Controls

EPA surface coating regulation reduction combined with Phase I and II of the OTC AIM Rule resulted in a reduction 32.4%.

Spatial and Temporal Allocations

Spatial

Data for spatial allocation is not available for this source.

Temporal

SAF was applied to emissions and were averaged according to period of operation to a daily estimate. See section 2.2.1.1

Emissions Calculation

The equation used to estimate emissions from architectural surface coatings is:

Equation to calculate solvent-based emissions is:

$$EM_{ASC-SB} = \frac{POP_i \times UF_{ASC-SB} \times EF_{SB} \times [(1 - (CE_{ASC} \times RE_{ASC} \times RP_{ASC}))]}{2000}$$

Where:

EM_{ASC-SB} = VOC emissions in tons per day from solvent-based architectural surface coatings

POP_i = 2016 population of county i

UF_{ASC-SB} = Usage factor for solvent-based architectural surface coatings

EF_{SB} = VOC emission factor for solvent-based architectural surface coatings

CE_{ASC} = Control efficiency⁴ for architectural surface coatings

RE_{ASC} = Rule effectiveness⁵ for architectural surface coatings

RP_{ASC} = Rule penetration for architectural surface coatings

Equation to calculate water-based emissions is:

$$EM_{ASC-WB} = \frac{POP_i \times UF_{ASC-WB} \times EF_{WB} \times [(1 - (CE_{ASC} \times RE_{ASC} \times RP_{ASC}))]}{2000}$$

Where:

EM_{ASC-WB} = VOC emissions in tons per day from water-based architectural surface coatings

POP_i = 2016 population of county i

UF_{ASC-WB} = Usage factor for water-based architectural surface coatings

EF_{WB} = VOC emission factor for water-based architectural surface coatings

CE_{ASC} = Control efficiency for architectural surface coatings

RE_{ASC} = Rule effectiveness for architectural surface coatings

RP_{ASC} = Rule penetration for architectural surface coatings

2017 Example Calculation Architectural Surface Coating (Carroll County)

⁴ An overall 32.4% reduction in emissions is due to regulation

⁵ EPA's AIM regulation and the OTC Rules were applied to architectural surface coatings

Solvent-Based

POP_{Carroll} = 167656 persons
UF_{ASC-SB} = 0.34988 gal/capita
EF_{SB} = 3.87 lbs. VOC/gal/year
CE_{ASC} = 32.4%
RE_{ASC} = 100%
RP_{ASC} = 100%

EM_{ASC-SB} = ((167656 x 0.34988 x 3.87) x [1 - (0.324 x 1.00 x 1.00)]) / 2000
EM_{ASC-SB} = 76.73 tons VOC per year Carroll County

Architectural Surface Coating Solvent-Based was found to have a
SAF = seasonal adjustment factor of 0.33
POS = peak ozone period of 0.25
Days of the Period 365
Daily adjusted **EM_{ASC-SBda} = (EM_{ASC-SB} / 365)*(SAF / POS)**

EM_{ASC-SBda} = (76.73 / 365*(0.33 / 0.25) = 2.77E-01 VOC tons/day

Water-Based

POP_{Carroll} = 167656 persons
UF_{ASC-WB} = 1.56748 gal/capita
EF_{WB} = 0.74 lbs. VOC/gal/year
CE_{ASC} = 32.4%
RE_{ASC} = 100%
RP_{ASC} = 100%

EM_{ASC-WB} = ((167656 x 1.56748 x 0.74) x [1 - (0.324 x 1.00 x 1.00)]) / 2000
EM_{ASC-WB} = 65.73 tons VOC per year Carroll County

Architectural Surface Coating Solvent-Based was found to have a
SAF = seasonal adjustment factor of 0.33
POS = peak ozone period of 0.25
Days of the Period 365
Daily adjusted **EM_{ASC-WBda} = (EM_{ASC-WB} / 365)*(SAF / POS)**

EM_{ASC-WBda} = (65.73 / 365*(0.33 / 0.25) = 2.38E-01 VOC tons/day

Spatial and Temporal Allocations

4.1.2.5

Auto Refinishing

S

CC: 24 01 005 000

Description

Automobile refinishing is the repainting of worn or damaged automobiles, light trucks and other vehicles. Coating of new cars is not included in this category but falls under industrial coating. In automobile refinishing, lacquers and enamels are usually applied with hand-operated spray guns. Because the vehicles contain heat-sensitive plastics and rubber, the coatings are dried or cured in low-temperature ovens or at ambient conditions. MDE adopted a regulation based upon federal guidance that requires the use of reformulated coatings and equipment with greater transfer efficiency in the application of coatings.

Pollutants

VOC

Method and Data Sources

MDE staff used an alternative per employee emission estimation methodology documented in EIIP⁶, Chapter 13, Auto Body Refinishing, dated January 2000. The document provides an outline for developing a per employee emission factor using a national VOC emission estimate and national employment data.

Activity

MDE calculated an emission factor of 669.008 lbs. VOC per employee per year using an estimate of 151.9 million pounds of solvents sold nationally in 2007 and dividing it by 2007 County Business Patterns employment number of 227,085 for NAICS 811121: Automotive Body, Paint, Interior and Glass Repair. The amount of solvent sold was provided by the EPA in conjunction with The Freedonia Group and ERTAC.

Maryland has an auto body regulation which allowed MDE to take an 8% reduction in emissions. The autobody refinishing category does not include new car coating.

Emission Factor:

669.008 lbs of VOC per employee per year

Autobody refinishing emissions from facilities identified as point sources were subtracted from the area source inventory to avoid double counting.

Adjustment for Controls

Maryland's auto body regulation allowed MDE to apply an 8% control.

⁶ Emission Inventory Improvement Program

Spatial

Data for spatial allocation is not available for this source

Temporal

SAF was applied to emissions and were averaged according to period of operation to a daily estimate. See section 2.2.1.1

Emissions Calculation

The equation used to estimate emissions from automobile refinishing is:

$$E_{AR} = \frac{(EMP_j - Emp_{Point\ AR}) \times EF_{AR} \times [1 - (RE \times RP \times CE)]}{2000}$$

Where:

E_{AR} = VOC emissions in tons per year from auto refinishing

EMP_j = Number of employees in county j for NAICS 811121 (auto refinishing) from County Business Patterns

EF_{AR} = VOC emission factor for auto refinishing

$Emp_{Point\ AR}$ = Employment back calculated from point source emissions

2017 Example Calculation Auto Refinishing (Baltimore City)

$$E_{AR} = \frac{(372 - 0) \times 669.008 \times [1 - (1.0 \times 1.0 \times .08)]}{2000}$$

$E_{AR} = 114.48$ Tons VOC / year

Auto Refinishing was found to have a

SAF = seasonal adjustment factor of 0.25

POS = peak ozone period of 0.25

Days of the Period 260

Daily adjusted $E_{ARda} = (E_{AR} / 260) \times (SAF / POS)$

$E_{ARda} = (114.48 / 260) \times (0.25 / 0.25) = 4.40E-01$ VOC tons/day

4.1.2.6 Traffic Markings

SCC: 24 01 008 000 - Traffic paints

Description

Traffic paints are used to mark pavement, the majority of which is used to create dividing lines for traffic lanes. These markings are applied by state or local highway maintenance crews or by contractors. VOC emissions result from the evaporation of organic solvents during and shortly after the application of the marking paint. All traffic paint emissions are included in the area source inventory.

Pollutants

VOC

Method and Data Sources

MDE surveyed city, county, and state agencies for gallons of paint used and the VOC content of the paint used.

Activity

The Maryland State Highway Administration (SHA) keeps data on gallons of traffic marking paint used by district and not by individual counties. For emissions from SHA line painting, each county's proportion of the total district's lane miles was multiplied by total gallons painted in a district to get an estimated amount of gallons used for each county. In a few counties, SHA does all the line painting. Also, data was collected from the Maryland Aviation Administration (MAA) and the Mass Transit Administration (MTA).

MDE was able to gather information on gallons of traffic paint used during the ozone season and during a year. The Material Safety Data Sheets and Environmental Data Sheets were collected for each paint and solvent used by each local jurisdiction and State agency doing the striping. It was necessary to collect data on yellow and white paint separately because the amount of VOCs per gallon is different for each type of paint.

The emission totals are slightly lower than in previous inventories because many jurisdictions have switched to latex (water-borne) paints for traffic marking, and those areas already using latex paints have switched to using a latex paint that is lower in VOC content than what was previously used. The widespread use of latex paints means that there are no longer any emissions from the solvents used to clean painting equipment when oil based paints are used. Several counties have been using thermoplastic and glass beads to help in traffic marking which also give off VOCs. A ratio of 14.1 and 13.5 pounds per gallon of white and yellow thermoplastic respectively were equated and added to the amount of paint used. A ratio of 17.5 gallons of white paint was used for every 148.75 pounds of beads used. VOC content for thermoplastic and beads came from Material Safety Data Sheets and ratios were estimated with the help of paint suppliers and contractors.

The following information was collected from all public agencies using traffic marking paint in Maryland:

Spatial and Temporal Allocations Emissions Calculation

Gallons of yellow traffic paint and solvent used in 2017

Gallons of white traffic paint and solvent used in 2017

The MSDS and Environmental Data Sheets per type of paint provided the following information:

- Percent volatile by weight
- Percent water by weight
- Percent volatile organic compounds by weight
- Total VOC (lbs./gal)
- VOC/gallon less water

Emission Factor

Traffic Paints	VOC Emission Factor (lbs. voc/gallons)
Yellow Paint	0.36 to 0.78
White Paint	0.11 to 0.78

The VOC pound per gallon of paint was obtained from the Material Safety Data Sheet (MSDS) for each color and brand of paint used. The appropriate factor was used for each calculation and the table above shows the range for each color.

Point Source Adjustments

No subtraction of emissions from point sources is necessary.

Adjustment for Controls

MDE applied controls obtained from EPA AIM Rule & OTC Phase II AIM Rule for this source category, which combined produced a 9.7% reduction.

Spatial

Data for spatial allocation is not available for this source.

Temporal

SAF was applied to emissions and were averaged according to period of operation to a daily estimate. See section 2.2.1.1

Traffic Paint Sample Calculation (Harford County)

(1) Calculate VOC emissions from yellow and white traffic paints for year 2017

a. State Highway Administration (SHA) and Local Government (LG) Traffic Paint Use

Total yellow gallons used in 2017 = 6,715 gallons LG
 Total VOC per gallon of yellow paint used²² = 0.56 lbs. _{VOC} /gallon
 Total white gallons used 2017 = 1,189 gallons LG
 Total VOC per gallon of white paint used²³ = 0.57 lbs. _{VOC} /gallon

Total yellow gallons used in 2017 = 12,884 gallons SHA
 Total VOC per gallon of yellow paint used²⁴ = 0.57 lbs. _{VOC} /gallon
 Total white gallons used 2017 = 17,079 gallons SHA
 Total VOC per gallon of white paint used²⁵ = 0.57 lbs. _{VOC} /gallon

$$E_{\text{Yellow Paint}} = \frac{((6,715 \times 0.56) + (12,884 \times 0.57))}{(2,000 \text{ lbs./ton})}$$

E_{Yellow Paint} = 5.55 tons / year

$$E_{\text{White Paint}} = \frac{((1,189 \times 0.57) + (17,079 \times 0.57))}{(2,000 \text{ lbs./ton})}$$

E_{White Paint} = 5.21 tons / year

b. Maryland Aviation Administration (MAA) Traffic Paint Use

The MAA did not apply any paint in Harford County.

c. Maryland Transportation Administration (MTA) Traffic Paint Use

Total yellow gallons used in 2017 = 92 gallons MTA
 Total VOC per gallon of yellow paint used²⁶ = 0.57 lbs. _{VOC} /gallon
 Total white gallons used 2017 = 167 gallons MTA
 Total VOC per gallon of white paint used²⁷ = 0.57 lbs. _{VOC} /gallon

$$E_{\text{Yellow Paint}} = \frac{(92 \times 0.57)}{(2,000 \text{ lbs./ton})}$$

E_{Yellow Paint} = 0.03 tons / year

$$E_{\text{White Paint}} = \frac{(167 \times 0.57)}{(2,000 \text{ lbs./ton})}$$

²² MSDS from Caroline County's Department of Public Works, Division of Highways
²³ MSDS from Caroline County's Department of Public Works, Division of Highways
²⁴ MSDS from Caroline County's Department of Public Works, Division of Highways
²⁵ MSDS from Caroline County's Department of Public Works, Division of Highways
²⁶ MSDS from Caroline County's Department of Public Works, Division of Highways
²⁷ MSDS from Caroline County's Department of Public Works, Division of Highways

$$E_{\text{White Paint}} = 0.05 \text{ tons / year}$$

$$E_{\text{Paint Total}} = E_{\text{SHA Paint Total}} + E_{\text{Local Paint Total}} + E_{\text{MAA Paint Total}} + E_{\text{MTA Paint Total}} + E_{\text{Paint Solvent}}$$

$$E_{\text{Paint Total}} = (5.55 + 5.21 + 0.0 + 0.08 + 0.0) \times (1 - 0.097)$$

$$E_{\text{Paint Total}} = 9.78 \text{ tons / year VOC emissions for Harford County.}$$

Traffic Paint was found to have a

SAF = seasonal adjustment factor of 0.25

POS = peak ozone period of 0.25

Days of the Period 260

Daily adjusted $E_{\text{ARda}} = (E_{\text{AR}} / 260) \times (\text{SAF} / \text{POS})$

$$E_{\text{ARda}} = (9.78 / 260) \times (0.25 / 0.25) = 3.76\text{E-}02 \text{ VOC tons/day}$$

4.1.2.7 Industrial Surface Coating

SCC: 24 01 015 000 (Finish Wood Product Manufacturing)
24 01 020 000 (Wood Furniture and Fixtures)
24 01 025 000 (Metal Furniture and Fixtures)
24 01 030 000 (Paper, Film, and Foil)
24 01 040 000 (Metal Cans)
24 01 060 000 (Household Appliances Manufacturing)
24 01 065 000 (Electronic and Other Electrical)
24 01070 000 (Motor Vehicles)
24 01 075 000 (Aircraft)
24 01 080 000 (Marine)
24 01 085 000 (Railroads)
24 01 090 000 (Miscellaneous Manufacturing)
24 01 100 000 (Industrial Maintenance Coatings)
24 01 200 000 (Other Coatings)

Description

Industrial surface coatings are applied during the manufacture of a wide variety of products, including furniture, cans, automobiles, other transportation equipment, machinery, appliances, metal coil, flat wood, wire and other miscellaneous products. In addition, coatings are used in maintenance operations at industrial facilities but these are considered paint sources.

Pollutants

VOC and HAPs

Method and Data Sources

MDE used the methods and procedures documented in EIIP²⁸, Chapter 8 Industrial Surface Coatings, dated September 1997. Applicable point source emissions (those within the same NAICS) are taken from the MDE/ARA registration files have been subtracted from the emissions calculated on a per capita and per employee basis that are presented below.

Activity

The choice between using per capita factors or per employee factors for categories where made based on the quality of data. County Business Patterns internet address: <http://censtats.census.gov/> lists employee data by North American Industry Classification System (NAICS). Many values are based on actual data. However, some county NAICS list a range for the number of employees through a letter code. In this case the arithmetic average number of employees per letter code per county was adjusted so that the state total employment in a NAICS matched the sum of the number of employees reported per county. For those categories where all or most of the employment data was listed as a range, the per capita factor was assumed to be more reliable and was used to calculate emissions. The U.S. Census Bureau reports population statistics for

²⁸ Emission Inventory Improvement Program

the counties of Maryland. Population statistics for 2017 for the counties of Maryland were collected from the U.S. Census Bureau Internet address (<http://www.census.gov>).

Because the emission factors were developed based on NAICS employment data and 2013 was the last year employment data was available per NAICS, MDE used the 2013 County Business Patterns as the source for employment figures.

Emission Factor

Per employee factors were used for the industry surrogate employment NAICS because they are generally more reliable (see Procedures, Table 4-10.1), and a comparison with per capita emissions in one county showed that for these SICs, the per capita factors led to a large overestimation of emissions. Per capita factors were used for the industry surrogate population NAICS because they prove to be more reliable for emission calculations than the per employee factor.

Industry	SCC	NAICS	Surrogate
Finish Wood Product Manufacturing	2401015000	321	Employment
Wood Furniture and Fixtures	2401020000	337110, 337121, 337122, 337127, 337129, 337211, 337212, 337215, 339111	Employment
Metal Furniture and Fixtures	2401025000	337124, 337127, 337214, 337215, 339111	Employment
Paper, Film, and Foil	2401030000	322222	Employment
Metal Cans	2401040000	33243	Employment
Household Appliances Manufacturing	2401060000	3352	Employment
Electronic and Other Electrical	2401065000	331319, 31422, 331491, 35921, 335929	Employment
Motor Vehicles	2401070000	3361, 3362, 3363	Employment
Aircraft	2401075000	3364	Employment
Marine	2401080000	3366, 488390	Employment
Railroads	2401085000	3365	Employment
Miscellaneous Manufacturing	2401090000	339, 3369	Employment
Industrial Maintenance Coatings	2401100000	NA _a	Population
Other Coatings	2401200000	NA _a	Population

Furthermore, NAICS used were the best correspond to SIC for each source category so that emission factors that were generated from EIIP SIC data could be used. EPA provided the correlation between NAICS and SIC

Industrial Maintenance Coatings (NAICS) and **Other Coatings (NAICS)**, emission factors are listed in a document prepared by Dennis Beauregard at EPA and named "Freedonia EFs 06-16-09.xls". The file has been modified by E.H Pechan and Associates, Inc. to correct for an error in NAICS code 441 for Cleaning Products: Industrial and Institutional (2415000000). The Freedonia emissions factor calculation file can be obtained from EPA for further detail on how each of the factors below were estimated.

Industry	Per Employment VOC Emission Factor (lbs. VOC/employee/year)	Per Capita VOC Emission Factor (lbs. VOC/person/year)
Finish Wood Product Manufacturing	43	NA
Wood Furniture and Fixtures	244	NA
Metal Furniture and Fixtures	772	NA
Paper, Film, and Foil	735	NA
Metal Cans	2,326	NA
Household Appliances Manufacturing	254	NA
Electronic and Other Electrical	24.7	NA
Motor Vehicles	164	NA
Aircraft	15	NA
Marine	198	NA
Railroads	222	NA
Miscellaneous Manufacturing	136	NA
Industrial Maintenance Coatings	NA	0.8
Other Coatings	NA	0.8

Point Source Adjustments

Applicable point source emissions (those within the same NAICS) taken from the MDE/ARA registration files have been subtracted from the calculated emissions, and their emissions are separated from the totals presented below.

Adjustment for Controls

No controls are available for this source category.

Spatial and Temporal Allocations

Spatial

Data for spatial allocation is not available for this source.

Temporal

SAF was applied to emissions and were averaged according to period of operation to a daily estimate. See section 2.2.1.1

Emissions Calculation

Equation:

$$E_{FW} = \frac{EMPL_i \times EF_{FW}}{2000}$$

Where:

E_{FW} = VOC emissions in tons per year from finish wood product manufacturing.

$EMPL_i$ = employees in county i employed in NAICS 321.

EF_{FW}^{29} = VOC emission factor for finished wood which is 43 lbs. _{VOC} per employee per year

2017 Example Calculation Industrial Surface Coating – Finish Wood Product Manufacturing (Baltimore City)

Number of employees in NAICS 321 in Baltimore City (2016 County Business Patterns):

$$EMPL_{BC} = \mathbf{44.8}$$

Emission factor for finish wood product manufacturing (lbs. VOC/employee/year):

$$EF_{FW} = \mathbf{43}$$

$$E_{FW \text{ (Baltimore City)}} = \frac{(44.8 \times 43)}{2000}$$

$$E_{FW \text{ (Baltimore City)}} = \mathbf{0.96 \text{ tons VOC per year}}$$

Traffic Paint was found to have a

SAF = seasonal adjustment factor of 0.25

POS = peak ozone period of 0.25

Days of the Period 260

Daily adjusted $E_{ARda} = (E_{FW \text{ (Baltimore City)}} / 260) * (SAF / POS)$

$$E_{ARda} = (0.96 / 260 * (0.25 / 0.25)) = \mathbf{3.70E-03 \text{ VOC tons/day}}$$

²⁹ Table 8.5-1, EIIP Chapter 8 Industrial Surface Coatings

Point Source Adjustments

4.1.2.8 Industrial Adhesives

SCC: 2440000000

Description

Industrial adhesives are the application of a liquid or powder substance, such as solvent type paints, varnishes, and lacquers to a surface for decorative or protective purposes. The substances can be applied by brushing, rolling, spraying, dipping or flow coating. VOCs are released into the air as the substance dries. Powder coatings are applied to a hot surface and then melted; VOCs are released as the powder melts and dries.

Pollutants

VOC and HAPs

Method and Data Sources

MDE staff used EPA's "Solvent Mass Balance" methodology for estimating emissions from nonpoint solvents, which uses the total solvent production and sales for a particular source category to estimate overall emissions then subtracting out emissions due to point sources, waste management, and recycling.

Activity

Per capita activity data was used and downloaded from the US Census Bureau (internet address: <http://www.census.gov>) July 1, 2017 population statistic estimates for the counties of Maryland³⁰.

Emission Factor

MDE used the emission factor of 1.10 lbs/capita/year developed by Determination of Reasonably Available Control Technology and Best Available Retrofit Control Technology for Adhesives and Sealants, California Air Resources Board document for adhesives and sealants (CARB RACT/BARCT for Adhesives/ Sealants, Dec 1998)³¹.

CARB RACT/BARCT estimated emission factor calculation for adhesives/sealants is as following:

VOC = 45 tons/day estimated in 1994 * 365 days/year * 2000 lbs/ton / 29,760,021 capita where 45 tons/day is the estimated state-wide emissions for industrial adhesives in California, 2000 lbs/ton is a conversion factor, and 29,760,021 capita is the 1990 population of California.

VOC Emf = 1.10 lbs/capita/year of industrial adhesives

No subtraction of emissions from point sources is necessary.

³⁰ 2017 estimated population from U.S. Bureau of the Census, Population Estimation Branch (see Appendices).

³¹ Emission factors were developed by CARB RACT/BARCT for Adhesives/ Sealants, Dec 1998.

Emissions Calculation

Adjustment for Controls

Maryland has adopted an industrial adhesive and coatings regulation (COMAR 26.11.19.15). The regulation is similar to the one proposed by the Ozone Transport Commission (OTC) and achieves VOC reductions through two basic components: sale and manufacture restrictions that limit the VOC content of specified adhesives, sealants and primers sold in the state; and use restrictions that apply primarily to commercial/industrial applications.

A reasonably available control technology determination (CARB RACT/BARCT for Adhesives/ Sealants, Dec 1998) prepared by the California Air Resources Board (CARB) in 1998 forms the basis of this model rule. In the years 1998-2001, the provisions of the CARB determination were adopted in regulatory form in various air pollution control districts in California including the Bay Area, Ventura County, Sacramento Metropolitan and San Joaquin Valley.

CARB and OTC estimate a 64.4 percent reduction in emissions from the source category regulation that was fully implemented in Maryland in 2009.

Spatial and Temporal Allocations

Spatial

Data for spatial allocation is not available for this source.

Temporal

SAF was applied to emissions and were averaged according to period of operation to a daily estimate. See section 2.2.1.1

Equation:

$$E_{oc} = \frac{POP_i \times EF_{oc}}{2000} \times [1 - (CE \times RE \times RP)]$$

where:

E_{oc}^{32} = VOC emissions in tons per year from industrial adhesives.

POP_i = 2017 population of county i

EF_{oc}^{33} = VOC emission factor for industrial adhesives.

CE = Control Efficiency

RE = Rule Effectiveness

RP = Rule Penetration

To adjust for control efficiency OTC-PECHAN Control Measure Report:

2017 base year where:

CE = 0.644, RE = RP = 1.

³² 2017 estimated population from U.S. Bureau of the Census, Population Estimation Branch (see Appendices).

³³ Emission Inventory Improvement Program Vol III, Ch. 6, September 1997.

$$[1 - (CE \times RE \times RP)] = [1 - (0.644 \times 1 \times 1)] = 0.356$$

2017 Per Capital Sample Calculation for Industrial Adhesives in Harford County:

2017 U.S. Census Bureau Population Estimate for Harford County:

$$POP_i = 251,032$$

Emission factor for industrial adhesives (lbs. VOC/person/year):

$$EF_{OC} = 1.10$$

5 days per week activity level, no seasonal adjustment factor

Equation:

$$E_{OC} = \frac{POP_i \times EF_{OC}}{2000} \times [1 - (CE \times RE \times RP)]$$

$$E_{OCHarford} = \frac{251,032 \times 1.10 \times [1 - (0.644 \times 1.0 \times 1.0)]}{2000} = 49.15 \text{ tons}_{VOC} \text{ per year.}$$

Industrial Adhesives was found to have a

SAF = seasonal adjustment factor of 0.28

POS = peak ozone period of 0.25

Days of the Period 365

Daily adjusted $E_{OCHarfordda} = (E_{OCHarford} / 365) \times (SAF / POS)$

$$E_{OCHarfordda} = (49.15 / 365) \times (0.28 / 0.25) = 1.51E-01 \text{ VOC tons/day}$$

4.1.2.9 Graphic Arts

SCC: 24 25 000 000 (Screen & Plateless)
24 25 010 000 (Offset Lithography)

24 25 020 000 (Letterpress)
 24 25 030 000 (Rotogravure)
 24 25 040 000 (Flexography)

Description

Graphic arts include operations that are involved in the printing of newspapers, magazines, books and other printed materials. There are six basic operations used in graphic arts: lithography, gravure, letterpress, flexography, screen printing and metal decorating (plateless). In our calculations screen and plateless printing were paired together and make up a combined 6% market share of all printing. Lithography accounts for nearly half of all graphic arts operations.

Pollutants

VOC

Method and Data Sources

MDE staff used an alternative per capita emission estimation method documented in EIIP⁴, Chapter 7 Graphic Arts, dated November 1996. The EIIP methodology recommended an emission factor of 1.3 lbs. _{voc} per capita per year emission factor (EPA, 1991) for graphic arts sources emitting less than 100 tons VOC per year. Yearly activity was used with no seasonal adjustment factor as recommended in Table 5.8-1 in Procedures. All point source graphic arts facilities (NAICS 11531) in the ARA registration files for 2017 emissions were subtracted from the area source inventory.

Activity

The estimated percentage of market share, reported in Table 7.2-3 of the EIIP document and reproduced below, was used to allocate the total graphic arts emissions to specific printing types. Maryland has different regulations regarding specific types of printing operations and thus to calculate controlled emissions the estimated percentage that each type of printing operation contributes to the total had to be determined.

Type of Printing (MS_{type})	Estimated Percentage of Product Market Share
Rotogravure	18
Flexography	18
Offset Lithography	47
Letterpress	8
Screen	3
Plateless	3

Emission Factor

1.3 lbs. _{voc} per capita per year

⁴ Emission Inventory Improvement Program

Point Source Adjustments

Graphic arts emissions from facilities identified as point sources were subtracted from the area source inventory to avoid double counting.

Adjustment for Controls

Control efficiency is based on Maryland regulations for each type of printing process and has been developed within technical support documents for the graphic arts printing regulations. Rule penetration has been defined as the estimated percentage that each type of printing operation. Rule effectiveness has been assigned the EPA default value of 80 per cent.

Control	Lithographic	Rotogravure	Letterpress	Flexographic	Screen
Rule Effectiveness (RE)	0.800	0.800	0.800	0.800	0.800
Rule Penetration (RP)	1.000	1.000	1.000	1.000	1.000
Control Efficiency (CE)	0.750	0.630	0.000	0.540	0.350
Reduction factor (RE x RP x CE)	0.600	0.504	0.000	0.432	0.280

Spatial and Temporal Allocations

Spatial

Data for spatial allocation is not available for this source.

Temporal

SAF was applied to emissions and were averaged according to period of operation to a daily estimate. See section 2.2.1.1

Emissions Calculation

The equation used to estimate emissions from graphic arts is:

Equation:

$$E_{GA} = \frac{MS_{type} \times POP_i \times EF_{GA}}{2000} \times (1 - RF_{GA})$$

Where:

E_{GA} = VOC emissions in tons per year from graphic arts

MS_{type} = Market share percent of the type of printing

POP_i = 2017 population of county i

- EF_{GA} = VOC emission factor for graphic arts (1.3³⁴ lbs. VOC per person per year)
 RF_{GA} = Reduction Factor for Printing
 RF_L = Reduction Factor for Lithographic Printing
 RF_{LP} = Reduction Factor for Letterpress Printing
 RF_R = Reduction Factor for Rotogravure Printing
 RF_F = Reduction Factor for Flexographic Printing
 RF_S = Reduction Factor for Screen & Plateless Printing

2017 Example Calculation Graphic Arts (Anne Arundel County)

$$E_{GAL} = \frac{0.47 \times 568,346 \times 1.3}{2000} \times (1 - 0.600)$$

$$E_{GALP} = \frac{0.08 \times 568,346 \times 1.3}{2000} \times (1 - 0.0)$$

$$E_{GAR} = \frac{0.18 \times 568,346 \times 1.3}{2000} \times (1 - 0.504)$$

$$E_{GAF} = \frac{0.18 \times 568,346 \times 1.3}{2000} \times (1 - 0.432)$$

$$E_{GAS} = \frac{0.06 \times 568,346 \times 1.3}{2000} \times (1 - 0.280)$$

$$E_{GAsum} = (E_{GAL} + E_{GALP} + E_{GAR} + E_{GAF} + E_{GAS})$$

$$E_{GAsum} = (69.45 + 29.55 + 32.98 + 37.77 + 15.96)$$

$$E_{GAsum} = \mathbf{185.72 \text{ tons VOC per person year}} \quad (\text{Totals may be slightly different due to rounding})$$

Graphic Arts was found to have a
 SAF = seasonal adjustment factor of 0.25
 POS = peak ozone period of 0.25
 Days of the Period 260
 Daily adjusted $E_{GAsumda} = (E_{GAsum} / 260) * (SAF / POS)$

$$E_{GAsumda} = (\mathbf{185.72} / 260) * (0.25 / 0.25) = \mathbf{7.14E-01 \text{ VOC tons/day}}$$

³⁴ Emission factor from EIIP Chapter 7 Graphic Arts

4.1.2.10 Asphalt Paving and Roofing

SCC: 24 61 022 000 Emulsified
24 61 020 000 Misc. Application (Road Oil)
24 61 021 000 Cutback
24 61 023 000 Roofing

Description

The two types of asphalt paving used for road paving and repair are cutback asphalt and emulsified asphalt. Cutback asphalt is a liquefied road surface prepared by blending (or "cutting back") asphalt cement with different petroleum distillates or (road oils). The second type, emulsified asphalt, is also a liquefied road surface, but is prepared with a water/soap mixture instead of petroleum distillates. Cutback asphalt emits more VOCs, and its use has been limited in Maryland to the non-ozone period of April 15 to October 15. Asphalt like tar is also used for roofing similar to rubberizing.

Pollutants

VOC

Method and Data Sources

MDE calculated emissions for this category by using a combination of factors from the Sacramento Metropolitan Air Quality Management District (SMAQMD) 1991 Survey, the California Air Resources Board, and EPA's AP-42. It estimated that 80% of all asphalt used in Maryland is for paving, and the remaining 20% is for roofing.

Activity

Total barrels of asphalt used in Maryland was obtained from the Energy Information Administration (EIA) and separated to county level. Maryland used 2,280,000 barrels of asphalt in 2016. Also, 2017 population statistics for the counties of Maryland were collected from the Census Bureau Internet address (<http://www.census.gov>).

Emission Factors:

Asphalt Related Material	VOC Emission Factors	EF Units
Emulsified	17.9	lbs/ton
Road Oils	70.4	lbs/ton
Cutback	268.3	lbs/ton
Asphalt Roofing	6.2	lbs/ton

Point Source Adjustments

No subtraction of emissions from point sources is necessary.

Adjustment for Controls

State of Maryland Department of Environment regulations (COMAR 26.11.11.02B), prohibit use of cutback asphalt paving from April 15 to October 15 so ozone precursor emissions from cutback asphalt application were not calculated. Cutback asphalt is made by blending asphalt cement with petroleum distillates that evaporate when the road surface is "cured" after application. Cutback was given a control efficiency of 100 %, rule effectiveness of 80%, and rule penetration of 100%. All other asphalts had no controls applied. Emulsified asphalt is asphalt cement mixed with a blend of water and an emulsifier, usually soap.

Spatial and Temporal Allocations

Spatial

Data for spatial allocation is not available for this source.

Temporal

SAF was applied to emissions and were averaged according to period of operation to a daily estimate. See section 2.2.1.1

Emissions Calculation

Emission estimates were calculated by converting total barrels used to tons of asphalt, multiplying it by appropriate emission factor, and then proportioning them by population to the county level. There is 350 lbs of asphalt in each barrel. Out of all asphalt used in the state, approximately 80% is used for paving and 20% is used for roofing. Paving asphalt usage is further separated below:

Paving Asphalt Percent	
Paving Hot-mix:	92%
Paving Emulsified:	5%
Paving Road Oils:	2%
Paving Cutback	1%
Roofing of state total	20%

Tons of Paving Asphalt	
Hot-mix:	293,664
Emulsified:	15,960
Road Oils:	6,384
Cutback	3,192
Roofing	79,864

Hot-mix emissions were calculated by facilities and reported with point source inventory.

The equation used to estimate emissions from asphalt paving is:

$$E_A = \frac{CLA_{Type} \times EF_{Type}}{2000} \times (1 - (RE \times RP \times CE))$$

Where:

E_A = VOC emissions tons

CLA_{Type} = Estimated amount of asphalt type used (tons)

EF_{Type} = emission factor for type of asphalt in lbs_{VOC} per ton of asphalt per yr

RE = Rule Effectiveness

RP = Rule Penetration

CE = Control efficiency

2017 Road Oils Asphalt Sample Calculations: Anne Arundel County

Total Maryland Population for 2017 was 6,016,447 people.

Anne Arundel County population for 2017 was 568,346 people.

Usage ratio for Anne Arundel County is USE_a = (568,346 / 6,016,447) = 0.0945

Total barrels of asphalt used in Maryland in

2017 were 2,280,000 and minus 20% for roofing leaves 1,824,000 barrels. 2% is road oils, which is 36,480 barrels.

$$CLA_{AA} = \frac{(36,480 \text{ barrel} \times 350 \text{ lbs per barrel})}{2000} \times 0.0945 = 603.29 \text{ tons road used}$$

$$E_{AARoadOils} = \frac{603.29 \times 70.4}{2000} \times (1 - (1 \times 1 \times 0))$$

$$E_{AARoadOils} = 21.24 \text{ tons}_{VOC} \text{ Anne Arundel County per year}$$

(Similar calculation can be done for each asphalt type for each county)

Road Oils Asphalt was found to have a

SAF = seasonal adjustment factor of 0.39

POS = peak ozone period of 0.25

Days of the Period 312

$$\text{Daily adjusted } E_{AARoadOilsda} = (E_{AARoadOils} / 312) \times (SAF / POS)$$

$$E_{AARoadOilsda} = (21.24 / 312) \times (0.39 / 0.25) = 1.06E-01 \text{ VOC tons/day}$$

4.1.2.11 Synthetic Organic Chemical Storage Tanks

This category is fully represented in the point source inventory.

4.1.2.12 Pesticide Application

SCC: 24 61 800 001 Surface Application
24 61 800 002 Soil Application

Description

Pesticides are substances or mixtures used to control plant and animal life for the purposes of: agricultural production, public health from pest-borne disease, reducing property damage due to pests, and improving the aesthetic quality of outdoor and indoor surroundings. Agriculture, homeowners, industry, and government agencies use pesticides. The largest usage of pesticides by weight is in agriculture. Agricultural pesticides control weeds, insects, mites, fungi, nematodes, and other threats to the yield, quality, or safety of food production. There are several methods used to apply pesticides. For our calculations we used surface or soil application.

Emissions arise from pesticide use because of the volatile nature of many ingredients, solvents, or other additives used in the formulations. Many pesticide formulations use solvents as carriers for more active organic or inorganic ingredients. In pesticide formulations, the organic or inorganic solute is the "active ingredient" (AI), while the solvent carrier is the "inert carrier." Thus, the terms "active" and "inert" in pesticide formulations refer to toxicological action, and are not indicators of photochemical activity. Both the active and inert ingredients in these formulations evaporate and contribute to VOC emissions.

Pollutants

VOC and HAPs

Method and Data Source:

Pesticide usage data used to calculate pesticide emissions came from a 2014 survey conducted by the Pesticide Regulation Section of the Maryland Department of Agriculture and the U.S. Department of Agriculture. Also, the Maryland and National Agricultural Statistics services in cooperation with the Departments of Agriculture compiled information for the document, [Maryland Pesticide Statistics for 2014](#), which reported pesticide usage in pounds used in a year by active ingredient for each Maryland County.

EPA post new guidance for calculating pesticide emissions on its FTP site under the document, "**Agricultural Pesticide Application**". The site also included files containing new estimated emission factors for several different pesticides and a weighted average emission factor (EF_{avg}) value of 0.4 pounds of VOC per pound of active ingredient (default factor). Since Maryland had over 200 pesticides reported and about 50 of the pesticides listed in the Maryland Pesticide Statistics were not found in any of EPA's files or any of the other

country wide databases, an estimation of emissions were split into those calculated from EPA factors and the rest were defaulted from the EF_{avg} value.

The emissions were calculated by multiplying the amount of active ingredient by its emission factor. The total amounts of emissions were estimated, but the amount used in each county was not given, therefore reported harvest acres were used to divide emissions into each county. Pesticide use was not reported for a particular pesticide-by-crop, but the Maryland Department of Agriculture's, "Harvested Acres 2015-2017 MD Annual Bulletin" reported the types of crops and the amount of each harvest in each county. In Maryland pesticides for soybean and corn are normally applied to soil and wheat and barley are applied to the surface. A percentage based on the portion of each crop type was also used to further divide emissions by county and by soil or surface application and reported by SCC. Pesticides used to estimate emissions are shown below. 2009 statistics had to be used for hay and alfalfa.

Pesticides Used in Maryland 2015 to 2017

County	Pesticide MD Report	EPA Emission Factor lb./lb.	Active Ingredient lbs	VOC lbs	VOC tons
ALLEGANY	Glyphosate	0.158572216	7,867	1,247	0.62
ALLEGANY	2;4-D	0.827317385	1,228	1,016	0.51
ALLEGANY	Picloram; K salt	0.398396794	1,130	450	0.23
ALLEGANY	Disod. Octa. tetra.	0.4	931	372	0.19
ALLEGANY	Beta-cyfluthrin	1.735956923	327	568	0.28
ALLEGANY	Aminopyralid potassium salt	0.160221675	221	35	0.02
ALLEGANY	Imidacloprid	0.30515662	194	59	0.03
ALLEGANY	Bifenthrin	1.565896363	133	208	0.10
ALLEGANY	Lambda-cyhalothrin	0.400383954	86	34	0.02
ALLEGANY	Pyriproxyfen	1.386748166	76	105	0.05
ANNE ARUNDEL	Fipronil	6.462993609	190,450	1,230,877	615.44
ANNE ARUNDEL	Glyphosate	0.158572216	13,974	2,216	1.11
ANNE ARUNDEL	2;4-D	0.827317385	8,733	7,225	3.61
ANNE ARUNDEL	Imidacloprid	0.30515662	7,184	2,192	1.10
ANNE ARUNDEL	Pyriproxyfen	1.386748166	6,753	9,365	4.68
ANNE ARUNDEL	Beta-cyfluthrin	1.735956923	5,989	10,397	5.20
ANNE ARUNDEL	Boric acid	0.4	2,712	1,085	0.54
ANNE ARUNDEL	MCPA; dimethyl. salt	0.470093248	2,299	1,081	0.54
ANNE ARUNDEL	Atrazine	0.148401799	2,202	327	0.16
ANNE ARUNDEL	Pendimethalin	0.558789524	2,154	1,204	0.60
BALTIMORE	Glyphosate	0.158572216	53,133	8,425	4.21
BALTIMORE	2;4-D	0.827317385	27,306	22,591	11.30
BALTIMORE	Imidacloprid	0.30515662	21,530	6,570	3.29
BALTIMORE	Cyfluthrin	1.735956923	20,029	34,769	17.38
BALTIMORE	Chlorothalonil	0.1129023	18,499	2,089	1.04
BALTIMORE	S-Metolachlor	0.197923197	16,635	3,292	1.65
BALTIMORE	Atrazine	0.148401799	16,279	2,416	1.21
BALTIMORE	Prodiamine	0.125840336	13,753	1,731	0.87
BALTIMORE	Paraquat Dichloride	0.310577425	10,044	3,119	1.56

BALTIMORE	Mineral oil	0.4	7,668	3,067	1.53
CALVERT	Imidacloprid	0.30515662	24,388	7,442	3.72
CALVERT	Glyphosate	0.158572216	5,062	803	0.40
CALVERT	Atrazine	0.148401799	2,708	402	0.20
CALVERT	Mineral oil	0.4	2,421	968	0.48
CALVERT	Paraquat Dichloride	0.310577425	2,142	665	0.33
CALVERT	Thifensulfuron	0.049333333	620	31	0.02
CALVERT	2;4-D	0.827317385	450	372	0.19
CALVERT	Fipronil	6.462993609	146	944	0.47
CALVERT	Bifenthrin	1.565896363	83	130	0.06
CALVERT	Beta-cyfluthrin	1.735956923	81	141	0.07
CAROLINE	Glyphosate	0.158572216	26,494	4,201	2.10
CAROLINE	Atrazine	0.148401799	12,960	1,923	0.96
CAROLINE	S-Metolachlor	0.197923197	9,009	1,783	0.89
CAROLINE	Simazine	0.08875528	4,354	386	0.19
CAROLINE	2;4-D	0.827317385	3,370	2,788	1.39
CAROLINE	Mineral oil	0.4	2,195	878	0.44
CAROLINE	Chlorothalonil	0.1129023	1,659	187	0.09
CAROLINE	Paraquat Dichloride	0.310577425	1,308	406	0.20
CAROLINE	Mesotrione	0.236083333	1,019	241	0.12
CAROLINE	Captan	0.144094541	909	131	0.07
CARROLL	Pendimethalin	0.558789524	112,428	62,824	31.41
CARROLL	Glyphosate	0.158572216	61,284	9,718	4.86
CARROLL	Atrazine	0.148401799	50,298	7,464	3.73
CARROLL	S-Metolachlor	0.197923197	38,036	7,528	3.76
CARROLL	Paraquat Dichloride	0.310577425	31,556	9,801	4.90
CARROLL	2;4-D	0.827317385	25,817	21,359	10.68
CARROLL	Simazine	0.08875528	18,716	1,661	0.83
CARROLL	Thifensulfuron	0.049333333	13,591	670	0.34
CARROLL	Fipronil	6.462993609	10,390	67,151	33.58
CARROLL	Tribenuron-methyl	0.030454341	6,772	206	0.10
CECIL	Chlorothalonil	0.1129023	13,144	1,484	0.74
CECIL	Glyphosate	0.158572216	11,589	1,838	0.92
CECIL	Mineral oil	0.4	9,571	3,828	1.91
CECIL	Atrazine	0.148401799	5,264	781	0.39
CECIL	2;4-D	0.827317385	3,915	3,239	1.62
CECIL	Captan	0.144094541	2,773	400	0.20
CECIL	Pendimethalin	0.558789524	2,055	1,148	0.57
CECIL	S-Metolachlor	0.197923197	1,824	361	0.18
CECIL	Imidacloprid	0.30515662	569	174	0.09
CECIL	Thiophanate-methyl	0.117956516	529	62	0.03
CHARLES	Glyphosate	0.158572216	6,005	952	0.48
CHARLES	Imidacloprid	0.30515662	5,570	1,700	0.85
CHARLES	2;4-D	0.827317385	2,231	1,846	0.92
CHARLES	Acetochlor	0.400383954	1,390	557	0.28
CHARLES	Atrazine	0.148401799	973	144	0.07
CHARLES	Pyriproxyfen	1.386748166	846	1,173	0.59
CHARLES	Bifenthrin	1.565896363	421	659	0.33

CHARLES	Beta-cyfluthrin	1.735956923	221	384	0.19
CHARLES	MCPP-P; DMA Salt	0.4	179	72	0.04
CHARLES	Cypermethrin	1.521227778	177	269	0.13
DORCHESTER	Glyphosate	0.158572216	26,735	4,239	2.12
DORCHESTER	Atrazine	0.148401799	16,170	2,400	1.20
DORCHESTER	S-Metolachlor	0.197923197	4,187	829	0.41
DORCHESTER	Permethrin	3.34487239	1,239	4,144	2.07
DORCHESTER	Difenoconazole	1.120455469	470	527	0.26
DORCHESTER	Beta-cyfluthrin	1.735956923	461	800	0.40
DORCHESTER	Imidacloprid	0.30515662	369	113	0.06
DORCHESTER	Bifenthrin	1.565896363	252	395	0.20
DORCHESTER	Indoxacarb	0.452534916	158	72	0.04
DORCHESTER	Lambda-cyhalothrin	0.400383954	139	56	0.03
FREDERICK	Simazine	0.08875528	159,303	14,139	7.07
FREDERICK	Glyphosate	0.158572216	54,620	8,661	4.33
FREDERICK	Chlorothalonil	0.1129023	46,910	5,296	2.65
FREDERICK	Atrazine	0.148401799	18,211	2,703	1.35
FREDERICK	2;4-D	0.827317385	12,974	10,734	5.37
FREDERICK	Bifenthrin	1.565896363	8,970	14,046	7.02
FREDERICK	S-Metolachlor	0.197923197	8,368	1,656	0.83
FREDERICK	Dithiopyr	0.955493833	5,859	5,598	2.80
FREDERICK	Paraquat Dichloride	0.310577425	5,753	1,787	0.89
FREDERICK	Mono-potassium salt	0.4	4,726	1,890	0.95
GARRETT	Glyphosate	0.158572216	9,451	1,499	0.75
GARRETT	S-Metolachlor	0.197923197	6,789	1,344	0.67
GARRETT	Imidacloprid	0.30515662	6,346	1,937	0.97
GARRETT	Atrazine	0.148401799	3,801	564	0.28
GARRETT	Metolachlor	0.197923197	2,094	414	0.21
GARRETT	Mesotrione	0.236083333	469	111	0.06
GARRETT	Pendimethalin	0.558789524	368	206	0.10
GARRETT	2;4-D	0.827317385	258	213	0.11
GARRETT	2;4-DB	0.066501976	195	13	0.01
GARRETT	Dicamba; dimet. salt	0.084360404	164	14	0.01
HARFORD	2;4-D	0.827317385	19,447	16,089	8.04
HARFORD	Glyphosate	0.158572216	15,384	2,439	1.22
HARFORD	Atrazine	0.148401799	14,589	2,165	1.08
HARFORD	Paraquat Dichloride	0.310577425	8,337	2,589	1.29
HARFORD	S-Metolachlor	0.197923197	6,836	1,353	0.68
HARFORD	Thifensulfuron	0.049333333	5,557	274	0.14
HARFORD	Simazine	0.08875528	3,593	319	0.16
HARFORD	Chlorothalonil	0.1129023	3,116	352	0.18
HARFORD	Prodiamine	0.125840336	2,948	371	0.19
HARFORD	Tribenuron-methyl	0.030454341	2,770	84	0.04
HOWARD	Glyphosate	0.158572216	23,936	3,796	1.90
HOWARD	S-Metolachlor	0.197923197	10,833	2,144	1.07
HOWARD	Atrazine	0.148401799	10,590	1,572	0.79
HOWARD	2;4-D	0.827317385	9,605	7,946	3.97
HOWARD	Fipronil	6.462993609	9,480	61,269	30.63

HOWARD	Propiconazole	1.052037715	5,839	6,143	3.07
HOWARD	Paraquat Dichloride	0.310577425	3,604	1,119	0.56
HOWARD	Imidacloprid	0.30515662	3,148	961	0.48
HOWARD	Thifensulfuron	0.049333333	2,922	144	0.07
HOWARD	Chlorothalonil	0.1129023	2,779	314	0.16
KENT	Glyphosate	0.158572216	31,754	5,035	2.52
KENT	Atrazine	0.148401799	7,606	1,129	0.56
KENT	S-Metolachlor	0.197923197	4,262	844	0.42
KENT	2;4-D	0.827317385	3,356	2,776	1.39
KENT	Simazine	0.08875528	3,130	278	0.14
KENT	Mono-potassium salt	0.4	476	190	0.10
KENT	Imidacloprid	0.30515662	270	82	0.04
KENT	Thifensulfuron	0.049333333	257	13	0.01
KENT	Bifenthrin	1.565896363	232	363	0.18
KENT	Difenoconazole	1.120455469	184	206	0.10
MONTGOMERY	Glyphosate	0.158572216	28,791	4,565	2.28
MONTGOMERY	Atrazine	0.148401799	18,717	2,778	1.39
MONTGOMERY	Chlorothalonil	0.1129023	12,508	1,412	0.71
MONTGOMERY	S-Metolachlor	0.197923197	9,161	1,813	0.91
MONTGOMERY	Fosetyl-al	0.04897535	6,070	297	0.15
MONTGOMERY	Paraquat Dichloride	0.310577425	5,764	1,790	0.90
MONTGOMERY	Mineral oil	0.4	5,657	2,263	1.13
MONTGOMERY	Dithiopyr	0.955493833	5,584	5,335	2.67
MONTGOMERY	Iprodione	0.202777271	5,520	1,119	0.56
MONTGOMERY	2;4-D	0.827317385	5,109	4,227	2.11
PRINCE GEORGE'S	Imidacloprid	0.30515662	17,076	5,211	2.61
PRINCE GEORGE'S	Glyphosate	0.158572216	8,121	1,288	0.64
PRINCE GEORGE'S	Beta-cyfluthrin	1.735956923	6,695	11,622	5.81
PRINCE GEORGE'S	Piperonyl butoxide	4.504163141	6,257	28,183	14.09
PRINCE GEORGE'S	Silicon dioxide	0.4	3,243	1,297	0.65
PRINCE GEORGE'S	Fipronil	6.462993609	2,487	16,073	8.04
PRINCE GEORGE'S	Pyriproxyfen	1.386748166	1,933	2,681	1.34
PRINCE GEORGE'S	Mineral oil	0.4	1,851	740	0.37
PRINCE GEORGE'S	Atrazine	0.148401799	1,756	261	0.13
PRINCE GEORGE'S	Boric acid	0.4	1,510	604	0.30
QUEEN ANNE'S	Glyphosate	0.158572216	45,283	7,181	3.59
QUEEN ANNE'S	Atrazine	0.148401799	7,739	1,148	0.57
QUEEN ANNE'S	2;4-D	0.827317385	5,762	4,767	2.38
QUEEN ANNE'S	S-Metolachlor	0.197923197	2,963	586	0.29
QUEEN ANNE'S	Mono-potassium salt	0.4	692	277	0.14
QUEEN ANNE'S	Simazine	0.08875528	418	37	0.02
QUEEN ANNE'S	Pendimethalin	0.558789524	400	224	0.11
QUEEN ANNE'S	Captan	0.144094541	349	50	0.03
QUEEN ANNE'S	Imidacloprid	0.30515662	283	86	0.04
QUEEN ANNE'S	Pyriproxyfen	1.386748166	235	326	0.16
ST. MARY'S	Imidacloprid	0.30515662	55,344	16,889	8.44
ST. MARY'S	Glyphosate	0.158572216	12,970	2,057	1.03
ST. MARY'S	Atrazine	0.148401799	6,864	1,019	0.51

ST. MARY'S	S-Metolachlor	0.197923197	5,476	1,084	0.54
ST. MARY'S	Paraquat Dichloride	0.310577425	2,661	826	0.41
ST. MARY'S	Chlorothalonil	0.1129023	2,199	248	0.12
ST. MARY'S	Pendimethalin	0.558789524	1,483	829	0.41
ST. MARY'S	Simazine	0.08875528	1,466	130	0.07
ST. MARY'S	Thifensulfuron	0.049333333	1,057	52	0.03
ST. MARY'S	2;4-D	0.827317385	788	652	0.33
SOMERSET	Glyphosate	0.158572216	10,040	1,592	0.80
SOMERSET	2;4-D	0.827317385	1,019	843	0.42
SOMERSET	Indoxacarb	0.452534916	2	1	0.00
TALBOT	Glyphosate	0.158572216	62,403	9,895	4.95
TALBOT	Clethodim	1.839959947	19,366	35,633	17.82
TALBOT	2;4-D	0.827317385	7,185	5,944	2.97
TALBOT	Atrazine	0.148401799	5,783	858	0.43
TALBOT	Metolachlor	0.197923197	2,900	574	0.29
TALBOT	Paraquat Dichloride	0.310577425	2,693	836	0.42
TALBOT	MCPP-P; DMA Salt	0.4	1,528	611	0.31
TALBOT	Copper triethanolamine complex	0.4	1,401	560	0.28
TALBOT	Copper ethanolamine	0.4	1,097	439	0.22
TALBOT	Diquat dibromide	1.456185648	379	552	0.28
WASHINGTON	Atrazine	0.148401799	32,002	4,749	2.37
WASHINGTON	Clopyralid mono salt	0.050478293	25,444	1,284	0.64
WASHINGTON	2;4-D	0.827317385	24,223	20,040	10.02
WASHINGTON	Glyphosate	0.158572216	23,756	3,767	1.88
WASHINGTON	Paraquat Dichloride	0.310577425	11,850	3,680	1.84
WASHINGTON	Thifensulfuron	0.049333333	8,692	429	0.21
WASHINGTON	Mineral oil	0.4	7,550	3,020	1.51
WASHINGTON	Mancozeb	0.04714311	4,851	229	0.11
WASHINGTON	Tribenuron-methyl	0.030454341	4,329	132	0.07
WASHINGTON	Disod. Octa. tetra.	0.4	4,198	1,679	0.84
WICOMICO	Glyphosate	0.158572216	13,634	2,162	1.08
WICOMICO	2;4-D	0.827317385	2,763	2,286	1.14
WICOMICO	S-Metolachlor	0.197923197	2,521	499	0.25
WICOMICO	Atrazine	0.148401799	1,445	214	0.11
WICOMICO	Deltamethrin	3.948853616	687	2,713	1.36
WICOMICO	Beta-cyfluthrin	1.735956923	396	687	0.34
WICOMICO	Lambda-cyhalothrin	0.400383954	162	65	0.03
WICOMICO	Indoxacarb	0.452534916	152	69	0.03
WICOMICO	Boric acid	0.4	141	56	0.03
WICOMICO	Difenoconazole	1.120455469	136	152	0.08
WORCESTER	Glyphosate	0.158572216	82,612	13,100	6.55
WORCESTER	Atrazine	0.148401799	19,221	2,852	1.43
WORCESTER	Paraquat Dichloride	0.310577425	14,771	4,588	2.29
WORCESTER	S-Metolachlor	0.197923197	10,356	2,050	1.02
WORCESTER	Deltamethrin	3.948853616	2,055	8,115	4.06
WORCESTER	Dicamba; dimet. salt	0.084360404	1,524	129	0.06
WORCESTER	2;4-D	0.827317385	1,483	1,227	0.61
WORCESTER	Beta-cyfluthrin	1.735956923	920	1,597	0.80

WORCESTER	Imidacloprid	0.30515662	707	216	0.11
WORCESTER	Lambda-cyhalothrin	0.400383954	618	247	0.12

Spatial and Temporal Allocations

Spatial

Data for spatial allocation is not available for this source.

Temporal

SAF was applied to emissions and were averaged according to period of operation to a daily estimate. See section 2.2.1.1

Harvested Acres by County and Percent of Total Harvested

County	Harvested Acres Crop Pesticides surface	Harvested Acres Crop Pesticides Soil	Harvested Acres Total	Percent (%) surface	Percent (%) soil
ALLEGHANY	8,375	2,116	10,491	0.80	0.20
ANNE ARUNDEL	3,500	4,400	7,900	0.44	0.56
BALTIMORE	7,500	41,100	48,600	0.15	0.85
CALVERT	3,000	3,498	6,498	0.46	0.54
CAROLINE	25,700	87,855	113,555	0.23	0.77
CARROLL	42,271	73,914	116,185	0.36	0.64
CECIL	27,213	42,386	69,599	0.39	0.61
CHARLES	5,500	0	5,500	1.00	0.00
DORCHESTER	39,509	72,100	111,609	0.35	0.65
FREDERICK	62,004	97,358	159,362	0.39	0.61
GARRETT	24,188	4,300	28,488	0.85	0.15
HARFORD	13,683	41,494	55,177	0.25	0.75
HOWARD	8,581	5,529	14,109	0.61	0.39
KENT	26,063	87,433	113,495	0.23	0.77
MONTGOMERY	10,000	10,575	20,575	0.49	0.51
PRINCE GEORGES	3,300	13,050	16,350	0.20	0.80
QUENN ANNES	14,600	105,600	120,200	0.12	0.88
ST. MARY'S	6,013	32,650	38,663	0.16	0.84
SOMERSET	9,100	31,700	40,800	0.22	0.78
TALBOT	18,000	71,700	89,700	0.20	0.80
WASHINGTON	26,672	20,643	47,315	0.56	0.44
WICOMICO	14,003	46,000	60,003	0.23	0.77
WORCESTER	17,952	69,600	87,552	0.21	0.79
BALTIMORE CITY	0	0	0	0.00	0.00

Emissions Calculation

Equations:

$$E_{\text{pest}} = \frac{(AI \times EF_{\text{pest}})}{2000}$$

where:

AI = Active Ingredient (lb. / yr.)

EF_{pest} = Emission Factor for particular pesticide (lb. VOC / lb. AI)

Sample Calculations:

Pesticide – Fipronil with 190,450 pounds of active ingredient used in Maryland.

EPA's EF for Fipronil is 6.46 (lb. VOC / lb. AI)

$$E_{\text{Fipronil}} = \frac{(190,450 \times 6.46)}{2000} = \mathbf{615.44} \text{ tons of Voc year}$$

After calculating VOCs for each pesticide a portion was distributed across counties that harvested crops using the table above containing percentages for total harvested acres. Then VOCs were summed in each county. The types of crops were summed in each county by application a percentage was derived and assigned the appropriate SCC code for soil or surface.

Total VOCs from Soil applied pesticides for Harford County were estimated to be:

E_{HarfordSoil} = 9.79 tons per year

Pesticides-Soil for Harford County was found to have a

SAF = seasonal adjustment factor of 0.25

POS = peak ozone period of 0.25

Days of the Period 312

Daily adjusted E_{HarfordSoil_{da}} = (E_{HarfordSoil} / 312)*(SAF / POS)

E_{HarfordSoil_{da}} = (9.79 / 312)*(0.25 / 0.25) = **3.14E-02 VOC tons/day**

4.1.2.13 Commercial/Consumer Solvent Use

SCC: 24 60 100 000 (Personal Care)
24 60 200 000 (Household)
24 60 400 000 (Automotive Aftermarket)
24 60 500 000 (Coatings and Related)
24 60 600 000 (Adhesives and Sealants)
24 60 800 000 (FIFRA - Regulated)
24 60 900 000 (Miscellaneous Products)

Description

Certain commercial/consumer uses of products containing volatile organics cannot easily be identified by questionnaires, surveys or other inventory procedures yielding locale-specific emission estimates. This category includes the following sources: household products, toiletries, aerosol products, rubbing compounds, windshield washing fluid, polishes, waxes, non-industrial adhesives, space deodorants, moth control agents and laundry detergents.

Pollutants

VOC and HAPs

Method and Data Sources

The recommended emission factor that combines emissions from all these sources is 7.84 pounds VOC per person per year, from EIIP Volume III, Area Sources, Preferred and Alternate Methods (July, 1997). This emission factor excludes non-reactive VOC and takes into account more recent volatility levels based on product reformulation, than does AP-42, Fifth Edition. MDE used an activity level of 7 days a week and no seasonal adjustment factor as suggested in Table 5.8-1 in Procedures.

Activity

The U.S. Census Bureau reports and collects population statistics for the counties of Maryland. U.S. Census Bureau Internet address: (<http://www.census.gov>).

Emission Factors:

Commercial and Consumer Products (All) 7.84 lbs. _{VOC}/person/year

Original EPA Per Capita VOC Emission Factors ^{35, 36}		
Industry	SCC	1996 Per Capita VOC Emission Factor (lbs. _{VOC} /person/year)
Personal Care Products	2460100000	2.32
Household Products	2460200000	0.79
Automotive Aftermarket Products	2460400000	1.36
Coatings and Related Products	2460500000	0.95
Adhesives and Sealants	2460600000	0.57
FIFRA - Regulated Products	2460800000	178
Miscellaneous Products	2460900000	0.07
Total (All Commercial & Consumer Products) =		7.84

Point Source Adjustments

No subtraction of emissions from point sources is necessary.

Adjustment for Controls

Federal regulations provide a 20 percent reduction in emissions from a 3.9 lbs. _{VOC}/person subset of the total commercial and consumer products category.

Commercial and consumer products are regulated by three separate category measures. The three control measures are; the original Federal regulations, effective, OTC Phase I controls, effective, and OTC Phase II controls effective. Each of the control measures are discussed briefly below:

Control Set 1: Federal regulations provide a 20 percent reduction in emissions from 3.9 lbs. _{VOC}/person subset of the total commercial and consumer products category. This results in following controls per commercial and consumer solvent subcategory:

Per Capita VOC Emission Factors After Federal Rule		
Product Category	SCC	Emission Factor (lbs. _{VOC} /person/year) ^c
Personal Care Products	24601000000	2.08

³⁵ Source: Adapted from EPA, 1995

³⁶ Emission factors are based on usage and population data for 1990.

Household Products	24602000000	0.63
Automotive Aftermarket Products	24604000000	1.13
Adhesives and Sealants	24606000000	0.51
FIFRA-Regulated Products	24608000000	1.68
Coatings and Related Products	24605000000	0.95
Miscellaneous Products	24609000000	0.07
Total (All Commercial & Consumer Products) =		7.06

Control Set 2: OTC Phase I rule was based on the five CARB consumer products rules and further emission reductions of 14.20 % beyond federal regulation provided in control set one above. This results in the following controls per commercial and consumer solvent subcategory:

Per Capita VOC Emission Factors After OCT Phase 1

Product Category	SCC	Emission Factor (lbs. VOC/person/year)c
Personal Care Products	24601000000	1.79
Household Products	24602000000	0.54
Automotive Aftermarket Products	24604000000	0.98
Adhesives and Sealants	24606000000	0.43
FIFRA-Regulated Products	24608000000	1.44
Coatings and Related Products	24605000000	0.82
Miscellaneous Products	24609000000	0.07
Total (All Commercial & Consumer Products) =		6.06

Control Set 3: OTC Phase II rule was based on the five CARB consumer products rules and further emission reductions of 2.0 % beyond federal regulation provided in control set one above. This results in the following controls per commercial and consumer solvent subcategory:

Per Capita VOC Emission Factors After OCT Phase 2

Product Category	SCC	Emission Factor (lbs. VOC/person/year)c
Personal Care Products	24601000000	1.7529695
Household Products	24602000000	0.5268063

Automotive Aftermarket Products	24604000000	0.9571004
Adhesives and Sealants	24606000000	0.4269687
FIFRA-Regulated Products	24608000000	1.4084942
Coatings and Related Products	24605000000	0.8047066
Miscellaneous Products	24609000000	0.0581146
Total (All Commercial & Consumer Products) =		5.9351604

Control Set 4: OTC Phase III rule was based on the five CARB consumer products rules and further emission reductions of 3.1% beyond federal regulation provided in control set one above. This results in the following controls per commercial and consumer solvent subcategory:

Per Capita VOC Emission Factors After OCT Phase 2

Product Category	SCC	Emission Factor (lbs. VOC/person/year)c
Personal Care Products	24601000000	1.6986275
Household Products	24602000000	0.5104753
Automotive Aftermarket Products	24604000000	0.9274303
Adhesives and Sealants	24606000000	0.4137326
FIFRA-Regulated Products	24608000000	1.3648309
Coatings and Related Products	24605000000	0.7797607
Miscellaneous Products	24609000000	0.0563131
Total (All Commercial & Consumer Products) =		5.7511704

Control Set 5: OTC Phase IV rule was based on the five CARB consumer products rules and further emission reductions of 10.3 % beyond federal regulation provided in control set one above. This results in the following controls per commercial and consumer solvent subcategory:

Per Capita VOC Emission Factors After OCT Phase 2

Product Category	SCC	Emission Factor (lbs. VOC/person/year)c
Personal Care Products	24601000000	1.5236689
Household Products	24602000000	0.4578964

Automotive Aftermarket Products	24604000000	0.8319050
Adhesives and Sealants	24606000000	0.3711182
FIFRA-Regulated Products	24608000000	1.2242533
Coatings and Related Products	24605000000	0.6994453
Miscellaneous Products	24609000000	0.0505128
Total (All Commercial & Consumer Products) =		5.1587998

Spatial and Temporal Allocations

Spatial

Data for spatial allocation is not available for this source.

Temporal

SAF was applied to emissions and were averaged according to period of operation to a daily estimate. See section 2.2.1.1

Emissions Calculation

The per capita equation used to estimate emissions from commercial and consumer solvents is:

$$E_{CC} = \frac{[POP_i \times EF_{CC}] - [(POP_i \times CS_{CC}) \times CE_{CC}]}{2000}$$

Where:

- E_{CC} = VOC emissions in tons per day from commercial and consumer solvents
- POP_i = 2017 population of county i
- EF_{CC} = VOC emission factor for commercial and consumer solvents (7.84 lbs. _{VOC}/person)
- CS_{CC} = Controlled subset of commercial and consumer solvents (3.9 lbs. _{VOC}/person)
- CE_{CC} = Control efficiency for controlled subset of commercial and consumer solvents (20%)

2017 Sample Calculation Personal Care Products Consumer Solvent Use (Anne Arundel County)

VOC Emission Factors after OCT Phase 2

$$E_{PersonalCare} = \frac{[(568,346^{37}) \times (1.5236689)]}{2000}$$

$$E_{PersonalCare} = \mathbf{432.99 \text{ tons}_{VOC} \text{ per year for Anne Arundel County}}$$

³⁷ 2017 Population data from U.S. Bureau of Census, Population Estimates Branch

Personal Care Products_for Anne Arundel_County was found to have a

SAF = seasonal adjustment factor of 0.25

POS = peak ozone period of 0.25

Days of the Period 365

Daily adjusted $E_{\text{PersonalCareda}} = (E_{\text{PersonalCare}} / 365) * (\text{SAF} / \text{POS})$

$E_{\text{PersonalCareda}} = (432.99 / 365) * (0.25 / 0.25) = 1.19\text{E}+00 \text{ VOC tons/day}$

4.1.2.14 Barge, Tank, Tank Truck, Rail Car and Drum Cleaning

SCC: 24 61 160 000

The EPA explained to MDE staff that the agency has not developed an emission factor for this category. The EPA also stated that most barge, tank truck, rail car and drum cleaning is done by steam cleaning and the residue goes to industrial and public waste disposal treatment plants. It is impossible to separate this category's portion of the treatment plant emissions. EPA considers the emissions from this category to be insignificant. Emissions from this category are calculated for the appropriate facilities in the point source inventory.

4.1.3 BIOPROCESS EMISSIONS SOURCES

4.1.3.1 Bakeries

SCC: 23 02 050 000

Description

Bakeries emit VOC, primarily ethanol formed by yeast fermentation of bread or dough, during the baking process. Ethanol is emitted through a vent, along with combustion product gases. Large commercial bakeries are inventoried as point sources. In-store and neighborhood bakeries have lower emissions, and thus are considered area sources.

Pollutants

VOC

Method and Data Sources

MDE staff followed methodology described in an EIP Area Source Category Method Abstract – Bakeries, dated June 1999. An emission factor of 220 tons_{VOC} per was used. Applicable point source emissions (those within the same NAICS) taken from the MDE/ARA registration files have been subtracted from the emissions calculated by employee.

Activity

Employee numbers were taken from County Business Patterns 2016 - Maryland, NAICS 311812, Bakery Products and 311811, Retail Bakeries (see Appendices). Some county employment data is represented by a letter code indicating a range for the number of employees for that NAICS. In this case the arithmetic average number of employees per letter code per county was adjusted so that the state total employment in a NAICS matched the sum of the number of employees reported per county.

Emission Factor

An emission factor of 220 tons_{VOC} per employee was utilized.

Point Source Adjustments

Bakery emissions from facilities identified as point sources (NAICS 311812 and 311811) were subtracted from the area source inventory to avoid double counting.

Adjustment for Controls

No controls are available for this source category.

Spatial and Temporal Allocations

Spatial

Data for spatial allocation is not available for this source.

Temporal

SAF was applied to emissions and were averaged according to period of operation to a daily estimate. See section 2.2.1.1

Emissions Calculation

The equation used to estimate emissions from bakeries is:

Equation:

$$E_{BAK} = EF_{BAK} \times EMP_j$$

Where:

$$\begin{aligned} E_{BAK} &= \text{VOC emissions from small bakeries in tons per year} \\ EF_{BAK} &= \text{per employee emission factor for bakeries} \end{aligned}$$

EMP_j = number of employees at small (less than 20 employees), bakeries in county j

Point Source Adjustments

$$E_{\text{BAK-ADJ}} = EF_{\text{BAK}} \times \text{EMP}_{\text{Pt. Sources}}$$

Where:

$E_{\text{BAK-ADJ}}$ = Point source adjusted bakery emissions

EF_{BAK} = per employee emission factor for bakeries

$\text{EMP}_{\text{Pt. SourcesAd}}^{38}$ = Point Source Adjustment was done by subtracting employment for Baltimore City related sources before calculating emissions.

2017 Sample Calculation for Bakery VOC Emissions (Baltimore City):

Employees in NAICS 311811 and 311812 in Baltimore City:

$$\text{EMP}_{\text{Pt.BCity}} = 786.54 \text{ emp}$$

Employees in Baltimore City Bakeries:

$$\text{EMP}_{\text{BCity}} = 1,021 \text{ emp}$$

$$\text{EMP}_{\text{BC Pt. SourcesAd}} = 1,021 - 786.54 = 234.45 \text{ emp}$$

$$E_{\text{BAK}} = EF_{\text{BAK}} \times \text{EMP}_{\text{Pt. SourcesAd}}$$

$$E_{\text{BAK}} = 220 \times 234.45 \text{ lbs. VOC per year}$$

$$E_{\text{BAK}} = 51,579 \text{ lbs. VOC per year}$$

$$E_{\text{BAK}} = \mathbf{25.79 \text{ tons VOC per year}}$$

Bakeries for Baltimore City was found to have a

SAF = seasonal adjustment factor of 0.25

POS = peak ozone period of 0.25

Days of the Period 260

Daily adjusted $E_{\text{BAKda}} = (E_{\text{BAK}} / 260) * (\text{SAF} / \text{POS})$

$$E_{\text{BAKda}} = (25.79 / 260) * (0.25 / 0.25) = \mathbf{9.92E-02 \text{ VOC tons/day}}$$

³⁸ Point Source Reduction from MDE ARA registration files

4.1.3.2 Breweries

SCC: 23 02 070 001

Description

During the fermentation process, breweries emit ethanol and other VOCs. Although large-scale commercial breweries have been inventoried as point sources, there are microbreweries and brewpubs that emit lower levels of VOCs and therefore must be inventoried as area sources. These smaller breweries emit most of their VOCs from the fermentation room, not the brew kettle as is the case with the large breweries.

Pollutants

VOC

Method and Data Sources

MDE/ARA staff surveyed small brewpubs and microbreweries in Maryland.

Activity

The survey questionnaire asked the brewing facilities to provide MDE/ARA with the amount of barrels brewed per month for the calendar year 2017. For those facilities that reported only annual production amounts, an average monthly value was used.

Emission Factor

Emissions from the small breweries were calculated using an emission factor cited in a February 5, 1992 Technical Memorandum prepared by Radian Corporation for EPA. This emission factor is 56.743 lbs. VOC per 1000 barrels produced. One barrel equals 31 gallons.

Note: Emf conversion is: 56.743 lb VOC/1000 barrels = 0.05674 lb/barrel = 0.0018303 lb/gal.

Point Source Adjustments

No subtraction of emissions from point sources is necessary.

Adjustment for Controls

No controls are available for this source category.

Spatial and Temporal Allocations

Spatial

Data for spatial allocation is not available for this source.

Temporal

SAF was applied to emissions and were averaged according to period of operation to a daily estimate. See section 2.2.1.1

Emissions Calculation

The equation used to estimate emissions from bakeries is:

$$E_{\text{BREW}} = \frac{EF_{\text{BREW}} \times BP_j}{2000}$$

Where:

- E_{BREW} = VOC emissions from small bakeries in tons per year
- EF_{BREW} = emission factor for small breweries
- BP_j = 2017 beer production in barrels

2017 Sample Calculation for Small Brewery VOC Emissions (Howard County):

Number barrels produced by microbreweries in Howard County = 15,108 barrels

$$E_{\text{BREW}} = \frac{0.05674 \times 15,108}{2000}$$

$$E_{\text{BREW}} = \mathbf{0.43 \text{ tons}_{\text{VOC}} \text{ per year}}$$

Breweries for Howard County was found to have a

SAF = seasonal adjustment factor of 0.25

POS = peak ozone period of 0.25

Days of the Period 260

Daily adjusted $E_{\text{BREWda}} = (E_{\text{BREW}} / 260) * (\text{SAF} / \text{POS})$

$$E_{\text{BREWda}} = (0.43 / 260) * (0.25 / 0.25) = \mathbf{1.65E-03 \text{ VOC tons/day}}$$

4.1.3.3 Wineries

SCC: 23 02 070 005

Description

Ethanol emissions from wineries occur during the fermentation process. The emissions vary, depending upon the type of wine (red vs. white), the fermentation temperature and the sugar content of the grapes used.

Pollutants

VOC

Method and Data Sources

MDE used the methods and procedures documented in AP-42³⁹, Chapter 12, Beverages, Section 2, Wines and Brandies dated September 1995. AP42 Chapter 9.12.2

Activity

The U.S. Department of the Treasury's Alcohol and Tobacco Tax and Trade Bureau, State of Maryland Comptroller's Office, and direct survey of most of Maryland's wineries revealed that approximately 514,969 gallons of wine was produced in 2017. The survey suggests that 249,635.53 gallons of white and 265,332.95 gallons of red wine were actually produced.

Emission Factor

Table 9.12.2-1 of AP-42 shows that ethanol emissions are 1.8 lbs. _{voc} per 1000 gallons of white wine fermented and 4.6 lbs. _{voc} per 1000 gallons of red wine fermented.

Point Source Adjustments

No subtraction of emissions from point sources is necessary.

Adjustment for Controls

No controls are available for this source category.

Spatial and Temporal Allocations

Spatial

Data for spatial allocation is not available for this source.

Temporal

SAF was applied to emissions and were averaged according to period of operation to a daily estimate. See section 2.2.1.1

³⁹ AP42, Chapter 9.12.2: Food and Agricultural Industries, Beverages, Wines and Brandies

Emissions Calculation State Total

Emission Factors: red = **0.0046 lb voc per gal**
 white = **0.0018 lb voc per gal**

White wine EMtotal = (249,635.53 gal x **0.0018 lb voc per gal**) / 2000

White wine EMtotal = 0.225 tons_{VOC} per year

Red wine EMtotal = (265,332.95 gal x **0.0046 lb voc per gal**) / 2000

Red wine EMtotal = 0.610 tons_{VOC} per year

Using the above figures, the production of wine by all Maryland wineries in 2017 resulted in the production of **0.835 tons_{VOC} per year**

Daily calculation can be made for each county (see example below)

Anne Arundel_County Winery VOC total was:

EM_{Anne Arundel} = 1.96E-02 tons_{VOC} per year

Wineries_for Anne Arundel_County was found to have a

SAF = seasonal adjustment factor of 0.25

POS = peak ozone period of 0.25

Days of the Period 260

Daily adjusted **EM_{Anne Arundel}da = (EM_{Anne Arundel} / 260)*(SAF / POS)**

EM_{Anne Arundel}da = (1.96E-02 / 260)*(0.25 / 0.25) = 7.54E-05 VOC tons/day

4.1.3.4 Distilleries

Description

Ethanol emissions are the largest component of the VOCs emitted from distilleries. Distilleries produce both grain alcohol for industrial and fuel purposes, and distilled spirits such as whiskey and brandy for consumption purposes. The emissions points in the distilled spirits manufacturing process are likely to be the same as in breweries and wineries, with the aging process as an additional source of emissions. During the aging process, ethanol and water seep through the wooden barrels used to age whiskey and evaporate into the air. Aging and barrel emptying are the major sources of VOC emissions from whiskey production.

Pollutants

VOC

Method and Data Sources

MDE staff indicated that no distilleries below the 10 ton per year point source cutoff operated in the inventory area during 2017. Fugitive VOC emissions from the aging process at large distillery operations can be substantial and will be included in the point source inventory.

4.1.4 CATASTROPHIC/ACCIDENTAL RELEASES

4.1.4.1 Oil Spills

SCC: 28 30 000 000

Description

Oil spills involve oil tanker accidents, tanker truck accidents, and spills and blowouts from oil rigs or pipelines in coastal and inland areas. Because a wide range of fuel types may be spilled, the nature and quantity of emissions can vary. Emissions are also influenced by the clean-up procedure and by dispersion and weathering processes.

Oil spill evaporation produces local VOC emissions. If spills catch fire, additional SO₂, CO, CO₂, PM, NO_x and VOC emissions may result. Other potentially toxic chemical compounds may also be released as a result of chemical cleanup

Pollutants

VOC

Method and Data Sources

Activity

Data on oil spills in Maryland were obtained from MDE's Oil Control's Emergency Response Program. They provided MDE/ARA staff a yearly report of all oil spills that occurred in Maryland during 2017. Spills around Maryland totaled to about 67,985 gallons.

Emission Factor

MDE staff used an emission factor recommended to the Metropolitan Washington Council of Governments by E.H. Pechan and Associates, Inc., the contractor used by MWCOG to prepare their 1990 base year inventory. This emission factor was based on a California Air Resources Board (CARB), study of air emissions from large oil spills. Using this information, an average emission factor was calculated to be 0.0000925 tons VOC per gallon of oil spilled.

Point Source Adjustments

No point source adjustments were made.

Adjustment for Controls

No controls are available for this source category.

Spatial and Temporal Allocations

Spatial

Data for spatial allocation is not available for this source.

Temporal

SAF was applied to emissions and were averaged according to period of operation to a daily estimate. See section 2.2.1.1

Emissions Calculation

The equation used to estimate emissions from oil spills:

$$E_{\text{Oil Spills}} = EF_{\text{Oil Spills}} \times \text{GOSi}$$

Where:

$E_{\text{Oil Spills}}$ = VOC emissions from oil spills in tons_{VOC} per year

$EF_{\text{Oil Spills}}$ = tons of pollutant per gallon of oil spilled

GOSi = gallons of oil spilled in county i

2017 Sample Calculation for Oil Spill VOC Emissions (Baltimore County):

Annual Emissions:

Number gallons oil spilled Baltimore County 2017: **6,351** gallons

$$E_{\text{Oil Spills}} = (0.0000925) \times (6,351)$$

$$E_{\text{Oil Spills}} = \mathbf{5.87E-01 \text{ tons}_{\text{VOC}} \text{ per year}}$$

Oil Spills for Baltimore County was found to have a

SAF = seasonal adjustment factor of 0.25

POS = peak ozone period of 0.25

Days of the Period 312

$$\text{Daily adjusted } E_{\text{Oil Spillsda}} = (E_{\text{Oil Spills}} / 312) * (\text{SAF} / \text{POS})$$

$$E_{\text{Oil Spillsda}} = \mathbf{(5.87E-01 / 312) * (0.25 / 0.25) = 1.88E-03 \text{ VOC tons/day}}$$

4.1.4.2 Leaking Underground Storage Tanks / Soil Remediation

SCC: 26 60 000 000

Description

Many underground storage tanks (USTs) are over 15 years old and are constructed of steel, which may rust over time. The underground piping connected to these tanks also has the potential to leak. Leaking USTs (leaking underground storage tank sites or LUST sites) are of concern because they may result in the

contamination of drinking water, subsurface soils, and ground and surface water, and may emit toxic and/or explosive vapors. The contaminated soil and water may also emit VOC.

Pollutants

VOC

Method and Data Sources

Activity

Emission calculation methods were taken from EIIP, AREA SOURCE CATEGORY METHOD ABSTRACT - REMEDIATION OF LEAKING UNDERGROUND STORAGE TANKS, 2001. The numbers of LUST sites by county were obtained from MDE's Oil Control Program. No seasonal variation was assumed. Each remediation event takes an average of 30 days; during this period emissions are released.

Emission Factor

An emissions factor of 28 lbs of VOC per day per site was used.

Point Source Adjustments

No point source adjustments were made.

Adjustment for Controls

No controls are available for this source category.

Spatial and Temporal Allocations

Spatial

Data for spatial allocation is not available for this source.

Temporal

SAF was applied to emissions and were averaged according to period of operation to a daily estimate. See section 2.2.1.1

Emissions Calculation

$$E_{LUST} = \frac{LS1_j \times EF \times 30 \text{ day}}{2000 \text{ lb./ton}}$$

where:

E_{LUST} = VOC emissions in tons per year from leaking underground storage tanks

$LS1_j$ = number of remediation site(s) in county j

EF = emissions factor

2017 Sample Calculation for Leaking Underground Storage Tanks (Anne Arundel County)

No seasonal variation assumed

$$E_{\text{LUST-AA}} = \frac{53 \times 28_{\text{VOC}} \text{ lbs./day} \times 30 \text{ day}}{2000 \text{ lb./ton}}$$

$E_{\text{LUST-AA}} = 22.66 \text{ tons}_{\text{VOC}} \text{ per year}$

Leaking Underground Storage Tanks for Anne Arundel was found to have a

SAF = seasonal adjustment factor of 0.25

POS = peak ozone period of 0.25

Days of the Period 365

Daily adjusted $E_{\text{LUST-AA}_{\text{da}}} = (E_{\text{LUST-AA}} / 365) * (\text{SAF} / \text{POS})$

$E_{\text{LUST-AA}_{\text{da}}} = (22.66 / 365) * (0.25 / 0.25) = 6.10\text{E-}02 \text{ VOC tons/day}$

4.1.5 SOLID WASTE DISPOSAL, TREATMENT, AND RECOVERY

4.1.5.1 On-site Incineration

SCC: 2601020000

Description

On-site incineration is the confined burning of waste on a small scale by institutions such as hospitals, nursing homes, veterinary offices, funeral homes and laboratories. Large-scale incineration is included in the point source inventory.

Pollutants

VOC, NO_x, SO_x, CO, PM₁₀, PM_{2.5}, and HAPS,

Method and Data Sources

In Maryland incinerators are regulated under COMAR 26.11.08. Maryland began regulating incinerators for control of particulates in the 1970's. In AQCRs III and IV single chamber incinerators, the type that would be used for on-site residential incineration, were banned. All such incinerators were rendered inoperative under the direction of the Maryland Department of the Environment (MDE). Over 1700 small incinerators were eliminated under this requirement.

In the other Maryland counties included in the Washington, D.C. nonattainment area, incineration of trash in on-site incinerators is prohibited except in areas where public trash collection is not provided.

COMAR 26.11.08.09 now requires all incinerators to obtain a permit to operate and any person who owns or operates an incinerator must obtain certification from MDE and renew the certification annually.

MDE/ARA maintains a registry of all incinerators within the State. Because of the requirements prohibiting single chamber incinerators, the requirement for a permit to operate, and the operator certification requirements, staff used the sum of the incinerators in the registry as representing the total area source emissions from incinerators of all types emitting less than 10 tons/VOC, 100 tons/yr CO and 50 tons per year NO_x. Incinerators from the registry with emissions above these thresholds are included in the point source inventory.

No seasonality is applied. The emission factor is chosen by type of incinerator: waste, pathological, hazardous, industrial, special medical, sewage sludge and municipal waste combustors. The burn rate is determined by stack test or AP-42. Hours of operation and tons of waste per day are supplied by the operator.

4.1.6 PUBLICLY OWNED TREATMENT WORKS (POTWs)

SCC: 26 30 020 000

Description

Wastewater is usually collected and treated at a public waterworks facility to be filtered and reused or discharged into surrounding waterways. While the wastewater is held and being treated VOCs are released into the air due to contaminants and byproducts in the water.

Pollutants

VOC

Method and Data Sources

The emissions from these facilities were calculated based on the method described in EPA EIIP II Chapter 5 Section 5.1.

Activity

The amount of actual flow for each POTW in Maryland was supplied by the MDE's Wastewater Management Administration (see Appendices). MDE staff multiplied this amount by the emission factor listed to get VOC emissions from each POTW. The individual POTW emissions were then totaled by county.

Emission Factor

EPA's Emission Inventory and Analysis Group supplied MDE with a new emission factor of 0.85 pounds_{VOC} per million gallons of actual flow of wastewater discharged (February 19, 2019).

Point Source Adjustments

No point source adjustments were made

A seasonal adjustment factor of 1.4 was used when calculating ozone season or daily emissions not yearly.

Adjustment for Controls

No controls are available for this source category.

Spatial and Temporal Allocations

Spatial

Data for spatial allocation is not available for this source.

Temporal

SAF was applied to emissions and were averaged according to period of operation to a daily estimate. See section 2.2.1.1

Emissions Calculation

The equation used to estimate yearly emissions from POTWs is:

$$E_{POTWY} = \frac{ADF_{IJ} \times EF_{POTW} \times 365 \text{ days}}{2000}$$

For seasonal emissions:

$$E_{POTWS} = \frac{ADF_{IJ} \times EF_{POTW} \times SAF_{POTW}}{2000}$$

Where:

- E_{POTWY} = VOC emissions in tons_{VOC} per year from POTWs
- ADF_{IJ} = Actual daily flow into POTW i in county j
- EF_{POTW}^{40} = VOC emission factor for POTWs
- SAF_{POTW}^{41} = Seasonal adjustment factor for peak ozone season which is 1.4
Plant operation is 365 days a year

2017 Sample Calculation for POTW VOC Emissions (Howard County):

Howard County has only one POTW,
Little Patuxent Treatment Plant statistics⁴²:
Actual daily flow (MGD)⁴³: 17.178

$$E_{POTWY} = \frac{(17.178) \times (0.85 \text{ lbs.}_{VOC} / \text{gal}) \times 365 \text{ days}}{2000}$$

$E_{POTWY} = 2.664 \text{ tons}_{VOC} / \text{year}$

POTW for Howard County was found to have a
SAF = seasonal adjustment factor of 0.35
POS = peak ozone period of 0.25
Days of the Period 365
Daily adjusted $E_{POTWYda} = (E_{POTWY} / 365) \times (SAF / POS)$

$E_{POTWYda} = (1.625 / 365) \times (0.35 / 0.25) = 1.02E-02 \text{ VOC tons/day}$

⁴⁰ Emission factor taken from Procedures, Section 3.5.1
⁴¹ Seasonal adjustment factor taken from Procedures, Table 5.8.1
⁴² Supplied by the Maryland Water Management Administration (see Appendices)
⁴³ MGD : Million Gallons per Day

4.1.6.1 Open Burning – Land Clearing Debris

SCC: 26 10 000 500

Description

Open burning of land clearing debris refers to the clearing of land for new construction and the burning of organic material (i.e., trees, shrubs and other vegetation). The clearing of land for the construction of new buildings and highways often results in debris consisting of trees, shrubs, and brush. This debris may be burned in place but it is usually collected in piles for burning. The burning of land clearing wastes may be practiced by private individuals, corporations, and government agencies (e.g., highway construction department). There are no federal laws restricting the open burning of land clearing wastes, although state or local laws may exist.

Residential open burning without a permit is prohibited in Maryland COMAR 26.11.07, where trash and leaf collection is available. The basic difference between the regulation as it applies to counties in AQCRs III and IV and the rest of the state is the requirements under which the burn takes place, i.e., minimum setbacks from property lines, etc. In the more rural counties, areas with no available trash collection are more prevalent. MDE adopted a regulation that prohibits open burning during the peak ozone period (June to August). The seasonal prohibition only affects those counties that lie within serious and severe ozone nonattainment areas. Certain exemptions must be in place however so as not to adversely affect agriculture or restrict fire training and recreational activities. Commercial open burning without a permit is prohibited in Maryland.

Pollutants

VOC, NO_x, SO_x, CO, PM₁₀ and PM_{2.5}

Method and Data Sources

The method used to calculate emissions, is presented in EIIP⁴⁴, Chapter 16, Open Burning (Revised Final 2001).

Activity

The number of acres disturbed by residential, non-residential and roadway construction are estimated and then these values are added together to obtain a county-level estimate of total acres disturbed by land-clearing. County-level emissions from land clearing debris are then calculated by multiplying the total acres disturbed by construction by a weighted loading factor and emission factor.

The BELD database in BEIS was used to determine the number of acres of hardwoods, softwoods, and grasses in each county. Average loading factors were weighted according to the percent contribution of each type of vegetation class to the total land area for each county. The loading factors for slash hardwood and slash softwood were further adjusted by a factor of 1.5 to account

⁴⁴ Emission Inventory Improvement Program

for the mass of tree that is below the soil surface that would also be subject to burning once the land is cleared.

Fuel loading factors are as follows:

Fuel Type	Fuel Load Factor (tons/acre)	Adjusted Load Factor (tons/acre)
Hardwood	66	99
Softwood	37.5	56.25 rounded by EPA to 57
Grass	4.5	4.5

Average fuel loading factors were calculated as follows:

$$LF_{OB-LCD-CO_i} = \frac{(Acres_{HW-CO_i} \times LF_{Adj-HW}) + (Acres_{SW-CO_i} \times LF_{Adj-SW}) + (Acres_{GR-CO_i} \times LF_{Adj-GR})}{Acres_{TOT-CO_i}}$$

- LF_{OB-LCD-CO_i} = Average Load Factor in County i
- Acres_{HW-CO_i} = Acres of hardwood in County i from BELD database
- LF_{Adj-HW} = Adjusted Load Factor for Hardwood
- Acres_{SW-CO_i} = Acres of softwood in County i from BELD database
- LF_{Adj-SW} = Adjusted Load Factor for Softwood
- Acres_{GR-CO_i} = Acres of grasses in County i from BELD database
- LF_{Adj-GR} = Adjusted Load Factor for Grasses
- Acres_{TOT-CO_i} = Total Land Acres in County i

Emission Factors⁴⁵

Emission factors in lbs. /ton were taken from AP-42 Table 2.5-1, Emission Factors for Open Burning of Municipal Refuse and are listed below:

VOC	11.6	Lbs. VOC/ ton
SOx	0.0	Lbs. SOx/ ton
CO	169	Lbs. CO/ ton
PM ₁₀	17	Lbs. PM ₁₀ / ton
PM _{2.5}	17	Lbs. PM _{2.5} / ton
NOx	5	Lbs. NOx/ ton

Ozone Season Daily (OSD) emissions calculated by multiplying annual emissions by 0.25 then dividing by 92.

⁴⁵ Emissions factors for VOC NOx, CO, SO₂, PM₁₀ and PM_{2.5} were obtained from AP-42 Table 2.5-1.

Point Source Adjustments

No subtraction of emissions from point sources is necessary.

Adjustments for Controls

No controls are available for this source category.

Spatial and Temporal Allocations

Spatial

Data for spatial allocation is not available for this source.

Temporal

Emissions are temporally allocated to months or seasons by the number of permits issued per month per county.

Emissions Calculation

Annual Emissions

$$E_{OB-LCD-Ann} = \frac{AD_{R-NR-Road} \times LF_{OB-LCD-CO_i} \times EF_{OB_i}}{2000}$$

$E_{OB-LCD-Ann}$ = Annual emissions from open burning of land clearing debris

$AD_{R-NR-Road}$ = Acres disturbed from Residential, Non-residential and Roadway construction in the county

$LF_{OB-LCD-CO_i}$ = Average Load Factor in County i

$FL_{HW-SW-G}$ = Fuel loading factor for hardwoods, softwoods, and grasses

EF_{OB_i} = Open burning emission factor for pollutant i in lbs. / ton

Ozone Season Daily Emissions

$$E_{OB-LCD-Day} = \frac{E_{OB-LCD-Ann}}{4 \times 92}$$

$E_{OB-LCD-Day}$ = Ozone Season Daily emissions from open burning

$E_{OB-LCD-Ann}$ = Annual emissions from open burning of land clearing debris

4 = Number of seasons in the year

92 = Days in the season

4.1.6.2 Open Burning – Residential Municipal Solid Waste

SCC: 26 10 030 000

Description

Open burning is the unconfined burning of wood, leaves, land clearing debris, household waste, and agricultural crop waste. Household waste often referred to as residential municipal solid waste (MSW), is a term for nonhazardous refuse produced by households (e.g., paper, plastics, metals, wood, glass, rubber, leather, textiles, and food wastes).

Open burning without a permit is prohibited in Maryland where trash and leaf collection is available, COMAR 26.11.07. The basic difference between the regulation as it applies to counties in AQCRs III and IV and the rest of the state is the requirements under which the burn takes place, i.e., minimum setbacks from property lines, etc. In the more rural counties, areas with no available trash collection are more prevalent. MDE adopted a regulation that prohibits open burning during the peak ozone period (June to August). The seasonal prohibition only affects those counties that lie within serious and severe ozone nonattainment areas. Certain exemptions must be in place however so as not to adversely affect agriculture or restrict fire training and recreational activities.

Pollutants

VOC, NO_x, SO_x, CO, PM₁₀, PM_{2.5}, and HAPs

Method and Data Sources

The method used to calculate emissions is presented in a study/survey conducted by the Mid-Atlantic/Northeast Visibility Union (MANE-VU), titled "Open Burning in Residential Areas Emissions Inventory Development Report."⁴⁶

Activity

The purpose of the survey was to obtain data for developing activity estimates and control information (e.g., bans on burning) that would form the basis of an improved open burning emission inventory for Mid-Atlantic/Northeast Visibility Union (MANE-VU) states and tribes for the year 2002. But for 2017, the percentages used to calculate emissions are the same; the emissions increase or decrease due to the estimated number of households that burn and the amount of material burned.

A rule effectiveness (RE) survey was also performed to estimate controlled emissions for areas that prohibit open burning. Household waste burning surveys were completed for 72 respondents or jurisdictions, while yard waste surveys were conducted for 181 respondents. The respondents for this survey were typically local fire wardens or chiefs. Rule effectiveness surveys related to residential MSW rules were conducted for 49 respondents, while RE surveys for yard waste burning rules were performed for 51 respondents. In obtaining survey responses, Pechan collected activity

⁴⁶ Open Burning in Residential Areas Emissions Inventory Development Report, Prepared by E.H. Pechan & Associates, Inc. for the Mid-Atlantic/Northeast Visibility Union, dated January 31, 2004.

data and control information for areas classified as urban, suburban, and rural, or a combination of these designations (defined using data from the 2000 U.S. Census). Pechan also developed a control database for each open burning category that describes the recommended control efficiency (CE) and rule penetration (RP) values by state and county, and by sub-county, where applicable.

Open burning activity estimates recorded from the survey were used directly to estimate emissions for the surveyed jurisdictions. For the non-surveyed areas, including tribal lands, the default activity data derived from all survey responses were applied. Households are defined as detached single-family unit dwellings as provided by the 2000 U.S. Census.

Emission Factors

Emission factors in lbs/ton total mass were taken from AP-42 Table 2.5-1. Emission Factors for Open Burning of Municipal Refuse and from a 1997 EPA research paper on open burning⁴⁷ are listed below:

SCC	Type of Waste	PM2.5 lb/ton	PM10 lb/ton	VOC lb/ton	NOX lb/ton	SO2 lb/ton	CO lb/ton
2610030000	HH MSW	34.8	38	8.56	6	1	85
2610000100	Leaf Waste	22	22	28	6.2	0.76	112
2610000400	Brush Waste	15.21	19.73	19	5	1.66	140

Point Source Adjustments

No subtraction of emissions from point sources is necessary.

Adjustments for Controls

If an area has controls or prohibitions on residential burning, controlled emissions were calculated from uncontrolled emissions using the following equation:

$$E_c = E_{uc} * [(1-(CE)(RP)(RE)]$$

where:

- E_c = Controlled area source emissions
- E_{uc} = Uncontrolled area source emissions
- CE = % Control efficiency varied 0 to 100%
- RP = % Rule penetration varied 0 to 100%

⁴⁷ EPA. 1997. Evaluation of Emissions from the Open Burning Of Household Waste in Barrels. EPA-600/R-97-134a. U.S. Environmental Protection Agency, Control Technologies Center. Research Triangle Park, North Carolina.

RE = % Rule effectiveness was 96.8%

The following sections describe how values for CE, RP and RE were derived from the survey.

Rule Effectiveness

Pechan evaluated differences in RE between rural/suburban and urban areas, as well as differences in RE for MSW and yard waste burning. Although one may expect that RE would be higher for urban than for suburban or rural areas, ANOVA of the survey results from these geographic subdivisions, as well as for the different open burning categories, did not show that RE values were drawn from distinct populations. Therefore, the final selection of RE reflects a value for all areas and all burning categories.

There were a total of 26 RE survey responses that included information on the number of violating households. To calculate RE, Pechan used the number of households violating the rule, and the number of households expected to perform open burning for areas in the region where there is no rule (i.e., # households x fraction of open burning households by region from survey).

The RE values obtained from the survey responses will be used for the specific State or jurisdiction surveyed. Non-surveyed areas could not be assigned a jurisdiction-specific RE, because no survey responses were obtained for those areas. Pechan did not develop state specific RE values since we had no reason to believe that local jurisdictions in individual states implemented their rules differently than local jurisdictions in the rest of the MANE-VU region. To estimate a default RE value for the remaining areas, the survey data were statistically analyzed. After evaluating the data using the Census 2000 data, a mean value of 96.8 percent reflected the best estimator of central tendency. As such, Pechan applied a rule effectiveness of 96.8 percent to all areas and for both MSW and yard waste burning (Pechan, 2002b).

Control Efficiency and Rule Penetration

For those areas identified to have a control, CE is assumed to be 100 percent (since the control is typically a ban on burning activity). For MSW burning, with the exception of Pennsylvania, Pechan assigned 100 percent CE and 100 percent RP to urban and suburban areas in the MANE-VU region (i.e., even if the state did not have a statewide ban on burning). In Pennsylvania, unless a jurisdiction or county (e.g., Allegheny County) was determined via survey to have a ban, it will be assumed that suburban and rural areas allow open burning. For yard waste burning, Pechan assigned 100 percent CE and RP to all urban areas in the MANE-VU region. Yard waste emissions calculated for suburban and urban areas were assumed to be uncontrolled, unless the survey data or other statewide or local control information indicated otherwise. For municipal yard waste burning, areas were assumed to either perform this activity or have associated emissions, or did not conduct burns and therefore were assigned zero emissions.

In determining annual emissions for those areas with a seasonal ban, Pechan adjusted the RP by the length of the seasonal ban relative to the entire year. The RP value also depends on how the time period of the ban overlaps with the activity profile for the specific category of burning.

For example, for brush waste burning, the survey data revealed an average activity profile as follows: Winter–20%; Spring–46%; Summer–6%; and Fall–28%. So, for an area that has a brush burning ban in the summer, although some percentage of burning is likely to be prevented during this season, we assume that 2 percent of the summer season brush burning in August is delayed until September when burning is permitted, resulting in an RP of 4 percent to apply to annual brush waste burning emissions. As mentioned

in the discussion of temporal allocation profiles, this also has an effect on the monthly activity profile. A summer RP value of 4 percent would result in a revised temporal allocation profile to be: Winter–20%; Spring–46%; Summer– 4%; and Fall–30%.

Control Percentages used for each county:

STATE CO	SCC	RE	RP	CE
24001	2610030000	96.80%	82.61%	82.61%
24003	2610030000	96.80%	93.62%	100%
24005	2610030000	96.80%	94.80%	100%
24009	2610030000	96.80%	60.29%	100%
24011	2610030000	96.80%	28.57%	28.57%
24013	2610030000	96.80%	100%	100%
24015	2610030000	96.80%	62.50%	100%
24017	2610030000	96.80%	68.75%	100%
24019	2610030000	96.80%	33.33%	33.33%
24021	2610030000	96.80%	71.88%	100%
24023	2610030000	96.80%	14.29%	14.29%
24025	2610030000	96.80%	80%	100%
24027	2610030000	96.80%	92.68%	100%
24029	2610030000	96.80%	40%	40%
24031	2610030000	96.80%	98.31%	100%
24033	2610030000	96.80%	100%	100%
24035	2610030000	96.80%	25%	100%
24037	2610030000	96.80%	40%	40%
24039	2610030000	96.80%	50%	50%
24041	2610030000	96.80%	33.33%	33.33%
24043	2610030000	96.80%	0%	0%
24045	2610030000	96.80%	94.12%	94.12%
24047	2610030000	96.80%	75%	75%
24510	2610030000	96.80%	0%	0%

Spatial and Temporal Allocations

Spatial

Pechan collected activity data and control information for areas classified as urban, suburban, and rural, or a combination of these designations (defined using data from the 2000 U.S. Census).

Temporal

Activity estimates and associated emissions are calculated on an annual basis. Pechan proposes the following temporal allocation profiles to represent monthly, weekly, and daily activity profiles by SCC (see Tables II-2 through II-5). The monthly activity profiles were developed based on data obtained

from the survey. The weekly and weekday/weekend profiles were developed based on engineering judgment. These profiles will be applied to annual activity for all areas of MANE-VU (i.e., variations in regional, State, or tribal areas are not accounted for).

Temporal Allocation Profile Formats (monthly)

SCC	Month											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2610030000	0.083	0.083	0.083	0.083	0.083	0.083	0.083	0.083	0.083	0.083	0.083	0.083
2610000400	0.067	0.067	0.153	0.153	0.153	0.020	0.020	0.020	0.093	0.093	0.093	0.067
2610040400	0.067	0.067	0.153	0.153	0.153	0.020	0.020	0.020	0.093	0.093	0.093	0.067
2610000100	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.333	0.333	0.333	0.000

Temporal Allocation Profile Formats (weekly)

SCC	Day of Week						
	Mon	Tue	Wed	Thu	Fri	Sat	Sun
2610030000	0.111	0.111	0.111	0.111	0.111	0.222	0.222
2610000400	0.111	0.111	0.111	0.111	0.111	0.222	0.222
2610040400	0.200	0.200	0.200	0.200	0.200	0.000	0.000
2610000100	0.111	0.111	0.111	0.111	0.111	0.222	0.222

Temporal Allocation Profile Formats (daily; weekday)

SCC	Weekday Hour											
	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200
2610030000	0	0	0	0	0	0	0.071	0.071	0.071	0.071	0.071	0.071
2610000400	0	0	0	0	0	0	0.071	0.071	0.071	0.071	0.071	0.071
2610040400	0	0	0	0	0	0	0.071	0.071	0.071	0.071	0.071	0.071
2610000100	0	0	0	0	0	0	0.071	0.071	0.071	0.071	0.071	0.071

SCC	Weekday Hour											
	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	0000
2610030000	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0	0	0	0
2610000400	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0	0	0	0
2610040400	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0	0	0	0
2610000100	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0	0	0	0

Temporal Allocation Profile Formats (daily; weekend day)

SCC	Weekend Day Hour											
	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200
2610030000	0	0	0	0	0	0	0.071	0.071	0.071	0.071	0.071	0.071
2610000400	0	0	0	0	0	0	0.071	0.071	0.071	0.071	0.071	0.071
2610040400	0	0	0	0	0	0	0.071	0.071	0.071	0.071	0.071	0.071
2610000100	0	0	0	0	0	0	0.071	0.071	0.071	0.071	0.071	0.071

SCC	Weekend Day Hour											
	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	0000
2610030000	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0	0	0	0

2610000400	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0	0	0	0
2610040400	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0	0	0	0
2610000100	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0	0	0	0

Emissions Calculation

Emissions were calculated at a census tract level and summed over a county for county level emissions. A county level sample emission calculation will not be presented here, however the equations for a particular census tract are presented below. All of the census tracts in a county would then be summed for county level emission estimates.

The equation for estimating the mass of waste burned is:

$$Wt_{MSW} = HH * Bt * M$$

Where:

Wt_{MSW} = Mass of waste burned per time period

HH	=	Number of households that burn (Question 1, Part 2 of survey)
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Bt = Number of burns per time period (Question 3, Part 2)

M = Mass of waste per burn (Question 5, Part 3)

Uncontrolled emissions were then calculated using the following equation:

$$E_{UNC} = Wt_{MSW} * EF$$

where:

E_{UNC} = Uncontrolled area source emissions

Wt_{MSW} = Mass of waste burned per time period

EF = Emission factor per pollutant

Controlled emissions were then calculated using the following equation:

$$E_C = E_{UNC} * [(1-(CE)(RP)(RE)]$$

where:

E_C = Controlled area source emissions

E_{UNC} = Uncontrolled area source emissions

4.1.6.3 Open Burning – Residential Yard Waste

SCC: 26 10 000 100 (Leaf Debris)
SCC: 26 10 000 400 (Brush Debris)

Description

Open burning is the unconfined burning of wood, leaves, land clearing debris, household waste, and agricultural crop waste. Household waste often referred to as residential municipal solid waste (MSW), is a term for nonhazardous refuse produced by households (e.g., paper, plastics, metals, wood, glass, rubber, leather, textiles, and food wastes).

Open burning without a permit is prohibited in Maryland where trash and leaf collection is available, COMAR 26.11.07. The basic difference between the regulation as it applies to counties in AQCRs III and IV and the rest of the state is the requirements under which the burn takes place, i.e., minimum setbacks from property lines, etc. In the more rural counties, areas with no available trash collection are more prevalent. MDE adopted a regulation that prohibits open burning during the peak ozone period (June to August). The seasonal prohibition only affects those counties that lie within serious and severe ozone nonattainment areas. Certain exemptions must be in place however so as not to adversely affect agriculture or restrict fire training and recreational activities.

Pollutants

VOC, NO_x, SO_x, CO, PM₁₀, PM_{2.5}, and HAPs

Method and Data Sources

The method used to calculate emissions is presented in a study/survey conducted by the Mid-Atlantic/Northeast Visibility Union (MANE-VU), titled "Open Burning in Residential Areas Emissions Inventory Development Report."⁴⁸

Activity

The purpose of the survey was to obtain data for developing activity estimates and control information (e.g., bans on burning) that would form the basis of an improved open burning emission inventory for Mid-Atlantic/Northeast Visibility Union (MANE-VU) states and tribes for the year 2002. But for 2017, the percentages used to calculate emissions are the same; the emissions increase or decrease due to the estimated number of households that burn and the amount of material burned.

A rule effectiveness (RE) survey was also performed to estimate controlled emissions for areas that prohibit open burning. Household waste burning surveys were completed for 72 respondents or jurisdictions, while yard waste surveys were conducted for 181 respondents. The respondents for this survey were typically local fire wardens or chiefs. Rule effectiveness surveys related to residential MSW rules were conducted for 49 respondents, while RE surveys for yard waste burning rules were performed for 51 respondents. In obtaining survey responses, Pechan collected activity

⁴⁸ Open Burning in Residential Areas Emissions Inventory Development Report, Prepared by E.H. Pechan & Associates, Inc. for the Mid-Atlantic/Northeast Visibility Union, dated January 31, 2004.

data and control information for areas classified as urban, suburban, and rural, or a combination of these designations (defined using data from the 2000 U.S. Census). Pechan also developed a control database for each open burning category that describes the recommended control efficiency (CE), rule penetration (RP) values by state per county, and by sub-county, where applicable.

Open burning activity estimates recorded from the survey were used directly to estimate emissions for the surveyed jurisdictions. For the non-surveyed areas, including tribal lands, the default activity data derived from all survey responses were applied. Households are defined as detached single-family unit dwellings as provided by the 2000 U.S. Census.

Emission Factors

Emission factors in lbs/ton total mass were taken from AP-42 Table 2.5-1, Emission Factors for Open Burning of Municipal Refuse and from a 1997 EPA research paper on open burning⁴⁹ are listed below:

SCC	Type of Waste	PM2.5 lb/ton	PM10 lb/ton	VOC lb/ton	NOX lb/ton	SO2 lb/ton	CO lb/ton
2610030000	HH MSW	34.8	38	8.56	6	1	85
2610000100	Leaf Waste	22	22	28	6.2	0.76	112
2610000400	Brush Waste	15.21	19.73	19	5	1.66	140

Point Source Adjustments

No subtraction of emissions from point sources is necessary.

Adjustments for Controls

If an area has controls or prohibitions on residential burning, controlled emissions were calculated from uncontrolled emissions using the following equation:

$$E_c = E_{uc} * [(1-(CE)(RP)(RE)]$$

where:

- E_c = Controlled area source emissions
- E_{uc} = Uncontrolled area source emissions
- CE = % Control efficiency varied 0% to 100%
- RP = % Rule penetration varied 0% to 100%

⁴⁹ EPA 1997. Evaluation of Emissions from the Open Burning Of Household Waste in Barrels. EPA-600/R-97-134a. U.S. Environmental Protection Agency, Control Technologies Center. Research Triangle Park, North Carolina.

RE = % Rule effectiveness 96.8%

The following sections describe how values for CE, RP, and RE were derived from the survey.

Rule Effectiveness

Pechan evaluated differences in RE between rural/suburban and urban areas, as well as differences in RE for MSW and yard waste burning. Although one may expect that RE would be higher for urban than for suburban or rural areas, ANOVA of the survey results from these geographic subdivisions, as well as for the different open burning categories, did not show that RE values were drawn from distinct populations. Therefore, the final selection of RE reflects a value for all areas and all burning categories.

There were a total of 26 RE survey responses that included information on the number of violating households. To calculate RE, Pechan used the number of households violating the rule, and the number of households expected to perform open burning for areas in the region where there is no rule (i.e., # households x fraction of open burning households by region from survey).

The RE values obtained from the survey responses will be used for the specific State or jurisdiction surveyed. Non-surveyed areas could not be assigned a jurisdiction-specific RE, because no survey responses were obtained for those areas. Pechan did not develop state specific RE values since we had no reason to believe that local jurisdictions in individual states implemented their rules differently than local jurisdictions in the rest of the MANE-VU region. To estimate a default RE value for the remaining areas, the survey data were statistically analyzed. After evaluating the data using the Census 2000 data, a mean value of 96.8 percent reflected the best estimator of central tendency. As such, Pechan applied a rule effectiveness of 96.8 percent to all areas and for both MSW and yard waste burning (Pechan, 2002b).

Control Efficiency and Rule Penetration

For those areas identified to have a control, CE is assumed to be 100 percent (since the control is typically a ban on burning activity). For MSW burning, with the exception of Pennsylvania, Pechan assigned 100 percent CE and 100 percent RP to urban and suburban areas in the MANE-VU region (i.e., even if the state did not have a statewide ban on burning). In Pennsylvania, unless a jurisdiction or county (e.g., Allegheny County) was determined via survey to have a ban, it will be assumed that suburban and rural areas allow open burning. For yard waste burning, Pechan assigned 100 percent CE and RP to all urban areas in the MANE-VU region. Yard waste emissions calculated for suburban and urban areas were assumed to be uncontrolled, unless the survey data or other statewide or local control information indicated otherwise. For municipal yard waste burning, areas were assumed to either perform this activity or have associated emissions, or did not conduct burns and therefore were assigned zero emissions.

In determining annual emissions for those areas with a seasonal ban, Pechan adjusted the RP by the length of the seasonal ban relative to the entire year. The RP value also depends on how the time period of the ban overlaps with the activity profile for the specific category of burning.

For example, for brush waste burning, the survey data revealed an average activity profile as follows: Winter–20%; Spring–46%; Summer–6%; and Fall–28%. So, for an area that has a brush burning ban in the summer, although some percentage of burning is likely to be prevented during this season, we assume that 2 percent of the summer season brush burning in August is delayed until September when burning is

permitted, resulting in an RP of 4 percent to apply to annual brush waste burning emissions. As mentioned in the discussion of temporal allocation profiles, this also has an effect on the monthly activity profile. A summer RP value of 4 percent would result in a revised temporal allocation profile to be: Winter–20%; Spring–46%; Summer– 4%; and Fall–30%.

Spatial and Temporal Allocations

Spatial

Pechan collected activity data and control information for areas classified as urban, suburban, and rural, or a combination of these designations (defined using data from the 2000 U.S. Census).

Temporal

Activity estimates and associated emissions are calculated on an annual basis. Pechan proposes the following temporal allocation profiles to represent monthly, weekly, and daily activity profiles by SCC (see Tables II-2 through II-5). The monthly activity profiles were developed based on data obtained from the survey. The weekly and weekday/weekend profiles were developed based on engineering judgment. These profiles will be applied to annual activity for all areas of MANE-VU (i.e., variations in regional, State, or tribal areas are not accounted for).

Temporal Allocation Profile Formats (monthly)

SCC	Month											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2610030000	0.083	0.083	0.083	0.083	0.083	0.083	0.083	0.083	0.083	0.083	0.083	0.083
2610000400	0.067	0.067	0.153	0.153	0.153	0.020	0.020	0.020	0.093	0.093	0.093	0.067
2610040400	0.067	0.067	0.153	0.153	0.153	0.020	0.020	0.020	0.093	0.093	0.093	0.067
2610000100	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.333	0.333	0.333	0.000

Temporal Allocation Profile Formats (weekly)

SCC	Day of Week						
	Mon	Tue	Wed	Thu	Fri	Sat	Sun
2610030000	0.111	0.111	0.111	0.111	0.111	0.222	0.222
2610000400	0.111	0.111	0.111	0.111	0.111	0.222	0.222
2610040400	0.200	0.200	0.200	0.200	0.200	0.000	0.000
2610000100	0.111	0.111	0.111	0.111	0.111	0.222	0.222

Temporal Allocation Profile Formats (daily; weekday)

SCC	Weekday Hour											
	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200
2610030000	0	0	0	0	0	0	0.071	0.071	0.071	0.071	0.071	0.071
2610000400	0	0	0	0	0	0	0.071	0.071	0.071	0.071	0.071	0.071
2610040400	0	0	0	0	0	0	0.071	0.071	0.071	0.071	0.071	0.071
2610000100	0	0	0	0	0	0	0.071	0.071	0.071	0.071	0.071	0.071

SCC	Weekday Hour
-----	--------------

	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	0000
2610030000	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0	0	0	0
2610000400	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0	0	0	0
2610040400	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0	0	0	0
2610000100	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0	0	0	0

Temporal Allocation Profile Formats (daily; weekend day)

SCC	Weekend Day Hour											
	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200
2610030000	0	0	0	0	0	0	0.071	0.071	0.071	0.071	0.071	0.071
2610000400	0	0	0	0	0	0	0.071	0.071	0.071	0.071	0.071	0.071
2610040400	0	0	0	0	0	0	0.071	0.071	0.071	0.071	0.071	0.071
2610000100	0	0	0	0	0	0	0.071	0.071	0.071	0.071	0.071	0.071

SCC	Weekend Day Hour											
	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	0000
2610030000	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0	0	0	0
2610000400	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0	0	0	0
2610040400	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0	0	0	0
2610000100	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0	0	0	0

Emissions Calculation

Emissions were calculated at a census tract level and summed over a county for county level emissions. A county level sample emission calculation will not be presented here, however the equations for a particular census tract are presented below. All of the census tracts in a county would then be summed for county level emission estimates.

The equation for estimating the mass of waste burned is:

$$W_{tMSW} = HH * B_t * M$$

where:

W_{tMSW} = Mass of waste burned per time period

HH = Number of households that burn (Question 1, Part 2 of survey)

B_t = Number of burns per time period (Question 3, Part 2)

M = Mass of waste per burn (Question 5, Part 3)

Uncontrolled emissions were then calculated using the following equation:

$$E_{UNC} = W_{tMSW} * EF$$

where:

E_{UNC} = Uncontrolled area source emissions

W_{tMSW} = Mass of waste burned per time period

EF = Emission factor per pollutant

Controlled emissions were then calculated using the following equation:

$$E_c = E_{unc} * [(1-(CE)(RP)(RE)]$$

where:

E_c	=	Controlled area source emissions
E_{unc}	=	Uncontrolled area source emissions
CE	=	% Control efficiency/100
RP	=	% Rule penetration/100
RE	=	% Rule effectiveness/100

4.1.6.4 Cremation – Animal and Human

SCC: 28 10 060 100 (Humans)
28 10 060 200 (Animals)

Description

Propane-fired burners (afterburner and ignition) are typically used at cemeteries for human body and animal cremation. Burners are usually rated at 2,115,000 Btu per hour capacity. Newer units installed in the late 1980's are equipped with a modulating ignition burner. When afterburner temperatures reach about 1800 F (980 C), the ignition burner modulates to a low-fire mode that will reduce the Btu per hour usage.

When the crematory reaches an operating temperature of 1,250 F (680 C) the body container is placed on the combustion chamber grate and the ignition burner is fired to attain a target combustion temperature sufficient for the proper reduction of human remains. The chamber preheats by the afterburner reaches 1,250 F (680 C) in about 30 to 45 minutes prior to ash removal. When the body container is introduced into the combustion chamber, and the burner is ignited, cremation begins at about 1600 to 1800 F (870 to 980 C). Flame impingement on the body takes two to three minutes; cremation occurs for about two hours. The remains are then raked towards the ignition burner for about two minutes. Cool-down follows for 45 minutes to 1.5 hours.

Pollutants

HAPs (Criteria Pollutants were not calculated supplied by sources)

Method and Data Sources

Activity

In Maryland crematories are regulated under COMAR. COMAR now requires all crematories to obtain a permit to operate and any person who owns or operates a crematory must obtain certification from MDE and renew the certification annually.

MDE/ARA maintains a registry of all crematories within the State. Because of the requirement for a permit to operate, and the operator certification requirements, staff used the sum of the crematories in the registry as representing the total area source emissions from crematories of all types emitting less than 10 tons/VOC, 100 tons/yr CO and 50 tons per year NO_x.

Point Source Adjustments

No subtraction of emissions from point sources is necessary.

4.1.6.5 Municipal Solid Waste Landfills

SCC: 26 20 030 000

Description

Municipal solid waste landfills receive household and commercial trash. VOC emissions are produced from volatilization, chemical reaction and biological decomposition of waste. Methane and Carbon dioxide are the primary constituents of landfill gas, and are produced during anaerobic decomposition of cellulose and proteins in the landfill waste. 98.7 percent of landfill emissions are methane and carbon dioxide according to the Volatile Organic Compounds Species Data Manual, an EPA publication. In addition to methane and carbon dioxide, non-methane organic carbons (NMOCs) are produced as a small fraction of the landfill gas emissions (less than 1%). NMOCs include hazardous air pollutants and reactive VOCs.

Pollutants

VOC

Method and Data Sources

The method used to calculate emissions, is presented in AP-42, Chapter 2.4, Municipal Solid Waste Landfills and EIP⁵⁰, Volume III, Chapter 15, Landfills, dated September 1997.

Emission estimation assumptions were also made using supporting documents Standards of Performance for New Stationary Sources (NARA, 1991a) and Emission Guidelines for Control of Existing Sources (NARA, 1997b).

To estimate emissions for the various compounds present in landfill gas, total landfill gas emissions must first be estimated. Emissions of landfill gas were calculated using a computer program known as the Landfill Gas Emissions Model (LandGEM 3.02). The model equation is as follows:

$$Q_{CH_4} = \sum_{i=1}^n \sum_{j=0.1}^1 kL_o \left(\frac{M_i}{10} \right) e^{-kt_{ij}}$$

Where:

Q_{CH_4} = annual methane generation in the year of the calculation (m³/year)

i = 1 year time increment

n = (year of the calculation) - (initial year of waste acceptance)

j = 0.1 year time increment

k = methane generation rate (year⁻¹)

L_o = potential methane generation capacity (m³/Mg)

M_i = mass of waste accepted in the i th year (Mg)

t_{ij} = age of the j th section of waste mass M_i accepted in the i th year (decimal years, e.g.,

⁵⁰ Emission Inventory Improvement Program

*Spatial and Temporal Allocations
Point Source Adjustments*

3.2 years)

*Adjustments for
Controls*

Site-specific landfill information is generally available for variables M_i , n , and t_{ij} . A more detailed explanation on how to run the model can be found in the LandGEM 3.02 Users Guide at

<http://www.epa.gov/ttnecat1/dir1/landgem-v302-guide.pdf> .

Landgem Model Parameters AP-42 Default Values

Lo : 100.00 m ³ / Mg	Methane Generation Potential
k : 0.0400 1/yr	Decay Rate/Rate of Decomposition
NMOC : 595.00 ppmv	Non-methane Concentration
Methane : 50.00 % volume	
Carbon Dioxide : 50.00 % volume	

Activity

Data was obtained from MDE’s Solid Waste Program and from the landfill facilities directly.

Emission Factors

All factors are incorporated into the LandGEM model.

Thirteen municipal solid waste landfills were considered point sources and LandGEM model runs for these landfills were done, but keep out of the Area source emission estimates.

Emission reductions were calculated for landfills that used control technology to reduce emissions. Controlled emissions from landfills were calculated in the following manner:

Equation:

$$E_{CON-LF} = \{E_{UNC-LF} \times (1 - C_{EFF})\} + \{E_{UNC-LF} \times C_{EFF} \times [1 - (D_{EFF} \times RE)]\}$$

Where:

- E_{CON-LF} = Controlled emissions from landfills
- E_{UNC-LF} = Uncontrolled emissions from landfills (generated from the LandGEM model)
- C_{EFF} = Landfill collection efficiency (EPA default = 75%)
- D_{EFF} = Control device destruction efficiency (98%)
- RE = Rule effectiveness (EPA default 80%)

Spatial

Data for spatial allocation is not available for this source.

Temporal

SAF was applied to emissions and were averaged according to period of operation to a daily estimate. See section 2.2.1.1

4.1.7 SMALL STATIONARY SOURCE FOSSIL FUEL USE

4.1.7.1 Small Electric Utility Boilers

All small electric utility boilers are inventoried in the point source category. The list of small boilers from [Inventory of Power Plants in the United States](#), DOE/EIA-0095(88) was obtained and indicated that all small electric boilers were included in the point source inventory.

4.1.7.2 Other Fuel Consumption

Coke and process gas emissions will be inventoried as point sources.

4.1.7.3 Fuel Oil Combustion

SCC: 21 04 011 000 (residential kerosene)
 21 03 011 000 (commercial/institutional kerosene)
 21 04 004 000 (residential distillate oil)
 21 03 004 000 (commercial/institutional distillate oil)
 21 03 005 000 (commercial/institutional residual oil)

Description

Data collection for fuel oil consumption covers the use of both distillate and residual oil. Distillate oil includes fuel oil grades 1, 2 and 4. Diesel fuel and kerosene also can be considered as distillate oils. Residential and commercial/institutional sources are the largest consumers of distillate oil, nationwide. Residual oil includes fuel oil grades 5 and 6. In most areas residual oil is not used by residential sources, but industrial and commercial/institutional users may consume significant amounts.

Pollutants

PM₁₀, PM_{2.5}, SO_x, NO_x, CO, VOC

Method and Data Sources

Activity

Total sales statistics of kerosene, distillate oil, and residual oil in the State of Maryland were obtained from the Annual Report on Sales of Fuel Oil and Kerosene, 2016, published by Energy Information Administration, U.S. Department of Energy⁵¹.

Emission Factors

Uncontrolled Emission Factors – AP-42 Tables 1.3-1 and 1.3-3 (hand-fed units)

Pollutant	Residential Distillate lbs/Kgal	Residential Kerosene lbs/Kgal	Commercial Distillate lbs/Kgal	Commercial Kerosene lbs/Kgal	Commercial Residual lbs/Kgal	Commercial Residual 1% S lbs/Kgal
PM10-FIL	1.080	1.080	1.080	1.080	13.494	7.703
PM2.5-FIL	0.830	0.830	0.830	0.830	5.011	2.861
PM-CON	1.300	1.300	1.300	1.300	1.500	1.500
NH3	1.000	1.000	0.800	0.800	0.800	0.800
SO2	43.200	41.657	43.200	41.657	318.000	159.000
NOx	18.000	18.000	20.000	20.000	55.000	55.000
CO	5.000	5.000	5.000	5.000	5.000	5.000

⁵¹ Total residential distillate oil use in the State of Maryland in 2016 from U.S Department of Energy, Energy Information Administration, Office of Oil and Gas, Petroleum Marketing Monthly, "Annual Report on Sales of Fuel Oil and Kerosene, 2016".

VOC	0.713	0.713	0.340	0.340	1.130	1.130
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Point Source Adjustments

No subtraction of emissions from point sources is necessary.

Adjustments for Controls

No controls are available for this source category.

Spatial and Temporal Allocations

Spatial

This information on total sales of kerosene, distillate oil and residual oil was broken down to the county level using a spatial allocation factor documented and recommended by EIIP⁵² in an Area Source Method Abstract for Residential and Commercial/Institutional Fuel Oil and Kerosene combustion.

MDE developed an allocation factor from local and state totals of annual heating-degree days and population with fuel oil to spatially allocate fuel oil consumption. The method is

A “heating-degree day” is a unit of measure used to indicate how cold it has been over a 24-hour period. Daily heating-degree days are calculated as the difference between the base value of 65°F and the mean temperature for the day (mean of the high and low temperatures for the day).

Annual heating degree days are the sum of the daily heating degree days. Heating degree data is available from the National Oceanographic and Atmospheric Administration (NOAA).⁵³

$$SAF_{InventoryCounty} = \frac{HDD_{InventoryCounty} * POP_{InventoryCounty}}{\sum_{AllCountiesInState} (HDD_{County} * POP_{County})}$$

Where:

- SAF_{InventoryCounty} = Spatial apportioning factor for inventory county
- HDD_{InventoryCounty} = Annual heating degree days for inventory county
- POP_{InventoryCounty} = Population of the inventory county
- HDD_{County} = Annual heating degree days for each county in the state
- POP_{County} = Population for each county in the state

The spatial apportioning factor is used to allocate the state fuel total to the county level using the

⁵² Emissions Inventory Improvement Program (EIIP) Area Source Method Abstract – Residential and Commercial/Institutional Fuel Oil and Kerosene Combustion, dated April 2011.

⁵³ <http://www.noaa.gov> (home page) or <http://www.ncdc.noaa.gov/ol/climate/climateproducts.html#PUBS> (for a list of available data)

following equation:

$$\text{Fuel}_{\text{INVENTORY COUNTY}} = \text{SAF}_{\text{INVENTORY COUNTY}} \times \text{Fuel}_{\text{TOTAL STATE}}$$

Where:

$$\begin{aligned} \text{Fuel}_{\text{INVENTORY COUNTY}} &= \text{Total Fuel consumed annually in the inventory county} \\ \text{Fuel}_{\text{TOTAL STATE}} &= \text{Total Fuel consumed annually in the state} \end{aligned}$$

Temporal

Kerosene, distillate oil, and residual oil are almost entirely used for space heating. MDE made the assumption that the amount of fuel consumed in a county over the course of a month is proportional to the number of heat degree days in that county for the month.

The total amount of fuel consumed in the county annually is allocated from state totals using the following formula.

$$\text{Fuel}_{\text{InventoryCountyAnnual}} = \text{SAF}_{\text{InventoryCounty}} * \text{Fuel}_{\text{TotalState}}$$

Where:

$$\begin{aligned} \text{Fuel}_{\text{InventoryCountyAnnual}} &= \text{Total Fuel consumed annually in the inventory county} \\ \text{Fuel}_{\text{TotalState}} &= \text{Total Fuel consumed annually in the state} \end{aligned}$$

The amount of fuel consumed in a month per county is proportional to the number heat degree days for the month in the county divided by the total number heat degree days for the year in the county.

$$\text{Fuel}_{\text{InventoryCountyPerMonth}} = \text{Fuel}_{\text{InventoryCountyAnnual}} * \frac{\text{HDD}_{\text{InventoryCounty} - \text{Month}}}{\text{HDD}_{\text{InventoryCounty} - \text{Annual}}}$$

Emissions Calculation

Activity Data Gathered

- Total amount of fuel (kerosene, distillate oil, and residual oil) consumed in the state.
- Number of heat degree days per county per month for the year of the inventory.

Calculate Spatial Apportioning Factor

$$\text{SAF}_{\text{InventoryCounty}} = \frac{\text{HDD}_{\text{InventoryCounty}} * \text{POP}_{\text{InventoryCounty}}}{\sum_{\text{AllCountiesInState}} (\text{HDD}_{\text{County}} * \text{POP}_{\text{County}})}$$

Apportion State Fuel Consumption to the County Level

$$F_{I-CTY} = SAF_{CTY} \times F_{ST}$$

Where

F_{I-CTY} = Fuel type I consumed in county

SAF_{CTY} = Spatial apportioning factor for inventory county

F_{ST} = Total fuel consumed in the state.

Calculate Annual Emissions

Emissions were calculated in tons/year for residential, commercial and industrial categories from each type of fuel combustion using following equations.

$$EM_R = (F_{I-CTY} \times EF_R) / 2000$$

Where

EM_R = Emissions from residential category.

F_{I-CTY} = Total annual residential sales of fuel i in the county.

EF_R = Residential emission factor for fuel i from AP-42

$$EM_C = (F_{I-CTY} \times EF_C) / 2000$$

Where

EM_C = Emissions from commercial/institutional category.

F_{I-CTY} = Total annual commercial/institutional sales of fuel i in the county.

EF_C = Commercial emission factor for fuel i from AP-42.

2017 Residential Distillate Oil Combustion Sample Calculation (Baltimore County)

Residential Distillate Oil Consumed State of Maryland = **2,006**⁵⁴ kbarrels (Thousand Barrels)

Spatial apportioning factor for Baltimore County:

$$SAF_{\text{Baltimore Co}} = \frac{HDD_{\text{Baltimore Co}} \times POP_{\text{Units Heating Baltimore Co}}^{55}}{\sum_{\text{ALL COUNTIES IN STATE}} (HDD_{\text{COUNTY}} \times POP_{\text{Units Heating State}})}$$

$$SAF_{\text{Baltimore Co}} = \mathbf{0.115411}$$

To calculate the total annual kilo gallons of distillate oil used in city of Baltimore for residential space heating:

⁵⁴ From EIA: Adjusted Sales for Residential End Use: Distillate Fuel Oil and Kerosene, 2016 (Thousand Barrels)

⁵⁵ Population data from the U.S. Bureau of the Census, The Maryland Department of Planning

$$\begin{aligned}
\text{Fuel}_{\text{Baltimore Co}} &= \text{SAF}_{\text{Baltimore City}} \times \text{Fuel}_{\text{TOTAL STATE}} \\
\text{Fuel}_{\text{Baltimore Co}} &= \mathbf{0.115411} \times 2006 \text{ kbarrels} \\
\text{Fuel}_{\text{Baltimore Co}} &= \mathbf{231.51} \text{ kbarrels} \\
\text{Fuel}_{\text{Baltimore Co}} &= \mathbf{231.51} \text{ kbarrels} \times 42 \text{ Kgal per kbarrels} \\
\text{Fuel}_{\text{Baltimore Co}} &= \mathbf{9,723.61} \text{ Kgal}
\end{aligned}$$

Annual Emissions Calculation

$$\begin{aligned}
E_{\text{Baltimore Co-Res-VOC}} &= \text{Fuel}_{\text{Baltimore County}} \times \text{EF}_{\text{VOC}} \\
E_{\text{Baltimore Co-Res-VOC}} &= 9,723.61 \text{ Kgal} \times 0.713 \text{ lbs}_{\text{VOC PER}} \text{ Kgal} \\
E_{\text{Baltimore Co-Res-VOC}} &= 6,932.94 \text{ lbs}_{\text{VOC}} / \text{year} \\
E_{\text{Baltimore Co-Res-VOC}} &= \mathbf{3.47 \text{ tons}_{\text{VOC}} / \text{year}}
\end{aligned}$$

Daily Emissions Calculation

Distillate Oil for Baltimore County was found to have a

SAF = seasonal adjustment factor of 0.002765272

POS = peak ozone period of 1

Days of the Period 31 (average days in summer month)

Daily adjusted $E_{\text{Baltimore Co-Res-VOCda}} = (E_{\text{Baltimore Co-Res-VOC}} / 31) \times (\text{SAF} / \text{POS})$

$$E_{\text{Baltimore Co-Res-VOCda}} = (3.47 / 31) \times (0.002765272 / 1) = \mathbf{3.09E-04 \text{ VOC tons/day}}$$

All pollutants (PM, SO_x, NO_x, VOC, and CO) are calculated in a similar manner.

Commercial and industrial emissions from this source category are calculated in a similar manner with the exception that the number of days in an ozone season changes from 214 for residential to 168 for commercial and industrial. Residential ozone season days are based on 7 days per week activity. Commercial and industrial ozone season days are based on 6 days per week activity.

4.1.7.4 Coal Combustion

SCC: 21 04 002 000 (Residential Coal)

SCC: 21 03 002 000 (Commercial/Institutional Coal)

Description Residential Coal

This source category covers air emissions from coal combustion in the residential sector. Bituminous coal, mined here in Maryland, represents the bulk of the coal used residentially for space heating in the State. Although mined nearby in Pennsylvania, readily available, and cleaner burning, anthracite coal is not used much in Maryland because of its expense.

Pollutants

PM₁₀, PM_{2.5}, SO_x, NO_x, CO, VOC

Method and Data Sources

Activity

The following assumptions were made in the computation of emissions from coal combustion from the residential sources.

(i) Number of Dwelling Units using Coal

The number of dwelling units using coal for space heating for 2014 was obtained from 2013 U. S. Census Profile on economic characteristics and the Maryland Office of Planning. MDE estimated that no new housing units would be equipped to burn coal as a home heating fuel.

(ii) Residential Coal Activity Consumption Data

The State Energy Data Report, Consumption Estimates, by the Energy Information Administration, provides information on estimated coal consumption. Bituminous coal is consumed by most of the hand-fired residential coal sources in the State of Maryland, but no coal usage activity was reported in 2017; resulting in no coal combustion emissions.

EXAMPLE CALCULATIONS ARE STILL SHOWN BELOW FOR RESIDENTIAL AND COMMERCIAL COAL COMBUSTION.

Emission Factors

Emission factors were obtained from AP-42, Tables 1.1-3 and 1.1-4 (Residential-hand-fed units) and PM2.5 from ERTAC.

Coal Emission Factors						
	NO_x (lbs./ton)	CO (lbs./ton)	VOC (lbs./ton)	PM10-PRI (lbs./ton)	PM2.5-PRI (lbs./ton)	SO₂ (lbs./ton)
Residential	9.1	275	10	6.2	3.84	37.2

Maryland's 2008 average sulfur content in coal = 1.2% Sulfur (DOE/EIA State Electricity Profiles 2008, March 2010 Table 6. page 124)

AP42 Table 1.1-19 (hand fed units) Emission factor SO₂ = 31S

In formula S = 1.2, such that SO₂ EF =31*1.2 = 37.2 lb/ton

Point Source Adjustments

No subtraction of emissions from point sources is necessary.

Adjustments for Controls

No controls are available for this source category.

Spatial and Temporal Allocations

Spatial

MDE developed an allocation factor from local and state totals of annual heating-degree days and housing units heating with coal to spatially allocated coal consumption. The method is documented and recommended by EIIP⁵⁶ in an Area Source Method Abstract for natural gas and LPG combustion. Because the emission factor was specifically adjusted to reflect seasonal emissions through heating degree days, no further seasonal adjustment factor is necessary.

A "heating-degree day" is a unit of measure used to indicate how cold it has been over a 24-hour period. Daily heating-degree days are calculated as the difference between the base value of 65°F and the mean temperature for the day (mean of the high and low temperatures for the day).

Annual heating-degree days are the sum of the daily heating-degree days. Heating degree data is available from the National Oceanographic and Atmospheric Administration (NOAA).⁵⁷

$$SAF_{InventoryCounty} = \frac{HDD_{InventoryCounty} * CHU_{InventoryCounty}}{\sum_{AllCountiesInState} (HDD_{County} * CHU_{County})}$$

Where:

- SAF_{INVENTORY COUNTY} = Spatial apportioning factor for inventory county
- HDD_{INVENTORY COUNTY} = Annual heating degree days for inventory county
- CHU_{INVENTORY COUNTY} = Housing units using coal in inventory county
- HDD_{COUNTY} = Annual heating degree days for each county in the state
- CHU_{COUNTY} = Housing units using coal for each county in the state

The spatial apportioning factor is used to allocate the state fuel total to the county level using the following equation:

$$Coal_{INVENTORY COUNTY} = SAF_{INVENTORY COUNTY} \times Coal_{TOTAL STATE}$$

Where:

- Coal_{INVENTORY COUNTY} = Total Coal fuel consumed in the inventory county
- Coal_{TOTAL STATE} = Total Coal fuel consumed in the state.

Temporal

MDE assumed that all residential coal combustion is used for space heating purposes. The total coal consumed in the county can be allocated by month or period using proportions of annual and monthly (or period) heating-degree days.

$$Residential\ Fuel_{MONTH} = Residential\ Fuel_{ANNUAL} \times \frac{HDD_{MONTH}}{HDD_{ANNUAL}}$$

where:

- Residential Fuel_{MONTH} = Space heating fuel use for inventory month
- Residential Fuel_{ANNUAL} = Space heating fuel use for inventory year
- HDD_{MONTH} = Heating degree days for inventory month
- HDD_{ANNUAL} = Heating degree days for inventory year

⁵⁷ <http://www.noaa.gov> (home page) or <http://www.ncdc.noaa.gov/ol/climate/climateproducts.html#PUBS> (for a list of available data)

Emissions Calculation

Equation:

$$E_{\text{COALR}} = \frac{(EF_{\text{COAL } i} \times \text{Coal}_{\text{INVENTORY COUNTY}})}{2000}$$

E_{COALR} = Yearly emissions from residential coal combustion
 $EF_{\text{COAL } i}$ = Emission factor for coal combustion for pollutant i

Annual Emissions Calculation

Residential Coal Combustion Sample Calculation (Harford County) (tons / year)

Total Residential Coal Consumption – State of Maryland 2,000 tons (Bituminous Coal)

To calculate spatial apportioning factor for Harford County:

$$\text{SAF}_{\text{HARFORD COUNTY}} = \frac{\text{HDD}_{\text{INVENTORY COUNTY}} \times \text{CHU}_{\text{INVENTORY COUNTY}}}{\sum_{\text{ALL COUNTIES IN STATE}} (\text{HDD}_{\text{COUNTY}} \times \text{CHU}_{\text{COUNTY}})}$$

$$\text{SAF}_{\text{HARFORD COUNTY}} = \mathbf{0.07254565}$$

To calculate tons of coal used in Harford County:

$$\begin{aligned} \text{Residential Coal}_{\text{HARFORD COUNTY}} &= \text{SAF}_{\text{HARFORD COUNTY}} \times \text{Coal}_{\text{TOTAL STATE}} \\ \text{Residential Coal}_{\text{HARFORD COUNTY}} &= 0.07254565 \times 2,000 \\ \text{Residential Coal}_{\text{HARFORD COUNTY}} &= 145.09 \text{ tons} \end{aligned}$$

Equation:

Residential Coal SO2 Emission Calculation for Harford County

$$E_{\text{COALR}} = \frac{(EF_{\text{COAL VOC}} \times \text{Coal}_{\text{HARFORD COUNTY}})}{2000}$$

$$E_{\text{COALR}} = \frac{(10.0 \times 145.09)}{2000}$$

$$E_{\text{COALR}} = \mathbf{0.73 \text{ tons}_{\text{VOC}} \text{ year}}$$

Description - Commercial and Institutional Coal

Daily Emissions Calculation

Residential Coal Combustion for Harford County was found to have a

SAF = seasonal adjustment factor of 0.002765272

POS = peak ozone period of 1

Days of the Period 31 (average days in summer month)

Daily adjusted $E_{COALRda} = (E_{COALR} / 31) * (SAF / POS)$

$$E_{COALRda} = (0.73 / 31) * (0.002765272 / 1) = 6.47E-05 \text{ VOC tons/day}$$

Commercial and Institutional sources of coal combustion above the point source threshold are included in the point source portion of the inventory. The following table lists area source emissions from commercial and institutional sources smaller than the threshold values.

Methods and Data Sources

The following assumptions were made in the computation of emissions from coal combustion from the commercial and institutional sources not included in the point source inventory.

Activity

(i) Coal Consumption Data

The State Energy Data Report (SEDR) estimated that approximately 9,000 tons/year of total coal was used commercially by Maryland in 2013.

(ii) Number of Dwelling Units using Coal

The number of businesses using coal for space heating for 2014 was obtained from 2013 U. S. Census Profile on economic characteristics. MDE estimated that no businesses would be equipped to burn coal for heating fuel.

COMAR 26.11.09.04 prohibits the use of solid fuel-burning equipment that has a rated heat input of less than 35 million BTU per hour.

Emission Factors

EMISSION FACTORS WERE OBTAINED FROM AP-42, TABLES 1.1-3 AND VOCS (TNMOC) TABLE 1.1-19 (AVERAGE OF OVERFEED AND UNDERFEED STOKER). PM10 AND PM2.5 EF ON TABLES 1.1-10 AND 1.1-11

Coal Emission Factors						
	NOx (lbs./ton)	CO (lbs./ton)	VOC (lbs./ton)	PM10-PRI (lbs./ton)	PM2.5-PRI (lbs./ton)	SO2 (lbs./ton)
Commercial / Institutional	8.5	8.5	0.675	6.1	3	41.4

Point Source Adjustments

No subtraction of emissions from point sources is necessary.

Adjustments for Controls

No controls are available for this source category.

Spatial and Temporal Allocations

Spatial

Spatial temporal allocations to this source category were calculated in the same manner as the residential coal combustion category.

Temporal

Spatial and temporal allocations to this source category were calculated in the same manner as the residential coal combustion category.

Emissions Calculation

Annual Emissions Calculation

Commercial Coal Combustion Sample Calculation (Allegany County) (tons / year)

Total Commercial Coal Consumption – State of Maryland 9,000 tons

To calculate spatial apportioning factor for Allegany County:

$$SAF_{ALLEGANY\ COUNTY} = \frac{HDD_{INVENTORY\ COUNTY} \times CHU_{INVENTORY\ COUNTY}}{\sum_{ALL\ COUNTIES\ IN\ STATE} (HDD_{COUNTY} \times CHU_{COUNTY})}$$

$$SAF_{ALLEGANY\ COUNTY} = \mathbf{0.371317}$$

To calculate tons of coal used in Allegany County:

$$\begin{aligned} \text{Commercial Coal}_{ALLEGANY\ COUNTY} &= SAF_{ALLEGANY\ COUNTY} \times \text{Coal}_{TOTAL\ STATE} \\ \text{Commercial Coal}_{ALLEGANY\ COUNTY} &= 0.371317 \times 9,000 \\ \text{Commercial Coal}_{ALLEGANY\ COUNTY} &= 3,341.85\ \text{tons} \end{aligned}$$

Equation:

Commercial Coal VOC Emission Calculation for Allegany County

$$E_{\text{COALC}} = \frac{(EF_{\text{COAL VOC}} \times \text{Coal}_{\text{ALLEGANY COUNTY}})}{2000}$$

$$E_{\text{COALC}} = \frac{(0.675 \times 3,341.85)}{2000}$$

$$E_{\text{COALC}} = \mathbf{1.13 \text{ tons}_{\text{VOC}} \text{ year}}$$

Daily Emissions Calculation

Commercial Coal Combustion for Allegany County was found to have a

SAF = seasonal adjustment factor of 0.002765272

POS = peak ozone period of 1

Days of the Period 31 (average days in summer month)

Daily adjusted $E_{\text{COALCda}} = (E_{\text{COALC}} / 31) * (\text{SAF} / \text{POS})$

$$E_{\text{COALCda}} = (1.13 / 31) * (0.002765272 / 1) = \mathbf{1.01E-04 \text{ VOC tons/day}}$$

4.1.7.5 Natural Gas Combustion

SCC: 21 04 006 000 (Residential Natural Gas)

SCC: 21 03 006 000 (Commercial/Institutional Natural Gas)

Description

This source category covers air emissions from natural gas combustion in the residential and commercial/institutional sectors for space heating, water heating, and cooking. This category includes small boilers, furnaces, heaters and other heating units that are not inventoried as point sources. Residential and commercial sectors comprise housing units; wholesale and retail businesses; health institutions; social and educational institutions; and Federal, state and local government institutions (e.g., military installations, prisons, office buildings). Natural gas is one of the major fuels used throughout the country. It is used mainly for power generation, for industrial process steam and heat production, and for domestic and commercial space heating. It is also used for domestic cooking and hot water heating.

Pollutants

PM₁₀, PM_{2.5}, SO_x, NO_x, CO, NH₃, VOC

Method and Data Sources

The following assumptions were made in the computation of the emissions from natural gas combustion.

Activity

- (i) Number of Dwelling Units using Natural Gas

The number of dwelling units using natural gas for space heating for 2017 was obtained from 2016 U. S. Census Profile on economic characteristics and the Maryland Office of Planning.

- (ii) Residential and Commercial/Institutional Natural Gas Consumption Data

Total residential and commercial/institutional natural gas consumption data in the State of Maryland for 2017 was obtained from surveying the following companies: Baltimore Gas and Electric (*Constellation Energy Group*), Washington Gas Energy Services (Maryland Division), Chesapeake Utilities Corporation, Columbia Gas of Maryland, Easton Utility Commission, and Elkton Gas Company. The companies provided natural gas sales statistics for the year 2017 in therms or cubic feet for all counties in their service area for the residential, commercial, and industrial categories. These statistics were then converted into million cubic feet using a conversion factor of 1 therm equals 100 cubic feet.

Emission Factors

- (iii) Emission Factors – Natural Gas

Emission factors for residential natural gas came from 2008 Emission Inventory Data & Documentation (<http://www.epa.gov/ttn/chief/net/2008inventory.html>) Nonpoint section for Residential Heating: Natural Gas factors for combustion of natural gas in commercial boilers are

presented in Table 1.4-1 and 1.4-2 of Section 1.4 of AP-42. Commercial factors came from the ICI Workbook on the same website created by EPA and ERTAC committee through a joint study.

Natural Gas Emission Factors							
	NOx (lbs./10 ⁶ scf)	CO (lbs./10 ⁶ scf)	VOC (lbs./10 ⁶ scf)	PM 10 (lbs./10 ⁶ scf)	PM 2.5 (lbs./10 ⁶ scf)	NH3 (lbs./10 ⁶ scf)	SOx (lbs./10 ⁶ scf)
Residential	94	40	5.5	0.2	0.11	20	0.6
Commercial	100	84	5.5	0.2	0.11	0.49	0.6

Point Source Adjustments

No subtraction of emissions from point sources is necessary.

Adjustments for Controls

No controls are available for this source category.

Spatial and Temporal Allocations

Spatial

The natural gas survey of suppliers provided MDE with county totals for natural gas consumption. Therefore MDE did not have to use an allocation factor derived from local and state totals of annual heating degree days and housing units heating with natural gas to spatially allocated natural gas consumption to the county level for most of the counties.

Temporal

In addition to space heating, natural gas is often used for cooking and water heating. For ozone and other seasonal inventories, consumption for cooking and water heating may be assumed to be constant through the year, but fuel used for space heating must be apportioned according to heating needs.

To separate residential space heating natural gas usage from cooking and water heating, MDE used data from the State Energy Data Report, Consumption Estimates, Energy Information Administration, Office of Energy Markets and End Use, U.S. Department of Energy. Specifically data was collected from Table 15 – Natural Gas Deliveries to Residential Customers, by State, 1998-2013. The residential deliveries for the month with the lowest deliveries can be assumed to be only for cooking and water heating. The percentage of residential natural gas consumption for cooking and water heating may then be calculated:

$$\text{Annual Non-Space} = \frac{12 * \text{Lowest Monthly Fuel Use}}{\text{Total Annual Fuel Use}} * 100$$

$$\begin{aligned} \text{Annual Non-Space Heating Percent} &= \frac{\text{Annual Fuel Use}}{80,447} * 100 \\ &= \frac{12 * 1635}{80,447} * 100 \\ &= 24.389 \% \end{aligned}$$

The annual non-space heating percent can be calculated in a similar manner for commercial/institutional natural gas usage. The percentage of commercial/institutional natural gas consumption for non-space heating may then be calculated:

$$\begin{aligned} \text{Annual Non-Space Heating Percent} &= \frac{12 * \text{Lowest Monthly Fuel Use}}{\text{Annual Fuel Use}} * 100 \\ &= \frac{12 * 2440}{65323} * 100 \\ &= 44.823 \% \end{aligned}$$

This percentage may be applied to the inventory area's total residential and/or commercial/institutional natural gas consumption to calculate the non-space heating portion of usage. This portion can be subtracted from the annual total, and the remaining consumption, which is being used for space heating, can be allocated by month or period using proportions of annual and monthly or period heating degree days.

$$\text{Space Heat Fuel}_{\text{MONTH}} = \text{Space Heat Fuel}_{\text{ANNUAL}} \times \frac{\text{HDD}_{\text{MONTH}}}{\text{HDD}_{\text{ANNUAL}}}$$

Where:

- Space Heat Fuel_{MONTH} = Space heating fuel use for inventory month
- Space Heat Fuel_{ANNUAL} = Space heating fuel use for inventory year
- HDD_{MONTH} = Heating degree days for inventory month
- HDD_{ANNUAL} = Heating degree days for inventory year

Emissions Calculation

Emission Calculation – Residential Emissions

Equation:

$$E_{\text{NatGas}} = \frac{(EF_{\text{NatGas-P}} \times NG_i)}{2000}$$

E_{NatGas} = Yearly emissions from natural gas combustion
 $EF_{\text{NatGas-P}}$ = Emission factor for natural gas combustion for pollutant i
 NG_i = Natural gas consumed for county i

Total Residential Natural Gas Consumption – Baltimore County⁵⁸ 11,677.19 M ft³

	Total Natural Gas Delivered (M ft ³)	
	Residential	Commercial
State of Maryland	74,103.60	74,748.51

$$E_{\text{NatGas}} = \frac{(EF_{\text{NatGas-voc}} \times NG_{\text{Bato.County}})}{2000}$$

$$E_{\text{NatGas}} = \frac{(5.5 \times 11,677.19)}{2000}$$

E_{NatGas} **32.11 tons_{voc} year**

The same equation and methodology can be used to estimate emission of various pollutants.

Daily Emissions Calculation

Residential Natural Gas Consumption for Baltimore County was found to have a

SAF = seasonal adjustment factor of 0.06283113

POS = peak ozone period of 1

Days of the Period 31 (average days in summer month)

Daily adjusted $E_{\text{NatGasda}} = (E_{\text{NatGas}} / 31) * (\text{SAF} / \text{POS})$

$E_{\text{NatGasda}} = (32.11 / 31) * (0.06283113 / 1) = 6.51\text{E-}02 \text{ VOC tons/day}$

4.1.7.6 Liquefied Petroleum Gas Combustion

SCC: 21 04 007 000 (Residential LPG)

SCC: 21 03 007 000 (Commercial/Institutional LPG)

Description

This source category covers air emissions from liquefied petroleum gas (LPG) combustion in the residential and commercial sectors for space heating, water heating, or cooking. LPG includes propane, propylene,

⁵⁶ Natural gas consumption data gathered from MDE survey – Baltimore County data from BGE

butane, and butylenes. The product used for domestic heating is composed primarily of propane. This category includes small boilers, furnaces, heaters and other heating units that are not inventoried as point sources. Residential and commercial sectors comprise housing units; wholesale and retail businesses; health institutions; social and educational institutions; and Federal, state and local government institutions (e.g., military installations, prisons, office buildings).

Pollutants

PM₁₀, PM_{2.5}, SO_x, NO_x, CO, NH₃, VOC

Method and Data Sources

The following assumptions were made in the computation of the emissions from liquefied petroleum gas (LPG) combustion.

Activity

1. Number of Dwelling Units using LPG

The number of dwelling units using LPG for space heating for 2017 was obtained from 2016 U. S. Census Profile on economic characteristics and the Maryland Office of Planning.

2. Residential and Commercial LPG Activity Consumption Data

Total residential and commercial LPG consumption data for space heating in the State of Maryland (LPG_{ST}) for 2017 were obtained from State Energy Data Report, Consumption Estimates, Energy Information Administration, Office of Energy Markets, and End Use, U.S. Department of Energy.

Emission Factors

Emission factors for LPG came from 2008 Emission Inventory Data & Documentation (<http://www.epa.gov/ttn/chief/net/2008inventory.html>) Nonpoint section for Residential Heating: LPG Combustion Table 1. Commercial factors came from the ICI Workbook on the same website created by EPA and ERTAC committee through a joint study. Factors have been rounded to one and two decimal places.

LPG Emission Factors							
	NOx (lbs./kbbl)	CO (lbs./kbbl)	VOC (lbs./kbbl)	PM10-FIL (lbs./kbbl)	PM2.5-FIL (lbs./kbbl)	NH3 (lbs./kbbl)	SO2 (lbs./kbbl)
Residential	562.8	159.6	21.91	0.8	0.44	1.95	2.39
Commercial	597.66	334.74	21.84	0.84	0.42	2.1	2.52

Point Source Adjustments

No subtraction of emissions from point sources is necessary.

Adjustments for Controls

No controls are available for this source category.

Spatial and Temporal Allocations

Spatial

MDE developed an allocation factor from local and state totals of annual heating degree days and housing units heating with liquid propane gas to spatially allocated liquid propane gas consumption. The method is documented and recommended by EIIP⁵⁹ in an Area Source Method Abstract for natural gas and LPG combustion.

A “heating degree day” is a unit of measure used to indicate how cold it has been over a 24-hour period. Daily heating degree days are calculated as the difference between the base value of 65°F and the mean temperature for the day (mean of the high and low temperatures for the day).

Annual heating degree days are the sum of the daily heating degree days. Heating degree data is available from the National Oceanographic and Atmospheric Administration (NOAA).⁶⁰

$$\text{SAF}_{\text{INVENTORY COUNTY}} = \frac{\text{HDD}_{\text{INVENTORY COUNTY}} \times \text{LP-HU}_{\text{INVENTORY COUNTY}}}{\sum_{\text{ALL COUNTIES IN STATE}} (\text{HDD}_{\text{COUNTY}} \times \text{LP-HU}_{\text{COUNTY}})}$$

Where:

- $\text{SAF}_{\text{INVENTORY COUNTY}}$ = Spatial apportioning factor for inventory county
- $\text{HDD}_{\text{INVENTORY COUNTY}}$ = Annual heating degree days for inventory county
- $\text{LP-HU}_{\text{INVENTORY COUNTY}}$ = Housing units using LP gas for inventory county
- $\text{HDD}_{\text{COUNTY}}$ = Annual heating degree days for each county in the state
- $\text{LP-HU}_{\text{COUNTY}}$ = Housing units using LP gas for each county in the state

The spatial apportioning factor is used to allocate the state fuel total to the county level using the following equation:

$$\text{LPG}_{\text{INVENTORY COUNTY}} = \text{SAF}_{\text{INVENTORY COUNTY}} \times \text{LPG}_{\text{TOTAL STATE}}$$

Where:

- $\text{LPG}_{\text{INVENTORY COUNTY}}$ = Total LPG fuel consumed in the inventory county
- $\text{LPG}_{\text{TOTAL STATE}}$ = Total LPG fuel consumed in the inventory county

⁵⁹ Emissions Inventory Improvement Program (EIIP) Area Source Method Abstract – Natural Gas and LPG Combustion, dated 2011

⁶⁰ <http://www.noaa.gov> (home page) or <http://www.ncdc.noaa.gov/ol/climate/climateproducts.html#PUBS> (for a list of available data)

Temporal

In addition to space heating, liquid propane gas is often used for cooking and water heating. For ozone and other seasonal inventories, consumption for cooking and water heating may be assumed to be constant through the year, but fuel used for space heating must be apportioned according to heating needs.

Emissions Calculation

Emission Calculation

$$E_{LPG_i} = \frac{(EF_{LPG_p} \times LPG_{County_i})}{2000}$$

- E_{LPG_i} = Yearly emissions from liquid propane gas combustion in county i
 EF_{LPG_p} = Emission factor for LPG combustion for pollutant p
 LPG_{County_i} = LPG consumed for space heating in county i

2017 Residential LPG Combustion Sample Calculation (Baltimore City) (tons/year)

Total Residential LPG Consumption – State of Maryland 1,654 thousand barrels (kbbbl)
To calculate spatial apportioning factor for Baltimore City:

$$SAF_{BALTIMORE\ CITY} = \frac{HDD_{INVENTORY\ COUNTY} \times LP-HU_{INVENTORY\ COUNTY}}{\sum_{ALL\ COUNTIES\ IN\ STATE} (HDD_{COUNTY} \times LP-HU_{COUNTY})}$$

$$SAF_{BALTIMORE\ CITY} = \frac{3,328 \times 2,478}{289,267,603}$$

$$SAF_{BALTIMORE\ CITY} = 0.0285092$$

To calculate thousand barrels of liquefied petroleum gas (LPG) used in Baltimore City:

$$\text{Residential LPG}_{BALTIMORE\ CITY} = SAF_{BALTIMORE\ CITY} \times LPG_{TOTAL\ STATE}$$

$$\text{Residential LPG}_{BALTIMORE\ CITY} = 0.0285092 \times 1,654$$

$$\text{Residential LPG}_{BALTIMORE\ CITY} = \mathbf{47.15\ kbbbl}$$

Equation:

$$E_{LPG_i} = \frac{(EF_{LPG_{voc}} \times LPG_{County_i})}{2000}$$

$$E_{\text{LPGi}} = \frac{(21.91 \times 47.15)}{2000}$$

$$E_{\text{LPGi}} = \mathbf{0.52 \text{ tons}_{\text{VOC}} \text{ per year}}$$

Daily Emissions Calculation

Residential LPG Consumption for Baltimore City was found to have a

SAF = seasonal adjustment factor of 0.06283113

POS = peak ozone period of 1

Days of the Period 31 (average days in summer month)

Daily adjusted $E_{\text{LPGida}} = (E_{\text{LPGi}} / 31) * (\text{SAF} / \text{POS})$

$$E_{\text{LPGida}} = (0.52 / 31) * (0.06283113 / 1) = \mathbf{1.05E-03 \text{ VOC tons/day}}$$

4.1.7.7 Wood Combustion

SCC: 21 04 008 000 (Residential Wood Combustion)

Description

This source category covers air emissions from wood combustion in the residential sectors primarily for space heating and aesthetics. The inventory includes emission estimates for indoor wood-burning equipment (e.g. fireplaces, woodstoves, pellet stoves, furnaces/boilers) and outdoor wood burning equipment (e.g. outdoor fireplaces, fire pits, wood-fired barbecues, chimneys).

Pollutants

NO_x, CO, VOC, PM₁₀, PM_{2.5}, NH₃, SO₂, and HAPs

Method and Data Sources

Maryland's Residential Wood Combustion Emission Inventory was calculated using a new EPA emissions estimation tool called the, RWC TOOL. A detailed explanation of how activity data and emission factors were developed in order to predict emissions for several states can be downloaded along with the RWC TOOL at EPA's FTP site. A collection of surveyed, census, housing tract, equipment use, and wood burned data was used in the tool along with EPA's estimation methodologies and statistics to create an emissions profile for Maryland that can be used repeatedly with a few periodic updates.

Point Source Adjustments

No subtraction of emissions from point sources is necessary.

Adjustments for Controls

No controls are available for this source category.

Emissions Calculation

MDE ran EPA's RWC TOOL and accepted the emissions generated by the tool as the best estimates of Maryland's residential wood combustion at the present time.

4.1.7.8 Commercial Cooking

SCC: 2302002100 (Conveyorized Charbroiling)
2302003000
2302002200 (Under-fired Charbroiling)
24608000000
2302003000 (Deep Fat Frying)
2302003100 (Flat Griddle Frying)
2302003200 (Clamshell Griddle Frying)

Description

This source category covers air emissions from commercial cooking in the Maryland area(s). These emissions (i.e. emissions from commercial cooking of meats) represent the “greatest sources of commercial cooking emissions. In particular, emissions of particulate matter (PM) and volatile organic compounds (VOCs) are the most significant. Of the cooking processes that have been identified, charbroiling is the most important air pollutant emissions contributor”⁶¹. It follows that this category includes the following meat sources: hamburger, steak, fish, pork, and chicken. And the five equipment types: chain-driven (conveyorized) charbroilers, under-fired charbroilers, deep fat fryers, griddles, and clam shell griddles.

Pollutants

PM, PM₁₀, PM_{2.5}, CO, VOC, HAPs

Method and Data Sources

The recommended methods for calculating emissions and emission factors to commercial cooking possessing sources was obtain from Pechan Technical Memorandum (December 2003) and EIIP Web site Volume III, Area Sources document series methods and web link:
http://www.epa.gov/ttnchie1/eiip/techreport/volume03/charbroilingtechmemo_122303.pdf.
<http://www.epa.gov/ttnchie1/conference/ei13/pointarea/roe.pdf>.

Activity

Total number of restaurants was collected from County Business Patterns 2016 - Maryland, NAICS: 722511, Full-Service Restaurants and 722513, Limited Service Restaurants. Year 2011 restaurants statistics for Maryland’s counties were collected from the U.S. Census Bureau Internet Website address (<http://www.census.gov/epcd/cbp/view/cbpview.html>). Table - 4.1.6.8-a shows CBP total number of Maryland County restaurants. MDE staff calculated the percent of county restaurant types (i.e. Ethnic Food, Fast Food, Family Food, and Seafood) reported in the Pechan Technical Memorandum. Table 4.1.6.8-b1 shows the percent of each restaurant type per county calculated from the Pechan Technical Memorandum. This percentage was applied to the total number of

⁶¹ Source: Adapted from PECHAN December 2003 Commercial Cooking Processes Technical Memorandum.

restaurants collected from the County Business Patterns to determine the number of each type of restaurant facility in each county⁶².

Table 4.1.6.8-b2 shows the estimated number of restaurant types in each county. Table 4.1.6.8-c gives average number of equipment pieces by restaurant type. Table 4.1.6.8-d shows average pounds of meat cooked on each type of equipment per week (lbs/week). And Table 4.1.6.8-e gives emission factors (lb/ton meat).

Table 4.1.6.8-a 2016 CBPs' Total Number of County Restaurants

County Name	NAICS Code 722511 & 722513
Allegany	115
Anne Arundel	881
Baltimore County	1178
Calvert	111
Caroline	26
Carroll	229
Cecil	114
Charles	189
Dorchester	39
Frederick	357
Garrett	54
Harford	298
Howard	455
Kent	38
Montgomery	1448
Prince George's	1088
Queen Anne's	67
St Mary's	137
Somerset	17
Talbot	92
Washington	215
Wicomico	147
Worcester	257
Baltimore City	1069

⁶² Source: Adapted from County Business Patterns (CBP) and U.S. Census Bureau 2013 reports. Total may not be multiplier and divisional because of rounding.

Table 4.1.6.8-b1 Percent of Each County Restaurant Type³

County Name	Ethnic	Fast Food	Family	Seafood	Steak & Barbeque
Allegany	30.61	46.94	14.29	0.00	8.16
Anne Arundel	27.27	47.73	11.65	9.94	3.41
Baltimore Co.	29.65	48.06	11.66	7.77	2.86
Calvert	23.08	41.03	15.38	15.38	5.13
Caroline	15.38	69.23	7.69	7.69	0.00
Carroll	19.51	59.76	14.63	3.66	2.44
Cecil	23.44	51.56	12.50	7.81	4.69
Charles	27.69	44.62	13.85	9.23	4.62
Dorchester	10.34	44.83	13.79	27.59	3.45
Frederick	26.61	47.58	17.74	6.45	1.61
Garrett	9.09	54.55	31.82	0.00	4.55
Harford	23.66	53.44	8.40	9.92	4.58
Howard	33.76	52.23	7.64	3.82	2.55
Kent	10.00	40.00	30.00	20.00	0.00
Montgomery	45.29	42.81	6.78	2.15	2.98
Prince George's	29.85	51.77	7.31	6.05	5.01
Queen Anne's	7.69	46.15	2.56	38.46	5.13
St Mary's	17.65	41.18	15.69	15.69	9.80
Somerset	0.00	43.75	18.75	37.50	0.00
Talbot	18.92	45.95	10.81	21.62	2.70
Washington	24.69	50.62	14.81	8.64	1.23
Wicomico	27.59	43.10	10.34	15.52	3.45
Worcester	24.17	42.50	10.00	18.33	5.00
Baltimore City	25.70	57.36	7.08	7.64	2.23

Note: Divide decimal numbers in Table 4.1.6.8-b1 by 100 to change % into fraction values.

Table 4.1.6.8-b2 Number of Restaurant Types in Each County

County Name	Ethnic	Fast Food	Family	Seafood	Steak & Barbeque
Allegany	35	54	16	0	9
Anne Arundel	240	420	103	88	30
Baltimore Co.	349	566	137	92	34
Calvert	26	46	17	17	6
Caroline	4	18	2	2	0
Carroll	45	137	34	8	6
Cecil	27	59	14	9	5
Charles	52	84	26	17	9
Dorchester	3	13	4	8	1
Frederick	95	170	63	23	6
Garrett	5	29	17	0	2

Harford	71	159	25	30	14
Howard	154	238	35	17	12
Kent	4	15	11	8	
Montgomery	656	620	98	31	43
Prince George's	325	563	79	66	55
Queen Anne's	5	31	2	26	3
St Mary's	24	56	21	21	13
Somerset	0	7	3	6	0
Talbot	17	42	10	20	2
Washington	53	109	32	19	3
Wicomico	41	63	15	23	5
Worcester	62	109	26	47	13
Baltimore City	275	613	76	82	24

Table 4.1.6.8-c Percent of Restaurants with each type of cooking equipment^{1, 2}

Restaurant Category	Chain-Driven Charbroilers (ufc) Rest	Underfired Charbroilers (ufc) Rest.	Deep-Fat Fryers (dff) Rest.	Flat Griddles (fg) Rest.	Clamshell Griddles (cg) Rest.
Ethnic	3.5	47.5	81.9	62.7	4
Fast Food	18.6	30.8	96.8	51.9	14.7
Family	10.1	60.9	91.4	82.9	1.4
Seafood	0	52.6	100	36.8	10.5
Steak & Barbeque	6.9	55.2	82.8	89.7	0

Table 4.1.6.8-d Average Number of Equipment Pieces by Restaurant Type^{1, 2}

Restaurant Category	Chain-Driven Charbroilers (ufc) Rest	Underfired Charbroilers (ufc) Rest.	Deep-Fat Fryers (dff) Rest.	Flat Griddles (fg) Rest.	Clamshell Griddles (cg) Rest.
Ethnic	1.62	1.54	1.63	1.88	1.8
Fast Food	1.07	1.58	3.1	1.43	2.09
Family	1.71	1.29	2.34	2.03	0
Seafood	0	1.1	2.47	1.11	1.5
Steak & Barbecue	0	1.63	2.42	1.35	0

Table 4.1.6.8-e Average Pounds of Meat Cooked on Each Type of Equipment Per Week^{1, 2}
(lbs/week)

Type of Meat	Chain-Driven Charbroilers	Underfired Charbroilers	Deep-Fat Fryers (dff)	Flat Griddles (fg) Rest.	Clamshell Griddles (cg) Rest.
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	(ufc) Rest	(ufc) Rest.	Rest.		
Steak	236	180	181	166	94
Hamburger	798	270	274	362	1314
Poultry, with Skin	147	144	365	88	113
Poultry, Skinless	266	179	208	111	108
Pork	57.6	148	58.6	112	118
Seafood	119	143	159	92.1	632
Other	0	41.5	274	57.5	0

Emission Factors

Table 4.1.6.8-f Emission Factor (lb/ton meat)^{1, 2}

Equipment Type (fuel)	SCC	Meat/Food	PM	PM10	PM2.5	CO	NOX	VOC
Under fired-charbroiler (charcoal) (ufc) Rest.	2302002200	Beef	16.2	15	14.2	327	4.8	9.4
		Beef (marinated)	19	18.4	17.4	335.2	7.2	11.6
		Chicken (marinated)	19.6	18.8	18.2	315.8	8.4	9
		Hamburger (25%fat)	65.4	65.4	63.8	27.44	0	7.88
Under fired-charbroiler (natural gas) (ufc) Rest.	2302002200	Steak	34.4	34.4	33.6	9.94	0	1.72
		Chicken (whole)	21.0	21.0	19.8	9.68	0	3.64
		Seafood	6.6	6.6	6.4	0	0	0.76
Conveyorized Charbroiler (natural gas) (cdc) Rest.	2302002100	Hamburger (21%fat)	14.8	14.8	14.6	16.58	0	4.54
		Shoestring potatoes	0	0	0	0	0	0.42
Deep fat fryer (natural gas) (dff) Rest.	2302003000	Breaded chicken	0	0	0	0	0	0.24
		Breaded fish	0	0	0	0	0	0.28
		Hamburger (24% fat)	10	10	7.6	0.76	0	0.14
		Chicken (boneless breast)	0	0	0	0.9	0	0.8
Griddle (electric) (fg) Rest.	2302003100	Seafood	0	0	0	0	0	0.22
		Hamburger (24% fat)	1.7	1.7	1.44	0	0	0.02
Double-sided (clamshell) Griddle (electric) (cg) Rest.	2302003200	Chicken	0	0	0	0	0	0.114285714
		Seafood	0	0	0	0	0	0.031428571

Point Source Adjustments

No point source subtraction of emissions.

Adjustments for Controls

No adjustments for controls in Maryland for this source.

Spatial

Data for spatial allocation is the number of restaurant per county from CBPs’.

Temporal

Emissions were averaged according to period of operation to a daily estimate. See section 2.2.1.

Emissions Calculation

The following steps were used to calculate commercial cooking emissions for Maryland:

- i. Multiply total restaurants in a county (i.e. from CBPs’ data source) by percent (%) type of restaurant (i.e. from Pechan document) Table 4.1.6.8-a, and Table 4.1.6.8-b1.
- ii. Multiply county-level facility counts by the fraction (i.e. percent) of restaurants with each type of cooking equipment (Table 4.1.6.8-c).
- iii. Multiply number of restaurants with each type of cooking equipment by number of pieces of equipment (Table 4.1.6.8-d).
- iv. Sum number of pieces of cooking equipment across restaurant types.
- v. Multiply total summed number of pieces of cooking equipment per restaurant types by average pounds of meat cooked on each type of equipment per week (Table 4.1.6.8-e).
- vi. Finally, multiply results from v by emission factor (lb/ton meat) (Table 4.1.6.8-f) and divided emission values by 2000 by 365 for daily lbs/ton unit.

$$B_{poe}$$

$$E_{CC} = (N * (\text{Frac}_n / 100)) * D_{tn} * \text{Sum}_{all} * \text{Meat}_{type} * EF_{\text{meat type}} / 2000$$

Where:

E_{CC} = Commercial Cooking Emissions in pound (lbs) per tons (i.e. Activity data times $EF_{\text{meat type}}$) for county per restaurant food type and equipment type SCC.

N = Total number of food restaurants in county

Frac_n = Fraction of restaurant type for that type of cooking equipment.

B_{poe} = Number of food restaurants for SCC with restaurants type of equipment.

D_{tn} = Total number of restaurants type of equipment at food restaurant.

Sum_{all} = Total number of summed of pieces of cooking equipment across restaurant type.

Meat_{type} = Total pounds per week of meat type cooked on restaurants equipment in county.

$EF_{\text{meat type}}$ = Meat type emission factor (lb/ton meat).

Example 2017 Commercial Cooking Emission Calculation for Baltimore County, Fast Food Restaurant Type, SCC 2302002100, Chain-Driven Charbroiler (Conveyorized). **Note:** Emissions are calculated for only a particular county, restaurant, food equipment, and food type. In order to determine emission for a particular county, all emission for meat types must be summed at the equipment level and multiply by the appropriate meat type emission factor.

Step i.

$$E_{BC,cdc,FFood}^3 = (N * (\text{Frac}_n / 100)) = 1178 * (48.06 / 100) = 566$$

Total number of businesses in Baltimore County times % of FF restaurant by CBP
 Number of fast food (FF) restaurants in Baltimore County is 566

Step ii.

$$E_{BC,cdc,FFood}^3 = 566 * (18.6 / 100) = 105.3$$

The number of FF restaurants times % of restaurants with cdc equipment
 The number of cdc restaurants in Baltimore County is 105.3

Step iii.

$$E_{BC,cdc,fast\ food}^3 = 105.3 * 1.07 = 112.7$$

The number of cdc restaurants times average cdc pieces of equipment for that restaurant type

Step iv.

$$Sum_{all,fast\ food} E_{BC,cdc,fast\ food}^3 = 112.7$$

Total pieces of cdc equipment for fast food restaurants in Baltimore County.

Step v.

Do steps 1 thru 4 again for the following restaurants: Ethnic, Family, Seafood, and Steak and Barbecue. The total pieces of cdc equipment for each restaurant type are:

Ethnic	19.8
Fast Food	112.6
Family	23.7
Seafood	0.0
Steak & Barbecue	0.0

$Sum_{all} = 156$ Total number of summed of pieces of cdc equipment across restaurants
 Average amount of meats cooked on cdc equipment each week
 Steak 236 lbs
 Hamburger 798 lbs
 Poultry, with skin 147 lbs
 Poultry, skinless 266 lbs
 Pork 57.6 lbs
 Seafood 119 lbs

Calculating VOC for Chain-Driven Charbroilers (cdc) restaurant in Baltimore County

Step vi.

$$Meat_{steak} = 156 \times 236 = 36,838 \text{ lbs}$$

$$Meat_{Hamburger} = 156 \times 798 = 124,564 \text{ lbs}$$

$$Meat_{Poultryskin} = 156 \times 147 = 22,946 \text{ lbs}$$

$$Meat_{Poultryskinless} = 156 \times 266 = 41,521 \text{ lbs}$$

$$Meat_{Pork} = 156 \times 57.6 = 8,991 \text{ lbs}$$

$$Meat_{Seafood} = 156 \times 119 = 18,575 \text{ lbs}$$

$$E_{CCSteakCDC} = (36,838 \times 1.72) / 2000 / 39 = 0.81 \text{ tons VOC}$$

$$E_{CCHamburgerCDC} = (124,564 \times 4.54) / 2000 / 39 = 7.25 \text{ tons VOC}$$

$$E_{CCPoultryskin} = (22,946 \times 3.64) / 2000 / 39 = 1.07 \text{ tons VOC}$$

$$E_{CCPoultryskinlessCDC} = (41,521 \times 3.64) / 2000 / 39 = 1.94 \text{ tons VOC}$$

$$E_{CCPorkCDC} = (8,991 \times 3.64) / 2000 / 39 = 0.42 \text{ tons VOC}$$

$$E_{CCSeafoodCDC} = (18,575 \times 0.76) / 2000 / 39 = 0.18 \text{ tons VOC}$$

Total Baltimore County Ecc for CDC Conveyorzed (sum all emissions)

$$E_{CCBaltoCOCDC} = 11.67 \text{ tons VOC per year}$$

Daily Emissions Calculation

Chain-Driven Charbroilers for Baltimore County was found to have a

SAF = seasonal adjustment factor of 0.3333333

POS = peak ozone period of 0.25

Days of the Period 365

$$\text{Daily adjusted } E_{CCBaltoCOCDCda} = (E_{CCBaltoCOCDC} / 365) * (\text{SAF} / \text{POS})$$

$$E_{CCBaltoCOCDCda} = (11.67 / 365) * (0.3333333 / 0.25) = 4.26E-02 \text{ VOC tons/day}$$

4.1.8 FUGITIVE SOURCES

Other area sources include forest fires, slash and prescribed burning, agricultural burning, structure fires, orchard heaters, leaking underground storage tanks and natural organic sources. Although often intermittent in nature, many of these sources can produce large quantities of air pollutant emissions.

4.1.8.1 Residential Construction Activity

SCC: 23 11 010 000

Description

This source category covers fugitive dust emissions from residential construction activities.

PM₁₀, PM_{2.5}, and HAPs

Method and Data Sources

Activity

For residential construction, housing permit data for single-family units, two-family units, and apartments were obtained at the county level from the U.S. Department of Commerce's (DOC) Bureau of the Census.

Estimated the number of buildings in each category, and then estimated the total acres disturbed by construction by applying conversion factors to the housing start data for each category as follows:

- Single-family ¼ acre/building
- Two-family ⅓ acre/building
- Apartment ½ acre/building

Housing construction PM₁₀ emissions are calculated using an emission factor of 0.032 tons PM₁₀/acre/month, the number of housing units created a units-to-acres conversion factor, and the duration of construction activity. The duration of construction activity for houses is assumed to be 6 months.

Apartment construction emissions are calculated separately using an emission factor of 0.11 tons PM₁₀/acre/month; with a 12 months period assumed for apartment construction.

For areas in which basements are constructed to estimate the cubic yards of dirt moved per house, an average value of 2000 square feet is assumed for both single family and two-family homes. Multiplying the average total square feet by an average basement depth of 8 feet and adding in 10 percent of the cubic feet calculated for peripheral dirt removed produces an estimate of the cubic yards of earth moved during residential construction. The percentage of one-family houses with basements was obtained from the DOC. The percentage of houses per Census region (Northeast,

Midwest, South, and West) that contain full or partial basements is applied to the housing start estimates for each of these respective regions. The best available control measures (BACM) Level 2 equation (emission factor of 0.011 tons PM₁₀/acre/month plus 0.059 tons PM₁₀/1000 cubic yards of on-site cut/fill) is applied once the number of acres disturbed due to the estimated number of houses built with basements is determined.

Table 4.1.7.1-a Emission Factors

	Single-family Construction ton PM ₁₀ /acre/month	Two-family Construction ton PM ₁₀ /acre/month	Multi-family Construction ton PM ₁₀ /acre/month
PM ₁₀ Emission Factor	0.032	0.032	0.11
Duration of Activity	6 months	6 months	12 months

Point Source Adjustments

No subtraction of emissions from point sources is necessary.

Adjustments for Controls

No controls are available for this source category.

Spatial and Temporal Allocations

Spatial

Data for spatial allocation is not available for this source.

Temporal

SAF was applied to emissions and were averaged according to period of operation to a daily estimate. See section 2.2.1.1

Emissions Calculation

$$E_{RCi} = E_{RC-SFH} + E_{RC-2FAM} + E_{RC-MF}$$

Where:

E_{RCi} = Emissions of pollutant i in tons per year from residential construction activity

- E_{RC-SFH} = Emissions of pollutant i in tons per year from residential single-family home construction activity
 $E_{RC-2FAM}$ = Emissions of pollutant i in tons per year from residential two-family home construction activity
 E_{RC-MF} = Emissions of pollutant i in tons per year from residential multi-family construction activity

and:

$$E_{RC-SFH} = E_{RC-SFH, w BM} + E_{RC-SFH, w/o BM}$$

Where:

- $E_{RC-SFH, w BM}$ = Emissions of pollutant i in tons per year from residential single-family home construction activity of homes with basements
 $E_{RC-SFH, w/o BM}$ = Emissions of pollutant i in tons per year from residential single-family home construction activity of homes without basements

$$E_{RC-SFH, w/o BM} = \frac{HS_{SFH} \times (1 - HS_{SFH, w BM}) \times (AD_{RC-SFH}) \times (PD_{RC-SFH}) \times EF_{RC-SFH}}{2000}$$

Where:

- $E_{RC-SFH, w/o BM}$ = Emissions of pollutant i in tons per year from residential single-family home construction activity
 HS_{SFH} = Residential single-family housing starts
 $HS_{SFH, w BM}$ = Percent of residential single-family housing starts with basements
 AD_{RC-SFH} = Acres disturbed per housing type (residential single-family)
 PD_{RC-SFH} = Average project duration in months
 $EF_{RC-SFH i}$ = Emissions factor in tons PM10/acre/month for pollutant i

$$E_{RC-SFH, w BM} = \text{Emissions from residential construction} + \text{Emissions from basement excavation}$$

$$E_{RC-SFH, w BM} = \frac{[HS_{SFH} \times HS_{SFH, w BM} \times (AD_{RC-SFH}) \times (PD_{RC-SFH}) \times EF_{RC-SFH}] + [HS_{SFH} \times HS_{SFH, w BM} \times AHS_{RC-SFH} \times ABD_{RC-SFH} \times PDE_{RC-SFH} \times EF_{Acres-Disturb}]}{2000}$$

where:

- $E_{RC-SFH, w BM}$ = Emissions of pollutant i in tons per year from residential single-family home construction activity
 HS_{SFH} = Residential single-family housing starts
 $HS_{SFH, w BM}$ = Percent of residential single-family housing starts with basements
 AD_{RC-SFH} = Acres disturbed per housing type (residential single-family)
 PD_{RC-SFH} = Average project duration in months

- $EF_{RC-SFH\ i}$ = Emissions factor in tons PM₁₀/acre/month for pollutant i
 AHS_{RC-SFH} = Average residential single-family house size (national default = 2000 ft²)
 ABD_{RC-SFH} = Average basement depth for residential single-family homes
 (national default = 8 ft)
- PDE_{RC-SFH} = Peripheral dirt excavated for residential single-family homes
 (national default = 10 percent)
- $EF_{Acres-Disturb}$ = Emissions factor for the acres disturbed during basement excavation
 activities during residential single-family home construction in tons
 PM₁₀/1000 cubic yards

4.1.8.2 Heavy Construction Activity

SCC: 23 11 020 000

Description

Emissions produced from the construction of nonresidential buildings are estimated using the value of construction put in place. The national value of construction put in place is obtained from the Bureau of the Census⁶³. The national value of construction put in place is allocated to the state level using non-residential building construction employment data within NAIC Code 2362 obtained from 2010 County Business Patterns⁶⁴. The state value of construction put in place is allocated to the county level using non-residential building construction employment data within NAIC Code 2362 obtained from the 2010 County Business Patterns for the State of Maryland.

Pollutants

PM₁₀ and PM_{2.5}

Method and Data Sources

Activity

ARA used data from the U.S. Census Bureau on the national value of construction put in place- Not Seasonally Adjusted. The national value of construction put in place is allocated to the state level and then to the county level using non-residential building construction employment data within NAIC 2362 obtained from 2016 County Business Patterns.

A conversion factor of 2.2902276 acres/10⁶ dollars (\$) is applied to the construction valuation data. This conversion factor is developed by adjusting the 1999 value of 2 acres/\$10⁶ to 1999 - 2017 constant dollars using The Bureau of Labor Statistics *Producer Price Index*⁶⁵ for Construction. The duration of construction activity for nonresidential construction is estimated to be 11 months.

Employee numbers were taken from County Business Patterns 2016 - Maryland, NAIC 2362, Non-residential Building Construction (see Appendices). Some county employment data is represented by a letter code indicating a range for the number of employees for that NAIC. In this case the arithmetic average number of employees per letter code per county was adjusted so that the state total employment in a NAIC matched the sum of the number of employees reported per county.

Table 4.1.7.2-a Emission Factors

⁶³ Bureau of Census, Annual Value of Construction Put in Place - Not Seasonally Adjusted in the United States: 2016

⁶⁴ U.S. Census Bureau, County Business Patterns, NAIC Code 2362, Industry Nonresidential Building Construction 2016

⁶⁵ U.S. Census Bureau, County Business Patterns, 2016

	PM ₁₀ (tons/acre/month)	PM _{2.5} (tons/acre/month)
Emissions	0.11	20% of PM ₁₀
Duration of Project	11 months	

Point Source Adjustments

No subtraction of emissions from point sources is necessary.

Adjustments for Controls

No controls are available for this source category.

Spatial and Temporal Allocations

Spatial

Data for spatial allocation is not available for this source.

Temporal

SAF was applied to emissions and were averaged according to period of operation to a daily estimate. See section 2.2.1.1

Emissions Calculation

Value of Construction Work in the U.S. - HC_J \$347,666,000,000

Number of Employees within NAIC 2362 in the U.S. – EMP_{US} 562,270

Number of Employees within NAIC 2362 in Maryland 12967

where:

$E_{HC,i}$ = Emissions of pollutant i in tons per year from heavy construction

HC_J = Value of Heavy construction in US j in 2014

EMP_{US} = Employment NAICS 2362 US in 2013

EMP_j = Employment NAICS 2362 County j in 2013

CF_{HC} = Conversion factor (acres/million dollars) for heavy construction (2.29)

$AEF_{HC,i}$ = Adjusted Emissions factor in tons per acre per month for pollutant i

DC_{HC} = Duration of construction activity (11 months)

2014 Sample Calculation Heavy Construction (Baltimore City)

Number of Employees within NAIC 2362
in Baltimore City 470

PE = precipitation-evaporation value for each State,

S = % dry silt content in soil for area being inventoried

$$AEF_{HC\ PM_{10}} = \text{Initial } EF_{HC\ I} \times (24/PE) \times (S/9\%)$$

$$AEF_{HC\ PM_{10}} = 0.19(\text{PM}_{10}) \times (24/114.1) \times (52/9\%)$$

$$AEF_{HC\ PM_{10}} = 0.2309$$

$$E_{HC\ PM_{10}} = HC_j \times (EMP_j / EMP_{us}) \times CF_{HC} \times EF_{HC\ i} \times DC_{HC}$$

$$E_{HC\ PM_{10}} = 347,666 \times (470 / 562,270) \times 2.2902276 \times 0.2309 \times 11$$

$$E_{HC\ PM_{10}} = 1690.54 \text{ tons/year } PM_{10}$$

Daily Emissions Calculation

Heavy Construction for Baltimore City was found to have a

SAF = seasonal adjustment factor of 0.260459225

POS = peak ozone period of 0.25

Days of the Period 365

Daily adjusted $E_{HC\ PM_{10\ da}} = (E_{HC\ PM_{10}} / 365) \times (SAF / POS)$

$$E_{HC\ PM_{10\ da}} = (1690.54 / 365) \times (0.260459225 / 0.25) = 4.83E+00 \text{ } PM_{10} \text{ tons/day}$$

4.1.8.3 Road Construction Activity

SCC: 23 11 030 000

Description

This source category covers fugitive dust emissions from road construction activity. PM_{10} emissions produced by road construction are estimated using an emission factor for heavy construction and the State capital outlay for new road construction.

Pollutants

PM_{10} and PM_{25}

Method and Data Sources

Activity

To estimate the acres disturbed by road construction, the Federal Highway Administration (FHWA) has *Highway Statistics, Section IV - Highway Finance, Table SF-12A, State Highway Agency Capital Outlay*¹ for 2016 which outlines spending by state in several different categories. For this SCC, the

following columns are used: New Construction, Relocation, Added Capacity, Major Widening, and Minor Widening. These columns are also differentiated according to the following six classifications:

- Interstate, urban
- Interstate, rural
- Other arterial, urban
- Other arterial, rural
- Collectors, urban
- Collectors, rural

Dollar expenditures are converted to miles constructed using data obtained from the North Carolina Department of Transportation (NCDOT) in 2000. A conversion of \$4 million/mile is applied to the interstate expenditures. For expenditures on other arterial and collectors, a conversion factor of \$1.9 million/mile is applied, which corresponds to all other projects.

Miles are converted to acres for each of the 6 road type areas using the following estimate of acres disturbed per mile:

- Interstates: Urban, Rural, and Urban Other Arterial - 15.2 Acres Disturbed/mile
- Rural, Other Arterials - 12.7 Acres Disturbed/mile
- Urban, Collectors - 9.8 Acres Disturbed/mile
- Rural, Collectors - 7.9 Acres Disturbed/mile

Emission Factors

A PM₁₀ emission factor of 0.42 tons/acre/month is used to account for the large amount of dirt moved during the construction of roadways. The duration of construction activity for road construction is estimated to be 12 months.

PM₂₅ emissions are estimated by applying a particle size multiplier of 0.10 to PM₁₀ emissions.

Soil Moisture Level

To account for the soil moisture level, base emissions were multiplied by 24 divided by the precipitation-evaporation (PE) value. Precipitation-Evaporation (PE) values were obtained from Thornthwaite's PE Index. Average PE values for each State were estimated based on PE values for specific climatic divisions within a State.

Silt Content

To account for the silt content, base emissions were multiplied by percent dry silt content in soil divided by 9 percent. A data base containing county-level dry silt values were applied to PM₁₀ emissions for each county. These values were derived by applying a correction factor developed by the California Air Resources Board to convert wet silt values to dry silt values.

Point Source Adjustments

No subtraction of emissions from point sources is necessary.

Adjustments for Controls

For construction emissions, a control efficiency of 50 percent is used for both PM₁₀ and PM_{2.5} for PM nonattainment areas. It is assumed that water techniques used statewide, reduce emissions by 50%.

Spatial and Temporal Allocations

Spatial

State-level estimates of acres disturbed are distributed to counties according to the housing starts per county, estimated for the residential construction category.

Temporal

SAF was applied to emissions and were averaged according to period of operation to a daily estimate. See section 2.2.1.1

Emissions Calculation

$$E_{RC,i} = \frac{\text{Exp} \times MC_i \times AD_i \times EF_{RC,i} \times \text{DUR}}{2000}$$

where:

- $E_{RC,i}$ = Emissions of pollutant i in tons per year from road construction
- $\text{Exp}_{RC,i}$ = Expenditures per road type i
- $MC_{RC,i}$ = Miles constructed per road type i
- AD_i = Acres disturbed per road type i
- $EF_{RC,i}$ = Emissions factor (tons per acre per month for pollutant i)
- DUR = Duration of project (months)

This calculation would have to be made for each road classification in a county and then summed to get total for that pollutant for that county.

4.1.8.4 Agricultural Land Preparation

SCC: 28 01 000 003

Description

The land preparation source category includes estimates of the airborne soil particulate emissions produced during the preparation of agricultural lands for planting and after harvest activities. Operations included in this methodology are dicing, tilling, leveling, chiseling, plowing, and other mechanical operations used to prepare the soil. Dust emissions are produced by the mechanical disturbance of the soil by the implement used and the tractor pulling it. Soil preparation activities tend to be performed in the early spring and fall months.

Particulate emissions from land preparation operations are computed by multiplying an emission factor (EF) by an activity factor. The agricultural tilling emission factor provided in the 4th edition of U.S. EPA's AP-42 document is used to estimate soil preparation emissions. The activity factor is based on the number of acres of each crop in production for each county in the State. Because different crops need different operations to prepare the soil, each crop also has its own acre-pass value. Acre-passes are the number of passes, per acre, that are typically needed to prepare a field for planting a particular crop. By combining the crop acreage, crop specific acre-pass data, and the agricultural tilling emission factor, we estimate the particulate matter produced by agricultural land preparation operations.

Agricultural soil preparation particulate dust emissions are estimated *for each crop* in each county in Maryland using the following equation:

$$\text{Emissions}_{\text{CROP}} = \text{Emission Factor} \times \text{Acres}_{\text{CROP}} \times \text{Acre-passes/acre}_{\text{CROP}}$$

The crop emissions for each county are summed to produce the county and statewide particulate matter (PM) and PM emission estimates.

Pollutants

PM₁₀ and PM_{2.5}

Method and Data Sources

Activity

The acreages used for estimating soil preparation emissions were collected from the United States Department of Agriculture and the National Agricultural Statistics Service. A summary of crop acreage harvested in 2017 from individual county agricultural commissioner reports was used to calculate emissions. In computing land preparation PM emissions, acre-passes are the number of passes typically performed to prepare a crop for planting. These operations may occur following harvesting or closer to planting, and can include dicing, tilling, land leveling, and other operations. Each crop is different in the type of soil operations performed and when they occur. MDE used acre-pass estimates compiled by the California Air Resources Board (CARB). For the crops that were not explicitly updated, we either applied an updated crop profile from a similar crop, or used one of the existing CARB profiles.

Emission Factors

The emission factor used to estimate the dust emissions from agricultural land preparations is from U.S. EPA's AP-42⁶⁶. This emission factor was developed in 1981 based on test data measured in California and Kansas by Midwest Research Institute. Because of a lack of more detailed estimates,

⁶⁶ U.S. Environmental Protection Agency. Compilation of Air Pollutant Emission Factors, AP-42, Section 11.2.2, Fourth Edition September 1985.

this single emission factor is used for all land preparation operations, all locations, and all seasons. The form of the emission factor is:

$$\text{Emission Factor (lbs PM/acre-pass)} = k (4.8) (s)^{0.6}$$

Where:

- k = particle size fraction of interest (EPA default = 0.042 for PM_{2.5} or 0.21 for PM₁₀)
- s = average percent soil silt content (EPA default = 18%)

For PM the value of 'k' used in California is 0.148. This is based on the EPA estimate that 33% of the total particulate entrained to the air during agricultural operations is 30 microns or less. Of this, analysis of California soil samples indicates that about 45% of the 30 micron or less sized particles are 10 microns or less in aerodynamic size (i.e., PM₁₀). So, the California PM particle size multiplier is 0.148 (i.e., 0.33 x 0.45 = 0.148). Maryland decided to use the EPA default values listed above for the particle size fraction. For the percent soil silt value, the EPA default value of 18% soil silt is used for most counties.

Emission Factor	PM _{2.5}	PM ₁₀
	(Lbs. PM _{2.5} /acre-pass)	(Lbs. PM ₁₀ /acre-pass)
	1.141968254	5.709841268

The EPA emission factor does not include an association between soil moisture and emissions. Because it is known that dust emissions are reduced when soil moisture is higher, California ARB staff has incorporated an emission correction during the wettest months of the year. The correction was based on some limited agricultural dust source test data, as well as the control factor used for watering at construction sites and their best judgment. During December and March, California ARB reduced the emission factor by 25% from the standard uncorrected value. In January and February, often the wettest months, the emission factor is reduced by 50%. This produces a seasonal emissions profile that is more consistent with California's actual ambient air dust levels, and also better reflects that soil preparation operations typically do not occur while the soil is excessively wet or muddy.

Point Source Adjustments

No subtraction of emissions from point sources is necessary.

Adjustments for Controls

No controls are available for this source category.

Spatial and Temporal Allocations

Spatial

Crop acreages are collected on a county basis.

Temporal

Data for temporal allocation is not available for this source in Maryland.

In collecting updated acre-pass data, California also collected detailed information on when agricultural operations occur. Using these data, it was possible to create detailed temporal profiles that help to indicate when PM emissions from land preparations may be highest. The more detailed background document includes detailed crop calendars for each crop with updated information. For all of the acre-pass and crop calendar information, the farmers and other agricultural experts of the San Joaquin Valley were instrumental in helping us to update our crop information.

Emissions Calculation

$$E_{ALP_i} = \frac{EF_{ALP_i} \times A_i \times AP_i}{2000}$$

where:

- E_{ALP} = Annual PM emissions of pollutant i in tons per day from agricultural land preparations.
- EF_{ALP_i} = Emissions factor in pounds per acre-pass for pollutant i
- A_i = Acres of crop I harvested in county j in 2014
- AP_i = Acre-passes per acres for crop i

2014 Sample Calculation Agricultural Land Preparation (Baltimore County)

$$E_{ALP_{PM_{2.5}}} = \frac{EF_{ALP_{PM_{2.5}}} \times [(A_{wheat} \times AP_{wheat}) + (A_{corn-gr} \times AP_{corn-gr}) + (A_{hay} \times AP_{hay}) + (A_{soy} \times AP_{soy}) + (A_{barley} \times AP_{barley})]}{2000}$$

$$E_{ALP_{PM_{2.5}}} = (1.141968254 \times [(0 \times 1) + (17,700 \times 4) + (0 \times 1) + (14,400 \times 6) + (0 \times 1)]) / 2000$$

$$E_{ALPPM_{2.5}} = (1.141968254 \times 157,200) / 2000$$

$$E_{ALPPM_{2.5}} = \mathbf{89.76 \text{ tons per year of } PM_{2.5}}$$

Daily Emissions Calculation

Agricultural Land Preparation for Baltimore County was found to have a

SAF = seasonal adjustment factor of 0.25

POS = peak ozone period of 0.25

Days of the Period 365

Daily adjusted $E_{ALPPM_{2.5da}} = (E_{ALPPM_{2.5}} / 365) \times (SAF / POS)$

$$E_{ALPPM_{2.5da}} = (89.76 / 365) \times (0.25 / 0.25) = \mathbf{2.46E-01 \text{ } PM_{2.5} \text{ tons/day}}$$

4.1.8.5 Paved Roads

SCC: 22 94 000 000

Description

This source category covers fugitive dust emissions from activity on paved roads. ONLY A GENERAL OUTLINE OF HOW THIS SOURCE WAS CALCULATED WILL BE GIVEN DUE TO THE LARGE NUMBER OF CALCULATIONS NEEDED TO SHOW A SAMPLE CALCULATION FOR ANY ONE COUNTY.

Pollutants

PM₁₀ and PM_{2.5}

Method and Data Sources

Activity

The basis for the activity data for fugitive dust emissions from paved roads is the state-level vehicle miles traveled per paved road type and the state-level vehicle miles traveled per unpaved road per road type.

Emission Factors

To calculate emissions for Paved Roads we used The Predictive Emission Factor Equation 13.2.1.3 from AP-42, Fifth Edition Vol. I Chapter 13: Miscellaneous Sources and the particle size multipliers, k from Table 13.2.1-1. Several factors used for Paved Road emissions calculations came from 2008 Emission Inventory Data & Documentation <http://www.epa.gov/ttn/chief/net/2008inventory.html>) Nonpoint section for Paved Roads. Such as, Silt Loading factors for Maryland from Table 2, factors below:

<u>Roadway Class</u>	<u>SL (g/m²)</u>
Rural Interstate	0.015
Rural Other Principal Arterial	0.03
Rural Minor Arterial	0.06
Rural Major Collector	0.2
Rural Minor Collector	0.2
Rural Local	0.6
Urban Interstate	0.015
Urban Other Freeways and Expressways	0.015
Urban Other Principal Arterial	0.03
Urban Minor Arterial	0.03
Urban Collector	0.06
Urban Local	0.2

$$EF_N = [(k) \times (sL)^{0.91} \times (W)^{1.02}] \times (1-P/4N)$$

EF_N = A calculated emission factor for a given road type in a month having N days

k = particle size multiplier; particle size range and units used were 0.015 (lb/VMT) for PM10, and 0.0037 (lb/VMT) for PM2.5 from EPA AP-42 Table 13.2.1-1. PARTICLE SIZE MULTIPLIERS FOR PAVED ROAD EQUATION

sL = road surface silt loading (grams per square meter) (g/m^2),

W = average weight (tons) of the vehicles traveling the road (Maryland estimates the average wt. to be 6,360 pounds or 3.18 tons)

P = Number of days in a month with greater than or equal to 0.1 inch of precipitation, BUT > 0.01 inches

N = number of days in the averaging period (e.g., 365 for annual, 91 for seasonal, 30 for monthly).

A temporal VMT fraction factor was supplied by which was used to breakdown yearly VMT into seasonal and then monthly VMT (millions of miles by road type).

Table 4.1.7.5-a

Look-Up	RUR_URB	SEASON	VMTFRAC
RURALWINTER	RURAL	WINTER	0.2199
RURALSPRING	RURAL	SPRING	0.2403
RURALSUMMER	RURAL	SUMMER	0.2845
RURALLFALL	RURAL	FALL	0.2553
URBANWINTER	URBAN	WINTER	0.236
URBANSPRING	URBAN	SPRING	0.2547
URBANSUMMER	URBAN	SUMMER	0.264
URBANFALL	URBAN	FALL	0.2453

A Transport factor (TF) also of 1, was used in estimation.

Allegany County Rural Interstate emissions example calculation:

$$EF_N = [(k) \times (sL)^{0.91} \times (W)^{1.02}] \times (1-P/4N)$$

$$EF_N = [(0.0022) \times (0.015)^{0.91} \times (6360/2000)^{1.02}] \times (1-5/4(31))$$

$$EF_N = 0.000150407 \text{ lb/mile}$$

Table 4.1.7.5-b 2014 Annual Rural Traffic VMT (millions of miles)

FUNCTIONAL CLASS	Inter-State	Other Principal Arterial	Minor Arterial	Major Collector	Minor Collector	Local	TOTAL RURAL
ALLEGANY	167	18	25	17	15	49	291
ANNE ARUNDEL	104	27	145	36	26	67	405
BALTIMORE	288	29	76	178	35	123	729
CALVERT	0	23	0	24	26	10	83
CAROLINE	0	117	110	72	38	64	401
CARROLL	0	41	188	91	58	69	447
CECIL	218	34	109	38	40	86	525
CHARLES	0	114	70	72	55	55	366
DORCHESTER	0	92	77	31	29	43	272
FREDERICK	248	206	90	162	84	152	942
GARRETT	175	68	65	71	45	81	505
HARFORD	67	71	133	89	54	77	491
HOWARD	275	67	74	69	31	104	620
KENT	0	32	45	51	26	28	182
MONTGOMERY	74	0	72	80	30	48	304
PRINCE GEORGE'S	0	32	27	63	35	26	183
QUEEN ANNE'S	0	309	75	76	46	99	605
ST. MARY'S	0	174	167	86	68	92	587
SOMERSET	0	88	35	25	23	32	203
TALBOT	0	206	95	33	26	72	432
WASHINGTON	505	23	91	82	51	151	903
WICOMICO	0	146	11	47	39	44	287
WORCESTER	0	220	31	59	26	67	403
BALTIMORE CITY	0	0	0	0	0	0	0
GRAND TOTALS	2121	2137	1811	1552	906	1639	10166

Table 4.1.7.5-c 2014 Annual Urban Traffic VMT (millions of miles)

FUNCTIONAL CLASS	Inter-state	Freeways & Express-ways	Other Principal Arterial	Minor Arterial	Collector	Local	TOTAL URBAN
ALLEGANY	158	0	176	92	37	33	496
ANNE ARUNDEL	1186	1618	969	792	483	358	5406
BALTIMORE	3612	465	1148	1260	582	502	7569
CALVERT	0	32	440	52	94	44	662
CAROLINE	0	0	0	0	0	0	0
CARROLL	37	0	467	136	126	54	820
CECIL	329	13	184	143	62	52	783
CHARLES	0	0	534	176	118	59	887
DORCHESTER	0	0	62	11	12	6	91
FREDERICK	802	319	301	211	288	136	2057
GARRETT	0	0	1	0	0	0	1
HARFORD	704	136	441	310	222	129	1942
HOWARD	1074	1065	247	448	316	224	3374
KENT	0	0	12	10	5	2	29
MONTGOMERY	2475	434	2085	1057	561	469	7081
PRINCE GEORGE'S	2994	1534	1826	996	713	572	8635
QUEEN ANNE'S	0	47	240	3	22	22	334
ST. MARY'S	0	9	180	52	45	20	306
SOMERSET	0	45	10	7	5	5	72
TALBOT	0	0	150	11	15	12	188
WASHINGTON	504	0	200	204	109	72	1089
WICOMICO	0	188	215	127	106	45	681
WORCESTER	0	26	209	42	38	22	337
BALTIMORE CITY	1061	136	1128	629	215	225	3394
GRAND TOTALS	14936	6067	11225	6769	4174	3063	46234

VMT should be converted into monthly totals by county by road type using seasonal fraction factors.

$$E_{rt} = EF_N \times VMT \times TF$$

Where:

E_{rt} = is the emissions for a particular road type

VMT = the vehicle miles traveled in millions of miles on a particular road type

$TF=1$

$$E_{PM10Allegany} = EF_N \times (VMT \times VMTFRAC_{winter}) \times TF$$

$$E_{PM10Allegany} = 0.000150407 \times (167 \times 0.2199) \times 1$$

$$E_{PM10Allegany} = 0.9408 \text{ tons per winter of PM}_{10} \text{ Inter-State Rural traffic emissions}$$

The previous calculations must now be repeated for each of 12 months using seasonal *VMTFRAC* for 13 different road types in Allegany and then summed to obtain the total emission for the county. The same process must be repeated for all counties to get a state total.

Daily Emissions Calculation

Paved Road for each Maryland County was found to have a

SAF = seasonal adjustment factor of 0.28

POS = peak ozone period of 0.25

Days of the Period 365

Daily adjusted $E_{PM10-PRIannual\ ad} = (E_{PM10-PRIannual} / 365) * (SAF / POS)$

You can total emissions for a given county and apply the daily parameters in the adjusted emissions equation above to obtain its daily emissions. The same method is used to calculate $PM_{2.5}$.

4.1.8.6 Unpaved Roads

SCC: 22 96 000 000

Description

This source category covers fugitive dust emissions +from activity on unpaved roads.

Pollutants

PM₁₀-PRI, PM₁₀-FIL, PM₂₅-PRI, PM₂₅-FIL

Method and Data Sources

Activity

Same method used in 2011 was used in 2014 and 2017 to calculate unpaved road emissions. The following examples were used in 2011. The basis for the activity data for fugitive dust emissions from unpaved roads is the county-level miles of unpaved roads. The unpaved road mileage is converted to county-level vehicle miles traveled per unpaved road type by the following equation:

$$VMT_{UNPAVED(x, i)} = \frac{ADTV_{(i)} * MILES_{UNPAVED(x, i)} * DAYS_{YR}}{1,000,000}$$

Where:

VMT _{UNPAVED(x, i)} :	Annual vehicle miles traveled for county x and road type i (in millions)
ADTV _(i) :	Average Daily Traffic Volume for road type i
MILES _{UNPAVED(x, i)} :	Miles of unpaved roads in county x and road type i
DAYS _{YR} :	Days per year (365) conversion of daily traffic to annual traffic

Maryland received unpaved road mileage by county from the Maryland State Highway Administration. The unpaved road mileage data was divided into two functional classes, (Rural Local and Urban Local). The Rural Local and Urban Local roads were further divided into Rural Unpaved and Urban Unpaved roads. The VMT for Unpaved and Unimproved urban and local roads was calculated and then summed by county.

Mileage on urban and rural local roads was broken down into two groups of average daily travel volume (ADTV) in the 1996 Highway Statistics publication (the last year that data was published). These groups are shown in Table 4.1.7.6-a. Maryland used a reasonable assumption that no more than 50 vehicles travel its urban and rural local unpaved roads daily. The assumed ADTV is 5 for both urban and rural groups (<50 Rural Local volume group).

Table 4.1.7.6-a Assumed Values for Average Daily Traffic Volume by Volume Group

Rural Roads				
Volume Category (vehicles per day per mile)	< 50	50-199	200-499	> 500
Assumed ADTV	5*	125**	350**	550***
Urban Roads				
Volume Category (vehicles per day per mile)	< 200	200-499	500-1999	> 2000
Assumed ADTV	20*	350**	1250**	2200***

Notes: *10% or volume group's maximum range endpoint, ** Average of volume group's range endpoints, *** 110% or volume group's minimum

Table 4.1.7.6-b Daily VMT by County and Road Class

County Name	2011 Daily VMT Rural rt210	2011 Daily VMT Urban rt330
ALLEGANY	0.2076	0.5947
ANNE ARUNDEL	0.0032	0.0529
BALTIMORE	0.0024	0.0368
CALVERT	0.1063	0.1260
CAROLINE	0.4473	0.0000
CARROLL	0.1949	0.2587
CECIL	0.0467	0.0424
CHARLES	0.0215	0.0422
DORCHESTER	0.1420	0.0983
FREDERICK	0.1695	0.4235
GARRETT	0.1852	0.0000
HARFORD	0.0896	0.3122
HOWARD	0.0023	0.0162
KENT	0.0031	0.0011
MONTGOMERY	0.0076	0.2619
PRINCE GEORGE'S	0.0041	0.1557
QUEEN ANNE'S	0.0553	0.0365
ST. MARY'S	0.0246	0.0150
SOMERSET	0.0456	0.0427
TALBOT	0.0086	0.0051
WASHINGTON	0.0544	0.1170
WICOMICO	0.0762	0.1659
WORCESTER	0.0437	0.0759
BALTIMORE CITY	0.0000	0.0542

Unpaved road VMT was calculated first by State and roadway class using temporally allocated NAPAP Inventory factors (seasonal temporal allocations factors or VMT fractions – VMTRAC values). These factors are provided in the EPA publication, "Paved and Unpaved Road VMT temp factors.xls". The seasonal VMT fractions were then multiplied by the ratio of the number of days in a month to the number of days in a

season to adjust to monthly VMTFRAC. The emission factors were then applied to estimate emissions by month.

Below is Table 4.1.7.6-c and d

Seasonal VMT Fractional Values by Road Class

Rural rt210 EPA		Urban rt330 EPA	
SEASON	VMTFRAC	SEASON	VMTFRAC
WINTER	0.2199	WINTER	0.2360
SPRING	0.2403	SPRING	0.2547
SUMMER	0.2845	SUMMER	0.2640
FALL	0.2553	FALL	0.2453

Emission Factors:

Re-entrained road dust emissions for unpaved roads were estimated using unpaved road VMT and the emission factor equation from AP-42¹:

$$EF = \frac{\left[k * \left(\frac{s}{12} \right)^a * \left(\frac{SPD}{30} \right)^b \right]}{\left(\frac{M}{0.5} \right)^c} - C$$

where k, a, b, and c are empirical constants given in Table 1 and

- EF = size specific emission factor (lb/VMT)
- s = surface material silt content (%)
- SPD = mean vehicle speed (mph)
- M = surface material moisture content (%)
- C = emission factor for 1980's vehicle fleet exhaust, brake wear, and tire wear (lb/VMT)

Table 4.1.7.6-e Constants for Unpaved Roads Re-entrained Dust Emission Factor Equation

Constant	PM ₂₅	PM ₁₀
K (lb/VMT)	0.18	1.8
a	1	1
b	0.5	0.5
c	0.2	0.2
C	0.00036	0.00047

Source: AP-42

Average State-level unpaved silt content values, developed as part of the 1985 National Acid Precipitation Assessment Program (NAPAP) Inventory, were obtained from the Illinois State Water Survey². Silt contents of over 200 unpaved roads from over 30 States were obtained. Average silt

¹ United States Environmental Protection Agency, Office of Air Quality Planning and Standards. "Compilation of Air Pollutant Emission Factors, AP-42, Fifth Edition, Volume I: Stationary Point and Area Sources, Section 13.2.2 Unpaved Roads." Research Triangle Park, NC. 2003.

² G. Stensland, Illinois State Water Survey, personal communication with W. Barnard of E.H.

contents of unpaved roads were calculated for each State that had three or more samples for that State. For States that did not have three or more samples, the average for all samples from all States was used. Samples and default values were provided by state. Silt content (%) from (AP-42 Table 13.2.2-1) of **3.9** was used for the Unpaved/Unimproved roads.

Table 4.1.7.6-f State-Level Unpaved Road Surface Material Silt Content Values used in MANE-VU Fugitive Dust Calculations

State	Unpaved Road Surface Material Silt Content (%)	Data Source
Connecticut	3.9	DEFAULT
Delaware	0	No Unpaved Roads
DC	0	No Unpaved Roads
Maine	3.9	DEFAULT
Maryland	3.9	DEFAULT
Massachusetts	3.9	DEFAULT
New Hampshire	3.9	DEFAULT
New Jersey	3.9	DEFAULT
New York	4.7	SAMPLES
Pennsylvania	3.3	SAMPLES
Rhode Island	3.9	DEFAULT
Vermont	3.9	DEFAULT

Table 4.1.7.6-g lists the speeds modeled on the unpaved roads by roadway type. These speeds were determined based on national average speeds modeled for onroad emission calculations and weighted to determine a single average speed for each of the roadway types. The value of 0.5 percent for M was chosen as the national default as sufficient resources were not available to determine more locally-specific values for this variable.

Table 4.1.7.6-g Speeds Modeled by Roadway Type on Unpaved Roads

Unpaved Roadway Type	Speed (mph)
Rural Minor Arterial	39

Rural Major Collector	34
Rural Minor Collector	30
Rural Local	30
Urban Other Principal Arterial	20
Urban Minor Arterial	20
Urban Collector	20
Urban Local	20

The emission factor for paved roads is calculated from the empirical AP-42 formula and then is adjusted for precipitation. Correction factors were applied to the emission factors to account for the number of days with a sufficient amount of precipitation to prevent road dust resuspension. Monthly-corrected emission factors by State and roadway classification were calculated using the following equation:

$$EF_{CORR} = EF * \left[\frac{(D - p)}{D} \right]$$

Where:

EF_{CORR} = unpaved road dust emission factor corrected for precipitation effects

EF = uncorrected emission factor

D = number of days in the month

p = number of days in the month with at least 0.01 inches of precipitation

The number of days in each county with at least 0.01 inches of precipitation in each month was obtained from the National Climatic Data Center³. For counties with more than one precipitation collection station with valid data from the NCDC data set, an average number of precipitation days were calculated for each month from all valid stations in the county. Counties with no precipitation collection station or no valid data were assigned the data from an adjacent county. The 2011 monthly precipitation data for MANE-VU counties were updated and are shown in Table 4.1.7.6-h. This method of assigning monthly precipitation days by county improves on the NEI approach of assigning monthly precipitation data by State. These are the same precipitation data used to calculate paved road emissions for the MANE-VU States.

Table 4.1.7.6-h 2011 Number of Days with at Least 0.01 Inches of Precipitation

State	County	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
MD	ALLEGANY	7	9	12	20	14	12	9	15	15	14	10	9
MD	ANNE ARUNDEL	9	9	12	14	12	10	8	16	16	11	9	7
MD	BALTIMORE	4	5	7	8	8	3	3	2	13	10	8	6
MD	CALVERT	9	4	14	12	11	12	9	10	12	9	11	9
MD	CAROLINE	11	10	11	12	11	11	8	14	12	15	11	6

³ U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Summary of the Day Element TD-3200, 2002 data provided on CD. National Climatic Data Center 2003

State	County	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
MD	CARROLL	12	9	11	16	15	10	7	17	22	14	8	11
MD	CECIL	8	12	11	15	10	9	9	14	19	14	10	5
MD	CHARLES	9	4	14	12	11	12	9	10	12	9	11	9
MD	DORCHESTER	9	4	14	12	11	12	9	10	12	9	11	9
MD	FREDERICK	10	9	12	16	16	10	6	14	22	11	9	7
MD	GARRETT	20	16	18	20	17	12	11	13	14	18	11	15
MD	HARFORD	8	12	11	15	10	9	9	14	19	14	10	5
MD	HOWARD	7	6	14	14	10	2	7	8	10	11	8	8
MD	KENT	11	8	9	15	8	8	7	16	13	11	7	6
MD	MONTGOMERY	10	9	12	17	12	7	7	13	18	12	8	11
MD	PRINCE GEORGE'S	9	10	12	15	13	8	6	11	14	16	9	9
MD	QUEEN ANNE'S	11	10	11	12	11	11	8	14	12	15	11	6
MD	ST. MARY'S	8	6	12	10	11	7	9	11	13	10	9	6
MD	SOMERSET	10	7	12	10	7	8	9	12	12	9	12	9
MD	TALBOT	9	7	11	12	11	11	9	14	12	13	9	10
MD	WASHINGTON	11	10	14	15	16	5	10	16	16	12	8	7
MD	WICOMICO	12	9	12	9	9	14	9	13	13	11	10	8
MD	WORCESTER	10	7	12	10	7	8	9	12	12	9	12	9
MD	BALTIMORE CITY	9	10	10	13	11	8	7	16	13	11	7	6

Point Source Adjustments

No subtraction of emissions from point sources is necessary.

Adjustment for Controls

No controls are available for this source category.

Spatial and Temporal Allocations

Spatial

BMC provided miles of unpaved roads at the county-level to spatially allocate emission estimates.

Temporal

The unpaved road VMT data were temporally allocated by month using the NAPAP⁴ temporal allocation factors. SAF was applied to emissions and were averaged according to period of operation to a daily estimate. See section 2.2.1.1

Emissions Calculation

AP-42 Unpaved Roads Emission Factor Formula

⁴ U.S. Environmental Protection Agency, "The 1985 NAPAP Emissions Inventory: Development of Temporal Allocation Factors," EPA-600/7-89-010d, Air & Energy Engineering Research Laboratory. Research Triangle Park, NC. April 1990.

$$EF = \frac{\left[k * \left(\frac{s}{12} \right)^a * \left(\frac{SPD}{30} \right)^b \right]}{\left(\frac{M}{0.5} \right)^c} - C$$

Where k, a, b, and c are empirical constants given in Table 1 and

EF = size specific emission factor (lb/VMT)

s = surface material silt content (%)

SPD = mean vehicle speed (mph)

M = surface material moisture content (%)

C = emission factor for 1980's vehicle fleet exhaust, brake wear, and tire wear (lb/VMT)

Calculate Local Unpaved Roads Emission Factors

Example: Anne Arundel County - Local Rural Unpaved Roads – PM₂₅

$$EF_{PM25} = \frac{\left[k * \left(\frac{s}{12} \right)^a * \left(\frac{SPD}{30} \right)^b \right]}{\left(\frac{M}{0.5} \right)^c} - C$$

$$EF_{PM25} = \frac{\left[0.27 * \left(\frac{3.9}{12} \right)^1 * \left(\frac{30}{30} \right)^{0.5} \right]}{\left(\frac{0.5}{0.5} \right)^{0.2}} - 0.00036$$

$$EF_{PM25} = 0.08739$$

Adjust Emission Factor Formula for Precipitation

$$EF_{CORR} = EF * \left[\frac{(D - p)}{D} \right]$$

Where:

EF_{CORR} = unpaved road dust emission factor corrected for precipitation effects

EF = uncorrected emission factor

D = number of days in the month

p = number of days in the month with at least 0.01 inches of precipitation

Calculate Unpaved Roads Emission Factors Adjusted for Precipitation

(Example Calculation: Anne Arundel County – July – PM₂₅)

$$EF_{PM25-CORR} = EF_{PM25} * \left[\frac{(D - p)}{D} \right]$$

$$EF_{PM25-CORR} = 0.08739 * \left[\frac{(31 - 8)}{31} \right]$$

$$EF_{PM_{25-CORR}} = 0.064838$$

Emission Equation:

$$EM_{PM_{25}} = \frac{EF_{PM_{25-CORR}} * VMT * VMTFRAC}{2000} * [1 - (CE * RE * RP)]$$

Where:

EM_{PM₂₅} = PM₂₅ emissions in tons per year for unpaved roads in county i

VMT_i = Annual VMT (million miles of Vehicle Miles Traveled for county i)

VMTFRAC = Temporal Allocation Factor

EF_{PM_{25-CORR}} = Unpaved road emission factor adjusted for precipitation in county i

CE = Control efficiency of 0% applied to Urban and Rural roads

RE = Rule effectiveness of 100% applied to Urban and Rural roads

RP = Rule penetration of 100% applied to Urban and Rural roads

Sample Calculation Unpaved Roads (Anne Arundel County - July)

$$EM_{PM_{25}} = \frac{EF_{PM_{25-CORR}} * VMT * VMTFRAC}{2000} * [1 - (CE * RE * RP)]$$

$$EM_{PM_{25}} = \frac{0.0648377 * 0.0001533 * 0.09586}{2000} * [1 - (0 * 100 * 100)]$$

EM_{PM₂₅} = 4.764E-10 tons PM₂₅ for July in Ann Arundel County Rural traffic emissions

Daily Emissions Calculation

Paved Road for each Maryland County was found to have a

SAF = seasonal adjustment factor of 0.28

POS = peak ozone period of 0.25

Days of the Period 365

Daily adjusted **E_{PM₂₅annual ad}** = (E_{PM₂₅annual} / 365) * (SAF / POS)

You can total emissions for a given county and apply the daily parameters in the adjusted emissions equation above to obtain its daily emissions.

4.2 FIRE SOURCES

Some fires are produced from sources such as forest fires, slash and prescribed burning, agricultural burning, structure fires, and vehicle fires.

EPA has developed new tools by which they use to estimate fire emissions for each state from a variety of sources. Using data collected from national fire database and activity on fire incidents and events around the county; with climate data and grid mapping EPA has estimated emissions for counties in each state. The emissions data are posted as csv files for every state on their FTP site. The methods used by EPA reflect use of the SMARTFIRE2 (SF2) framework. For the 2017 PEI MDE reviewed the data and estimations by EPA and decided to accept and use EPA's emissions:

Wild Fires / Forest Fires /smoldering -- SCC: 2810001001

Wild Fires / Forest Fires /flaming -- SCC: 2810001002

Prescribed Burns /smoldering -- SCC: 2810015001

Prescribed Burns /flaming -- SCC: 2810015002

Slash Burns were included with the Prescribed burns emissions by EPA.

4.2.1.1 Vehicle Fires

SCC: 28 10 050 000

Description

This emission guidance report covers air emissions from accidental vehicle fires. Vehicles included are any commercial or private mode of transportation that is authorized for use on public roads.

Pollutants

PM₁₀, NO_x, CO, VOC

Method and Data Sources

Activity

Local data was collected from state or local fire marshals and public safety departments. See the spatial apportioning section for available information sources.

Emission Factors

Emission factors are available for open burning of automobile components including upholstery, belts, hoses, and tires (AP-42, Section 2.5 Open Burning) (EPA, 1996)⁵. The amount of vehicle material burned (the fuel loading) in a vehicle fire must be estimated to use these factors. A conservative assumption is that an average vehicle has 500 pounds of components that can burn in a fire, based on a 3,700 pound average vehicle weight (CARB, 1995)⁶. Maryland used a more conservative assumption based on a 2,000 pound average vehicle weight. EPA and ERTAC committee through a joint study estimated PM_{2.5}-PRI to be 100 lbs per ton of material burned in fire. Also, we used EIIP Vehicle Fires – January 1999 and 2000 guidance.

Pollutant	Lbs/ton burned
VOC	32
NO _x	4
CO	125
PM ₁₀ -PRI	100
PM _{2.5} -PRI	100

Point Source Adjustments

No subtraction of emissions from point sources is necessary.

Adjustment for Controls

⁵ EPA 1996 *Compilation of Air Pollutant Emission Factors--Volume I: Stationary Point and Area Sources. Fifth Edition AP-42*. U. S. Environmental Protection Agency, Office of Air Quality Planning and Standards. (GPO 055-000-00251-7) Research Triangle Park, North Carolina

⁶ CARB 1995. *Emission Inventory Procedural Manual, Vol. III: Methods for Assessing Area Source Emissions*. California Environmental Protection Agency: Air Resources Board.

No controls are available for this source category.

Spatial and Temporal Allocations

Spatial

The activity data for vehicle fires was collected at a county-level. No other method to spatially profile the vehicle fire source category was used.

Temporal

SAF was applied to emissions and were averaged according to period of operation to a daily estimate. See section 2.2.1.1

Emissions Calculation

$$E_{VF,i} = \frac{VB_j \times FLF_{VF} \times EF_{VF,i}}{2000}$$

where:

- $E_{VF,i}$ = Emissions of pollutant i in tons per year from vehicle fires
- VB_j = Vehicles burned in county j in 2017
- FLF_{VF} = Fuel loading factor 0.25 tons/vehicle burned
- $EF_{VF,i}$ = Emissions factor in pounds per ton burned for pollutant i

2017 Example Calculation Vehicle Fires (Anne Arundel County)

$$E_{VF,Ann} = \frac{VB_j \times FLF_{VF} \times EF_{VOC}}{2000}$$

$$E_{VF,Ann} = \frac{(210 \times (0.25) \times 32)}{2000}$$

$$E_{VF,Ann} = \mathbf{0.84 \text{ tons VOC per year emitted from vehicle fires in Anne Arundel County in 2017}}$$

Daily Emissions Calculation

Vehicle Fires for Anne Arundel County was found to have a

SAF = seasonal adjustment factor of 0.25

POS = peak ozone period of 0.25

Days of the Period 365

Daily adjusted $E_{VF,Ann\ da} = (E_{VF,Ann} / 365) \times (SAF / POS)$

$$E_{VF,Ann\ da} = (0.91 / 365) \times (0.25 / 0.25) = \mathbf{2.30E-03 \text{ VOC tons/day}}$$

4.2.1.2 Agricultural Burning

SCC: 21 01 500 000

Description

This source category covers agricultural burning practices used to clear and/or prepare land for planting. Operations included under this category are stubble burning, burning of agricultural crop residues, and burning of standing field crops as part of harvesting (e.g., sugar cane).

Pollutants

PM₁₀ and PM_{2.5},

Method and Data Sources

Emissions from this source were assigned to the open burning category because the county permits issued in 2017 did not require information distinguishing the amount of agricultural waste to be burned versus other materials.

4.2.1.3 Structure Fires

SCC: 28 10 030 000

Description

Building fires produce short-term emissions of organic compounds.

Pollutants

PM₁₀ and PM_{2.5}, NO_x, CO, VOC

Method and Data Sources

MDE staff used emission factors, fuel loading factors and methodology documented in EIIP⁷, Structure Fires, dated July 1999.

Activity

The Maryland State Fire Marshal's office provided the number of structure fires by county.

Emission Factors

	VOC	NO _x	CO	PM10-PRI
	(lbs./ton)	(lbs./ton)	(lbs./ton)	(lbs./ton)
Emissions	11.0	1.4	60.0	10.8
Fuel loading factor:	1.15	Tons/fire		

Point Source Adjustments

No subtraction of emissions from point sources is necessary.

Adjustments for Controls

⁷ Emission Inventory Improvement Program

No controls are available for this source category.

Spatial and Temporal Allocations

Spatial

The activity data for structure fires was collected at a county-level. No other method to spatially profile the prescribed burning source category was used.

Temporal

Because structure fires occur at different times of the year, ARA used no seasonal adjustment factor. The activity level is seven days per week.

Emissions Calculation

$$E_{SF\ i} = \frac{SF_k \times EF_{SF\ i} \times FLF_{SF}}{2000}$$

where:

$E_{FF\ i}$ = Emissions of pollutant i in tons per year from structure fires

FLF_{SF} = Fuel loading factor (tons/acre burned) for structure fires

SF_k = Structure fires in county k in 2017

$EF_{SF\ i}$ = Emission factor for pollutant i in pounds per ton

ARA used an activity level of 7 days a week with no seasonal variation as given in Table 5.8-1 in the EIIP document.

2017 Example Calculation Structure Fires (Baltimore County)

Equation:

$$E_{SF\ BCo} = \frac{SF_k \times EF_{SF\ i} \times FLF_{SF}}{2000}$$

$$E_{SF\ BCo} = \frac{367 \times 11 \times 1.15}{2000}$$

$$E_{SF\ BCo} = \mathbf{2.32 \text{ tons}_{VOC} / \text{year}}$$

Daily Emissions Calculation

Structure Fires for Baltimore County was found to have a

SAF = seasonal adjustment factor of 0.2

POS = peak ozone period of 0.25

Days of the Period 365

Daily adjusted $E_{SF\ BCo\ da} = (E_{SF\ BCo} / 365) \times (SAF / POS)$

$$E_{SF\ BCo\ da} = (2.32 / 365) \times (0.2 / 0.25) = \mathbf{5.09E-03 \text{ VOC tons/day}}$$

4.2.1.4 Orchard Heaters

SCC: 28 01 520 000

Description

In areas of the country where frost threatens orchards, heaters may be used in cold portions of the growing season.

Pollutants

PM₁₀ and PM_{2.5}

Method and Data Sources

Calls to several orchards in Washington and Frederick Counties (where most of the orchards in Maryland are located), revealed that no heaters were used. One orchard used fans to move air on still nights when there would be danger of frost to fruit tree blossoms. Therefore, orchard heaters are not included in Maryland's baseline inventory.

4.3 AMMONIA SOURCES

4.3.1 INTRODUCTION

Currently, there is a significant amount of uncertainty concerning the contribution of soil to ammonia emission levels. High quality emission factors for this category do not exist, and even the physics of ammonia-surface exchange is not well understood. Soils emit and uptake ammonia so it is difficult to evaluate the net contribution, emissions may be potentially significant in some regions if the uptake is not substantial. Indeed, the literature shows that a soil-plant canopy system can be a source of ammonia emissions under certain conditions and a sink under other conditions. Because of this uncertainty, the State of Maryland has decided not to include emissions from soils. MDE inventoried the following sources for ammonia emissions.

- Agricultural Livestock Production Operations
- Agricultural Fertilizer Application
- Mobile Sources
- Publicly Owned Treatment Works (POTWs)
- Human activity

4.3.2 EMISSION CALCULATIONS METHODOLOGY

Normally, the Department uses the Carnegie Mellon University Ammonia Model (CMU-Ammonia Model version 3.6)⁸ computer program to develop an ammonia emissions inventory. However, for the 2017 NEI emissions inventory cycle, MDE has accepted EPA's 2017 emissions inventory data.

The CMU-Ammonia Model program is an approved methodology by EPA for developing ammonia source categories emissions inventory. Basically, the CMU-Ammonia Model program multiplies emission factors per source category by its particular activity data

4.3.3 AMMONIA SOURCE EMISSION CATEGORIES

4.3.3.1 Agricultural Livestock Production Operations

Livestock waste is one of the most important sources of ammonia when considering the sheer magnitude of the emissions. Existing ammonia inventories indicate that livestock wastes are responsible for 50-70% of national ammonia emissions. The United States Department of Agriculture publishes the Census of Agriculture (USDA, 2012), conducted every five years, which includes accurate inventories for livestock; however, the categories of animals reported at the county level differ from the categories of animals for which current emission factors exist.

⁸ Copyright 2004 CMU- NH₃ Ammonia Model Inventory Version 3.6 computer program, Departments of Civil and Environmental Engineering and Engineering and Public Policy Porter Hall Room 119, Carnegie Mellon University, 5000 Forbes Ave, Pittsburgh, PA 15213

2017 activity data were used from the USDA Census of Agriculture data to develop the 2017 ammonia emission inventory.

4.3.3.2 Beef and Dairy cattle (cows)

SCC: 2805002000 (Beef Cattle)
2805018000 (Dairy Cows)

Description

These animals and livestock are sources of ammonia emissions that are due to the biological decomposition of their waste products.

Pollutants

NH₃, VOC

Method and Data Sources

Conceptually, the method for estimating emissions from cattle is to count the number of animals, then multiply this by the average emissions per animal, and the resulting value provides the emissions. The CMU Ammonia Model v.3.6 program utilizes this approach, a methodology approved by EPA for developing the emissions inventory for other categories.

Activity

The U.S. Census Bureau, 2017 was used to obtain activity level data for this category.

Emission Factors

Emission factors are the defaulted values in the CMU ammonia model (version 3.6).

Point Source Adjustments

No subtraction of emissions from point sources is necessary.

Adjustment for Controls

The CMU ammonia model automatically applies controls, when applicable for a given year.

Spatial and Temporal Allocations

Spatial

The CMU ammonia model spatially allocates activity data emissions. Input files specify the state or county then set up county-level allocations factor files for the chosen state.

Temporal

The CMU-NH₃ ammonia model temporally allocates activity data to the different months of the year or annually (yearly). Emissions were averaged according to period of operation to a daily estimate. See section 2.2.1.1

Emissions Calculation

Equation:

2014 TPY ammonia emissions for cows in an individual county

$$EM_{\text{COWS-2014 Total}} = 2014EM_{\text{BC}} + 2014 EM_{\text{MC}} + 2014 EM_{\text{HF}} + 2014 EM_{\text{ST}}$$

Where:

$EM_{\text{COWS-2014 Total}}$ = Total NH3 emissions from cows, all categories

EM_{BC} = 2014 Uncontrolled emissions from beef cows

EM_{DC} = 2014 Uncontrolled emissions from dairy cows

Where:

$$EM_{\text{BC}} = AC_{\text{BC}} * EF_{\text{BC}}$$

$$EM_{\text{DC}} = AC_{\text{DC}} * EF_{\text{DC}}$$

Where:

AC_{BC} = Activity level (number) of beef cows

AC_{DC} = Activity level (number) of dairy cows

EF_{BC} = Emission factor for beef cows

EF_{DC} = Emission factor for dairy cows

4.3.3.3 Hogs and Pigs

SCC: 28 05 025 000 (Swine Composite)

Description

These animals and livestock are sources of ammonia emissions that are due to the biological decomposition of their waste products.

Pollutants

NH₃, VOC

Method and Data Sources

Conceptually, the method for estimating emissions from hogs and pigs are to count the number of animals, then multiply this by the average emissions per animal, and the resulting value provides the emissions. The CMU Ammonia Model v.3.6 program utilizes this approach, a methodology approved by EPA for developing the emissions inventory for other categories.

Activity

The U.S. Census Bureau, 2017 was used to obtain activity level data for this category.

Emission Factors

Emission factors are the defaulted values in the CMU ammonia model (version 3.6).

Point Source Adjustments

No subtraction of emissions from point sources is necessary.

Adjustment for Controls

The CMU ammonia model automatically applies controls, when applicable for a given year.

Spatial and Temporal Allocations

Spatial

The CMU ammonia model spatially allocates activity data emissions. Input files specify the state or county then set up county-level allocations factor files for the chosen state.

Temporal

The CMU-NH₃ ammonia model temporally allocates activity data to the different months of the year or annually (yearly). Emissions were averaged according to period of operation to a daily estimate. See section 2.2.1.1

Emissions Calculation

Equation:

2014 TPY ammonia emissions for swine in an individual county

$$EM_{\text{SWINE-2014 Total}} = 2014 EM_{\text{HOGS}} + 2014 EM_{\text{PIGS}}$$

Where:

$EM_{\text{SWINE-2014 Total}}$ = Total NH₃ emissions from swine, all categories

EM_{HOGS} = 2014 Uncontrolled emissions from hogs

EM_{PIGS} = 2014 Uncontrolled emissions from pigs

Where:

$$EM_{\text{HOGS}} = (AC_{\text{HOGS}} * EF_{\text{HOGS}})$$

$$EM_{\text{PIGS}} = (AC_{\text{PIGS}} * EF_{\text{PIGS}})$$

Where:

AC_{HOGS} = Activity level (number) of hogs

AC_{PIGS} = Activity level (number) of pigs

EF_{HOGS} = Emission factor for hogs

EF_{PIGS} = Emission factor for pigs

4.3.3.4 Chickens (Layers and Broilers)

SCC: 28 05 007 100 (Chickens Layers)
28 05 009 100 (Broilers, Poultry)

Description

These animals and livestock are sources of ammonia emissions that are due to the biological decomposition of their waste products.

Pollutants

NH₃, VOC

Method and Data Sources

Conceptually, the method for estimating emissions from chickens composite is to count the number of animals, then multiply this by the average emissions per animal, and the resulting value provides the emissions. The CMU Ammonia Model v.3.6 program utilizes this approach, a methodology approved by EPA for developing the emissions inventory for other categories.

Activity

The U.S. Census Bureau, 2017 was used to obtain activity level data for this category.

Emission Factors

Emission factors are the defaulted values in the CMU ammonia model (version 3.6).

Point Source Adjustments

No subtraction of emissions from point sources is necessary.

Adjustment for Controls

The CMU ammonia model automatically applies controls, when applicable for a given year.

Spatial and Temporal Allocations

Spatial

The CMU ammonia model spatially allocates activity data emissions. Input files specify the state or county then set up county-level allocations factor files for the chosen state.

Temporal

The CMU-NH₃ ammonia model temporally allocates activity data to the different months of the year or annually (yearly). Emissions were averaged according to period of operation to a daily estimate. See section 2.2.1.1

Emissions Calculation

Equation:

2014 TPY ammonia emissions for chickens in an individual county

$$EM_{\text{CHICKENS-2014 Total}} = 2014 EM_{\text{LAYER}} + 2014 EM_{\text{BROILER}}$$

Where:

$$EM_{\text{CHICKENS-2014 Total}} = \text{Total NH}_3 \text{ emissions from chickens, all categories}$$

$$EM_{\text{LAYER}} = \text{2014 Uncontrolled emissions from layers}$$

$$EM_{\text{BROILER}} = \text{2014 Uncontrolled emissions from broilers}$$

Where:

$$EM_{\text{LAYER}} = AC_{\text{LAYER}} * EF_{\text{LAYER}}$$

$$EM_{\text{BROILER}} = AC_{\text{BROILER}} * EF_{\text{BROILER}}$$

Where:

- AC_{LAYER} = Activity level (number) of layer chickens
- AC_{BROILER} = Activity level (number) of broiler chickens
- EF_{LAYER} = Emission factor for layer chickens
- EF_{BROILER} = Emission factor for broiler chickens

4.3.3.5 Agricultural Fertilizer Application

SCC: 28 01 700 099 (Miscellaneous Fertilizers)

Description:

The following description comes directly from the EPA's agricultural fertilizer application documentation.

"Fertilizer in this category refers to any nitrogen-based compound, or mixture containing such a compound, that is applied to land to improve plant fitness.

The approach to estimate 2017 fertilizer emissions consists of these general steps:

- Run the Fertilizer Emissions Scenario Tool for CMAQ (FEST-C¹) and CMAQ² model with bidirectional ("bidi") NH₃ exchange to produce year 2011 nitrate (NO₃) Ammonium (NH₄, including Urea), and organic (manure) nitrogen fertilizer estimates and gaseous ammonia NH₃ emission estimates respectively.
- Run the Environmental Policy Integrated Climate (EPIC³) modeling system to produce year 2017 NO₃, Ammonium (including Urea), and organic (manure) nitrogen fertilizer estimates.
- Compute emission factors from the FEST-C outputs to use in estimating year 2017 NH₃ emissions.
- All emissions are assigned to one SCC: "...Miscellaneous Fertilizers" (2801700099).

FEST-C reads land use data from the Biogenic Emissions Landuse Dataset (BELD) version 4, meteorological variables from the Weather Research and Forecasting (WRF⁴) model, and nitrogen deposition data from a previous or historical average CMAQ simulation.

Pollutants

NH₃

Emission Factors

The emission factors were derived from the 2011 FEST-C outputs. Total fertilizer emission factors for each month and county were computed by taking the ratio of total fertilizer NH₃ emissions (short tons) to total nitrogen fertilizer application (short tons).

Sample Calculations

EPA's modeling system is too large and many spreadsheets would be needed to show chemical make and transport modeling, making it very difficult to show a sample calculation.

5.0 NONROAD SOURCES-DONE 02-22

5.1 INTRODUCTION NONROAD VEHICLES/ENGINES

This section contains the nonroad source emission inventory for volatile organic compounds (VOCs), nitrogen oxides (NOx), and carbon monoxide (CO) air pollutants. Nonroad mobile sources include motorized vehicles and equipment that are normally not operated on public roadways to provide transportation. Nonroad mobile sources are broken up into the following categories:

Modeled Sources

- Lawn and garden equipment
- Airport service equipment
- Logging equipment
- Recreational marine equipment
- Light commercial equipment
- Industrial equipment
- Construction and Mining equipment
- Agricultural or farm equipment
- Recreational land vehicles or equipment

Off-Model Sources

- Railroads
- Aircraft
 - Commercial aviation
 - Air taxis
 - General aviation
 - Military aviation
- Commercial Marine Vessels

MDE used the latest version of the MOVES3.0 model approved by the EPA for developing the 2017 SIP emissions inventory for nonroad categories. In a memorandum¹, dated June 16, 2003, EPA allowed the use of the draft NONROAD Model and associated default inputs in the development of inventories supporting State Implementation Plans (SIPs), in which the methodologies entailed the use of EPA emission factors. The NONROAD2008 independently can not be used for SIP reporting because they do not contain the current updates required by EPA which are part of the MOVES3.0 portion. MOVES3.0 incorporates significant improvements in calculating nonroad equipment emissions.

¹ USEPA Memorandum, dated June 16, 2003, from Gene Tierney of the Air Quality and Modeling Center and Leila H. Cook of the Transportation and Regional Programs Division; to Regional Mobile Source Program Managers and Staff.

5.2 MOVES3.0 MODEL

The MOVES3.0 Model incorporates the version of the NONROAD2008 models to calculate nonroad emissions. The MOVES-Nonroad model produces county-level mobile source emission inventories from a national county database that can be easily updated which includes onroad and nonroad data for each state. The National County Database (NCD) used for nonroad inputs by the model is capable of processing county-level inputs on an annual, monthly, or daily basis in a single model run.

5.3 MOVES-NONROAD EMISSION CALCULATION METHODOLOGIES

The MOVES-Nonroad model estimates emissions for each specific type of nonroad equipment by multiplying the following input data estimates:

- Equipment population for base year (or base year population grown to a future 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 factor with deterioration and/or new standards.

The emissions are then temporally and geographically allocated using appropriate allocation factors. There are several input files that provide necessary information to calculate and allocate emissions estimates. These input files correspond to the basic data needed to provide the calculations: emission factors, base year equipment population, activity, load factor, average lifetime, scrappage function, growth estimates, and geographic and temporal allocation. Default values are provided for all input files.

5.4 EMISSIONS 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 in MOVES3.0 Model. The MOVES-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).

The MOVES-Nonroad model estimates air pollution from more than 80 types of compression ignition (CI) and spark ignition (SI) nonroad engines including such items as lawnmowers, motorboats, portable generators and construction equipment. By bringing together information on engine populations, equipment use, and emission factors, the MOVES-Nonroad model estimates nonroad emissions for specific states and counties for past and future years, providing a flexible tool that can be applied to a wide variety of air quality modeling and planning functions.

The MOVES-Nonroad calculations rely on emissions factors – estimates of the amount of pollution emitted by a particular type of equipment during a unit of use. Typically, emission factors for nonroad engines are reported in grams per horsepower-hour (g/hp-hr), but they also may be reported in grams per mile, grams per hour, and grams per gallon. The CI emission factors in the MOVES-Nonroad model are reported in g/hp-hr and are based on emissions test data where available and adjusted when necessary to account for in-use operation that differs from the typical test conditions. These emission

factors are stored in MOVES-Nonroad’s data input files. Emission changes with the age of the engine, often called ‘deterioration,’ are also applied by the model²,

The MOVES-Nonroad model was used to estimate average ozone season day emissions for VOC, NO_x, and CO for the purposes of creating the base year 2017 emissions inventory. All emissions sources in the model were included in the run.

Average Ozone Season Day (OSD) daily emissions were estimated by using the month of July’s weekends and weekdays totals and then divided by 31 to get an average OSD daily emissions. The MOVES-Nonroad model default inputs (temperature, fuel, and other parameters) used in this analysis are included in the NCD county database mentioned above and were the same as the inputs used in developing the 2017 NEI for the Nonroad model sources.

5.5 NONROAD MOVES MODEL CATEGORIES

The following is a list of each nonroad category with its description, data sources, methods used, a sample calculation, and a table with results for each county.

5.5.1 LAWN AND GARDEN EQUIPMENT

SCC: 2-Stroke, 4-Stroke, and LPG equipment

2260004015	2260004030	2265004011	2265004031	2265004051	2265004076	2270004071
2260004016	2260004031	2265004015	2265004035	2265004055	2270004031	2270004076
2260004020	2260004035	2265004016	2265004036	2265004056	2270004036	2267004066
2260004021	2260004036	2265004025	2265004040	2265004066	2270004046	
2260004025	2260004071	2265004026	2265004041	2265004071	2270004056	
2260004026	2265004010	2265004030	2265004046	2265004075	2270004066	

Description

Lawn and garden equipment includes a variety of types of machinery used in the maintenance of lawns and gardens. Examples of the types of equipment included in this category are trimmers/edgers/brush cutters, lawn mowers, leaf blowers, snow blowers, rear engine riding mowers, front mowers, chainsaws (<4HP), shredders (<5HP), tillers (<5HP), lawn and garden tractors, wood splitters, snow blowers, chippers/stump grinders, commercial turf equipment, and other lawn and garden equipment. Emissions result from operation of the internal combustion engines that power the equipment.

Pollutants

CO, NO_x, and VOC

Method and Data Sources

² Exhaust and Crankcase Emission Factors for Nonroad Compression-Ignition Engines in MOVES20114b.

Data sources

- EPA's "MOVES3.0 User Guide" and "User's Guide for Nonroad Emissions Model NONROAD2008" both contain an overview of the model, equipment types, pollutants reported, geographic and temporal coverage, the model components, model inputs, and output options. The guides document how to install and run the models and the associated reporting utilities.
- MOVES3.0 Website: <https://www.epa.gov/moves/latest-version-motor-vehicle-emission-simulator-moves>
- NONROAD2008 Website: <https://www.epa.gov/moves/nonroad-model-nonroad-engines-equipment-and-vehicles>

Methods sources

Based upon EPA's requirements for determining nonroad emissions, the Department ran the MOVES-Nonroad Model to calculate nonroad emissions estimates for 2017. MDE-ARA opted to choose monthly seasonal (Annual and Summer) period totals as the output files from the model.

Point Source Adjustments

No subtraction of emissions from point sources is necessary.

Adjustments for Controls

The MOVES-Nonroad model automatically applies controls, when applicable, for a given year.

Spatial and Temporal Allocations

Spatial

The MOVES-Nonroad models spatially allocates equipment populations and emissions. Input files specify the state or county then sets up the population and allocation factor data files for the chosen state.

Temporal

The MOVES-Nonroad model allocates activity monthly through the National County Database (NCD). The model can calculate emissions for a variety of time periods; an entire year, one of four seasons, or any particular month. Emissions for the period selected are estimated either for the total period or for a typical day (weekday or weekend) in that period. Average Ozone Season Day (OSD) daily emissions were estimated using the month of July's weekends and weekdays emissions. The weekend and weekday emissions were multiplied by the fraction of weekend or weekday days for the month of July. (Note: fraction weekday portion for example is calculated by dividing the number of weekdays in July (23 days in 2020) by the total number of days in July (31). The sum of the products (weekday daily emissions times weekday fraction plus weekend daily emissions times weekend day fraction), is the average of weekend day emissions.

Emissions Calculation

The MOVES-Nonroad model estimates the amount of pollution emitted by a particular type of equipment during a unit of use. Emission factors activity data are stored in MOVES-Nonroad's data input files. Adjustments are made within the model based on the age of equipment and controls applied for given time frames. Emission changes with the age of the engine, often called 'deterioration', are also applied by the model.

5.5.2 AIRPORT SERVICE EQUIPMENT

SCC: 22 65 008 005 (4-Stroke)
22 67 008 005 (LPG)
22 70 008 005

Description

Airport service equipment includes a variety of types and sizes of machinery used to tow airplanes or for transferring luggage between a terminal and an airplane. Examples of the types of equipment included in this category are aircraft support equipment and terminal tractors. Emissions result from operation of the internal combustion engines that power the equipment.

Pollutants

CO, NO_x, and VOC

Method and Data Sources

Data sources

- EPA's "MOVES3.0 User Guide" and "User's Guide for Nonroad Emissions Model NONROAD2008" both contain an overview of the model, equipment types, pollutants reported, geographic and temporal coverage, the model components, model inputs, and output options. The guides document how to install and run the models and the associated reporting utilities.
- MOVES3.0 Website: <https://www.epa.gov/moves/latest-version-motor-vehicle-emission-simulator-moves>
- NONROAD2008 Website: <https://www.epa.gov/moves/nonroad-model-nonroad-engines-equipment-and-vehicles>

Methods sources

Based upon EPA's requirements for determining nonroad emissions, the Department ran the MOVES-Nonroad Model to calculate nonroad emissions estimates for 2017. MDE-ARA opted to choose monthly seasonal (Annual and Summer) period totals as the output files from the model.

Ground Support Equipment (GSE) emissions were estimated using MOVES3.0 nonroad modeling for all airports. Additional GSE emissions for large and military airports were calculated using the EPA

EDMS³ model and those values were subtracted from MOVES3.0 nonroad GSE emissions when reporting Quazi Point totals for nonattainment counties only.

Point Source Adjustments

No subtraction of emissions from point sources is necessary.

Adjustments for Controls

The MOVES-Nonroad model automatically applies controls, when applicable, for a given year.

Spatial and Temporal Allocations

Spatial

The MOVES-Nonroad model spatially allocates equipment populations and emissions. Input files specify the state or county then sets up the population and allocation factor data files for the chosen state.

Temporal

The MOVES-Nonroad model allocates activity monthly through the National County Database (NCD). The model can calculate emissions for a variety of time periods; an entire year, one of four seasons, or any particular month. Emissions for the period selected are estimated either for the total period or for a typical day (weekday or weekend) in that period. Average Ozone Season Day (OSD) daily emissions were estimated using the month of July's weekends and weekdays emissions. The weekend and weekday emissions were multiplied by the fraction of weekend or weekday days for the month of July. (Note: fraction weekday portion for example is calculated by dividing day the number of weekdays in July (23 days in 2020) by the total number of days in July (31). The sum of the products (weekday daily emissions times weekday fraction plus weekend daily emissions times weekend day fraction), is the average of weekend day emissions.

Emissions Calculation

The MOVES-Nonroad model estimates the amount of pollution emitted by a particular type of equipment during a unit of use. Emission factors activity data are stored in MOVES-Nonroad's data input files. Adjustments are made within the model based on the age of equipment and controls applied for given time frames. Emission changes with the age of the engine, often called 'deterioration', are also applied by the model.

5.5.3 RECREATIONAL LAND VEHICLES

SCC:

2260001010	2-Stroke	motorcycles
2260001020	2-Stroke	snowblowers
2260001030	2-Stroke	ATVs

³ Emissions & Dispersion Modeling System (EDMS) Version 4.12 for Windows from CSSI, Inc

2260001060	2-Stroke	Specialty vehicles - carts
2265001010	4-Stroke	motorcycles
2265001030	4-Stroke	ATVs
2265001050	4-Stroke	golf carts
2265001060	4-Stroke	Specialty vehicles - carts
2267001060	LPG	Specialty vehicles - carts
2270001060	Diesel	Specialty vehicles - cartts

Description

Recreational vehicles include a variety of types of vehicles used off normal roads for pleasure use. Examples of the types of vehicles included in this category are all-terrain vehicles, off-road motorcycles, minibikes, and golf carts. Emissions result from operation of the internal combustion engines that power these vehicles.

Pollutants

CO, NOx, and VOC

Method and Data Sources

Data sources

- EPA's "MOVES3.0 User Guide" and "User's Guide for Nonroad Emissions Model NONROAD2008" both contain an overview of the model, equipment types, pollutants reported, geographic and temporal coverage, the model components, model inputs, and output options. The guides document how to install and run the models and the associated reporting utilities.
- MOVES3.0 Website: <https://www.epa.gov/moves/latest-version-motor-vehicle-emission-simulator-moves>
- NONROAD2008 Website: <https://www.epa.gov/moves/nonroad-model-nonroad-engines-equipment-and-vehicles>

Methods sources

Based upon EPA's requirements for determining nonroad emissions, the Department ran the MOVES-Nonroad Model to calculate nonroad emissions estimates for 2017. MDE-ARA opted to choose monthly seasonal (Annual and Summer) period totals as the output files from the model.

Point Source Adjustments

No subtraction of emissions from point sources is necessary.

Adjustments for Controls

The MOVES-Nonroad model automatically applies controls, when applicable, for a given year.

Spatial and Temporal Allocations

Spatial

The MOVES-Nonroad model spatially allocates equipment populations and emissions. Input files specify the state or county then sets up the population and allocation factor data files for the chosen state.

Temporal

The MOVES-Nonroad model allocates activity monthly through the National County Database (NCD). The model can calculate emissions for a variety of time periods; an entire year, one of four seasons, or any particular month. Emissions for the period selected are estimated either for the total period or for a typical day (weekday or weekend) in that period. Average Ozone Season Day (OSD) daily emissions were estimated using the month of July's weekends and weekdays emissions. The weekend and weekday emissions were multiplied by the fraction of weekend or weekday days for the month of July. (Note: fraction weekday portion for example is calculated by dividing day the number of weekdays in July (23 days in 2020) by the total number of days in July (31). The sum of the products (weekday daily emissions times weekday fraction plus weekend daily emissions times weekend day fraction), is the average of weekend day emissions.

Emissions Calculation

The MOVES-Nonroad model estimates the amount of pollution emitted by a particular type of equipment during a unit of use. Emission factors activity data are stored in MOVES-Nonroad's data input files. Adjustments are made within the model based on the age of equipment and controls applied for given time frames. Emission changes with the age of the engine, often called 'deterioration', are also applied by the model.

5.5.4 PLEASURE CRAFT EQUIPMENT

SCC:

2282005010	2-Stroke	Outboard
2282005015	2-Stroke	Personal Water Craft
2282010005	4-Stroke	Inboard/Sterndrive
2282020005	Diesel	Inboard/Sterndrive
2282020010	Diesel	Outboard

Description

Recreational marine equipment includes engines used to power recreational motor boats and sailboat auxiliary engines. Emissions results from the operations of these engines.

Pollutants

CO, NOx, and VOC

Method and Data Sources

Data sources

- EPA's "MOVES3.0 User Guide" and "User's Guide for Nonroad Emissions Model NONROAD2008" both contain an overview of the model, equipment types, pollutants reported, geographic and temporal coverage, the model components, model inputs, and output options. The guides document how to install and run the models and the associated reporting utilities.
- MOVES3.0 Website: <https://www.epa.gov/moves/latest-version-motor-vehicle-emission-simulator-moves>
- NONROAD2008 Website: <https://www.epa.gov/moves/nonroad-model-nonroad-engines-equipment-and-vehicles>

Methods sources

Based upon EPA's requirements for determining nonroad emissions, the Department ran the MOVES-Nonroad Model to calculate nonroad emissions estimates for 2017. MDE-ARA opted to choose monthly seasonal (Annual and Summer) period totals as the output files from the model.

Point Source Adjustments

No subtraction of emissions from point sources is necessary.

Adjustments for Controls

The MOVES-Nonroad model automatically applies controls, when applicable, for a given year.

Spatial and Temporal Allocations

Spatial

The MOVES-Nonroad model spatially allocates equipment populations and emissions. Input files specify the state or county then sets up the population and allocation factor data files for the chosen state.

Temporal

The MOVES-Nonroad model allocates activity monthly through the National County Database (NCD). The model can calculate emissions for a variety of time periods; an entire year, one of four seasons, or any particular month. Emissions for the period selected are estimated either for the total period or for a typical day (weekday or weekend) in that period. Average Ozone Season Day (OSD) daily emissions were estimated using the month of July's weekends and weekdays emissions. The weekend and weekday emissions were multiplied by the fraction of weekend or weekday days for the month of July. (Note: fraction weekday portion for example is calculated by dividing day the number of weekdays in July (23 days in 2020) by the total number of days in July (31). The sum of

the products (weekday daily emissions times weekday fraction plus weekend daily emissions times weekend day fraction), is the average of weekend day emissions.

Emissions Calculation

The MOVES-Nonroad model estimates the amount of pollution emitted by a particular type of equipment during a unit of use. Emission factors activity data are stored in MOVES-Nonroad’s data input files. Adjustments are made within the model based on the age of equipment and controls applied for given time frames. Emission changes with the age of the engine, often called ‘deterioration’, are also applied by the model.

5.5.5 COMMERCIAL EQUIPMENT

SCC	Description	SCC	Description
2260006005	2-Stroke generator set	2267006025	LPG welders
2260006010	2-Stroke pump	2267006030	LPG pressure washers
2260006015	2-Stroke air compressors	2267006035	LPG hydro-power units
2260006035	2-Stroke hydro-power units	2268006005	CNG generator set
2265006005	4-Stroke generator set	2268006010	CNG pump
2265006010	4-Stroke pump	2268006015	CNG air compressors
2265006015	4-Stroke air compressors	2268006020	CNG gas compressors
2265006025	4-Stroke welders	2270006005	Diesel generator set
2265006030	4-Stroke pressure washers	2270006010	Diesel pump
2265006035	4-Stroke hydro-power units	2270006015	Diesel air compressors
2267006005	LPG generator set	2270006025	Diesel welders
2267006010	LPG pump	2270006035	Diesel pressure washers
2267006015	LPG air compressors	2270006035	Diesel hydro-power units

Description

Commercial equipment and Light Diesel Commercial equipment includes a variety of types and sizes of machinery used in small commercial applications. Examples of the types of equipment included in this category are pumps, generators, compressors, and welders. Emissions results from operation of the internal combustion engines that power the equipment.

Pollutants

CO, NOx, and VOC

Method and Data Sources

Data sources

- EPA's "MOVES3.0 User Guide" and "User's Guide for Nonroad Emissions Model NONROAD2008" both contain an overview of the model, equipment types, pollutants reported, geographic and temporal coverage, the model components, model inputs, and output options. The guides document how to install and run the models and the associated reporting utilities.
- MOVES3.0 Website: <https://www.epa.gov/moves/latest-version-motor-vehicle-emission-simulator-moves>
- NONROAD2008 Website: <https://www.epa.gov/moves/nonroad-model-nonroad-engines-equipment-and-vehicles>

Methods sources

Based upon EPA's requirements for determining nonroad emissions, the Department ran the MOVES-Nonroad Model to calculate nonroad emissions estimates for 2017. MDE-ARA opted to choose monthly seasonal (Annual and Summer) period totals as the output files from the model.

Point Source Adjustments

No subtraction of emissions from point sources is necessary.

Adjustments for Controls

The MOVES-Nonroad model automatically applies controls, when applicable, for a given year.

Spatial and Temporal Allocations

Spatial

The MOVES-Nonroad model spatially allocates equipment populations and emissions. Input files specify the state or county then sets up the population and allocation factor data files for the chosen state.

Temporal

The MOVES-Nonroad model allocates activity monthly through the National County Database (NCD). The model can calculate emissions for a variety of time periods; an entire year, one of four seasons, or any particular month. Emissions for the period selected are estimated either for the total period or for a typical day (weekday or weekend) in that period. Average Ozone Season Day (OSD) daily emissions were estimated using the month of July's weekends and weekdays emissions. The weekend and weekday emissions were multiplied by the fraction of weekend or weekday days for the month of July. (Note: fraction weekday portion for example is calculated by dividing the number of weekdays in July (23 days in 2020) by the total number of days in July (31). The sum of the products (weekday daily emissions times weekday fraction plus weekend daily emissions times weekend day fraction), is the average of weekend day emissions.

Emissions Calculation

The MOVES-Nonroad model estimates the amount of pollution emitted by a particular type of equipment during a unit of use. Emission factors activity data are stored in MOVES-Nonroad's data input files. Adjustments are made within the model based on the age of equipment and controls applied for given time frames. Emission changes with the age of the engine, often called 'deterioration', are also applied by the model.

5.5.6 INDUSTRIAL EQUIPMENT

SCC

2260003030	2265003050	2267003030	2268003040	2270003070
2260003040	2265003060	2267003040	2268003060	2270010010
2265003010	2265003070	2267003050	2268003070	2270003030
2265003020	2265010010	2267003070	2268010010	2270003040
2265003030	2267003010	2268003020	2270003010	2270003050
2265003040	2267003020	2268003030	2270003020	2270003060

Description

Industrial equipment includes a variety of types and sizes of machinery. Examples of the types of equipment included in this category are forklifts, sweepers, mobile refrigeration units, auxiliary engines for hydraulic pump service on garbage trucks and other large vehicles, generator and pump service for utilities, airports, and state maintenance organizations, logging, mining, quarrying, oil field operations, and portable well drilling equipment. Emissions results from the operation of the internal combustion engines that power the machines.

Pollutants

CO, NO_x, and VOC

Method and Data Sources

Data sources

- EPA's "MOVES3.0 User Guide" and "User's Guide for Nonroad Emissions Model NONROAD2008" both contain an overview of the model, equipment types, pollutants reported, geographic and temporal coverage, the model components, model inputs, and output options. The guides document how to install and run the models and the associated reporting utilities.
- MOVES3.0 Website: <https://www.epa.gov/moves/latest-version-motor-vehicle-emission-simulator-moves>
- NONROAD2008 Website: <https://www.epa.gov/moves/nonroad-model-nonroad-engines-equipment-and-vehicles>

Methods sources

Based upon EPA's requirements for determining nonroad emissions, the Department ran the MOVES-Nonroad Model to calculate nonroad emissions estimates for 2017. MDE-ARA opted to choose monthly seasonal (Annual and Summer) period totals as the output files from the model.

Point Source Adjustments

No subtraction of emissions from point sources is necessary.

Adjustments for Controls

The MOVES-Nonroad model automatically applies controls, when applicable, for a given year.

Spatial and Temporal Allocations

Spatial

The MOVES-Nonroad model spatially allocates equipment populations and emissions. Input files specify the state or county then sets up the population and allocation factor data files for the chosen state.

Temporal

The MOVES-Nonroad model allocates activity monthly through the National County Database (NCD). The model can calculate emissions for a variety of time periods; an entire year, one of four seasons, or any particular month. Emissions for the period selected are estimated either for the total period or for a typical day (weekday or weekend) in that period. Average Ozone Season Day (OSD) daily emissions were estimated using the month of July's weekends and weekdays emissions. The weekend and weekday emissions were multiplied by the fraction of weekend or weekday days for the month of July. (Note: fraction weekday portion for example is calculated by dividing day the number of weekdays in July (23 days in 2020) by the total number of days in July (31). The sum of the products (weekday daily emissions times weekday fraction plus weekend daily emissions times weekend day fraction), is the average of weekend day emissions.

Emissions Calculation

The MOVES-Nonroad model estimates the amount of pollution emitted by a particular type of equipment during a unit of use. Emission factors activity data are stored in MOVES-Nonroad's data input files. Adjustments are made within the model based on the age of equipment and controls applied for given time frames. Emission changes with the age of the engine, often called 'deterioration', are also applied by the model.

5.5.7 CONSTRUCTION AND MINING EQUIPMENT

SCC: 2-Stroke, 4-Stroke, CNG, and LPG equipment

2260002006	2265002021	2265002060	2267002033	2270002003	2270002045	2270002081
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2260002009	2265002024	2265002066	2267002039	2270002006	2270002048	
2260002021	2265002027	2265002072	2267002045	2270002009	2270002051	
2260002027	2265002030	2265002078	2267002054	2270002015	2270002057	
2260002039	2265002033	2265002081	2267002057	2270002018	2270002060	
2260002054	2265002039	2267002003	2267002060	2270002021	2270002066	
2265002003	2265002042	2267002015	2267002066	2270002024	2270002069	
2265002006	2265002045	2267002021	2267002072	2270002036	2270002072	
2265002009	2265002054	2267002024	2267002081	2270002039	2270002075	
2265002015	2265002057	2267002030	2268002081	2270002042	2270002078	

Description

Construction and mining equipment includes a variety of types and sizes of machinery used in the construction of roadways, buildings, digging and tunneling. Examples of the types of equipment included in this category are bulldozers, power shovels, scrapers, haulers, back hoes, and motor graders. Emissions results from the internal combustion engines used to power this equipment.

Pollutants

CO, NOx, and VOC

Method and Data Sources

Data sources

- EPA's "MOVES3.0 User Guide" and "User's Guide for Nonroad Emissions Model NONROAD2008" both contain an overview of the model, equipment types, pollutants reported, geographic and temporal coverage, the model components, model inputs, and output options. The guides document how to install and run the models and the associated reporting utilities.
- MOVES3.0 Website: <https://www.epa.gov/moves/latest-version-motor-vehicle-emission-simulator-moves>
- NONROAD2008 Website: <https://www.epa.gov/moves/nonroad-model-nonroad-engines-equipment-and-vehicles>

Methods sources

Based upon EPA's requirements for determining nonroad emissions, the Department ran the MOVES-Nonroad Model to calculate nonroad emissions estimates for 2017. MDE-ARA opted to choose monthly seasonal (Annual and Summer) period totals as the output files from the model.

Point Source Adjustments

No subtraction of emissions from point sources is necessary.

Adjustments for Controls

The MOVES-Nonroad model automatically applies controls, when applicable, for a given year.

Spatial and Temporal Allocations

Spatial

The MOVES-Nonroad model spatially allocates equipment populations and emissions. Input files specify the state or county then sets up the population and allocation factor data files for the chosen state.

Temporal

The MOVES-Nonroad model allocates activity monthly through the National County Database (NCD). The model can calculate emissions for a variety of time periods; an entire year, one of four seasons, or any particular month. Emissions for the period selected are estimated either for the total period or for a typical day (weekday or weekend) in that period. Average Ozone Season Day (OSD) daily emissions were estimated using the month of July's weekends and weekdays emissions. The weekend and weekday emissions were multiplied by the fraction of weekend or weekday days for the month of July. (Note: fraction weekday portion for example is calculated by dividing day the number of weekdays in July (23 days in 2020) by the total number of days in July (31). The sum of the products (weekday daily emissions times weekday fraction plus weekend daily emissions times weekend day fraction), is the average of weekend day emissions.

Emissions Calculation

The MOVES-Nonroad model estimates the amount of pollution emitted by a particular type of equipment during a unit of use. Emission factors activity data are stored in MOVES-Nonroad's data input files. Adjustments are made within the model based on the age of equipment and controls applied for given time frames. Emission changes with the age of the engine, often called 'deterioration', are also applied by the model.

5.5.8 AGRICULTURAL EQUIPMENT

SCC			SCC	
2260005035	Gas,2-Stroke	Sprayers	2270005010	Diesel, 2-Wheel Tractors
2265005010	Gas,4-Stroke	2-Wheel Tractors	2270005015	Diesel, Ag-Tractors
2265005015	Gas,4-Stroke	Tractors	2270005020	Diesel, Combines
2265005020	Gas,4-Stroke	Combines	2270005025	Diesel, Balers
2265005025	Gas,4-Stroke	Balers	2270005030	Diesel, Mowers
2265005030	Gas,4-Stroke	Mowers	2270005035	Diesel, Sprayers
2265005035	Gas,4-Stroke	Sprayers	2270005040	Diesel, Tillers : 6 HP

2265005040	Gas,4-Stroke	Tillers : 6 HP	2270005045	Diesel, Swathers
2265005045	Gas,4-Stroke	Swathers	2270005055	Diesel, Ag-Equipt
2265005050	Gas,4-Stroke	Hydro-power Units	2270005060	Diesel, Irrigation Sets
2265005055	Gas,4-Stroke	Other Agricultural Equipt		
2265005060	Gas,4-Stroke	Irrigation Sets		
2267005055	LPG	Other Agricultural Equipt		
2267005060	LPG	Irrigation Sets		
2268005055	CNG	Other Agricultural Equipt		
2268005060	CNG	Irrigation Sets		

Equipt: Equipment;CNG: Compressed Natural Gas; Gas: Gasoline.

Description

The two types of sources within the agricultural equipment category are tractors and all other motorized equipment. Tractors account for most of the emissions produced from agricultural equipment. The primary types of equipment, other than tractors, are combines, balers, harvesters, and general-purpose machines. Emissions results from operation of the internal combustion engines that power the equipment.

Pollutants

CO, NOx, and VOC

Method and Data Sources

Data sources

- EPA's "MOVES3.0 User Guide" and "User's Guide for Nonroad Emissions Model NONROAD2008" both contain an overview of the model, equipment types, pollutants reported, geographic and temporal coverage, the model components, model inputs, and output options. The guides document how to install and run the models and the associated reporting utilities.
- MOVES3.0 Website: <https://www.epa.gov/moves/latest-version-motor-vehicle-emission-simulator-moves>
- NONROAD2008 Website: <https://www.epa.gov/moves/nonroad-model-nonroad-engines-equipment-and-vehicles>

Methods sources

Based upon EPA's requirements for determining nonroad emissions, the Department ran the MOVES-Nonroad Model to calculate nonroad emissions estimates for 2017. MDE-ARA opted to choose monthly seasonal (Annual and Summer) period totals as the output files from the model.

Point Source Adjustments

No subtraction of emissions from point sources is necessary.

Adjustments for Controls

The MOVES-Nonroad model automatically applies controls, when applicable, for a given year.

Spatial and Temporal Allocations

Spatial

The MOVES-Nonroad model spatially allocates equipment populations and emissions. Input files specify the state or county then sets up the population and allocation factor data files for the chosen state.

Temporal

The MOVES-Nonroad model allocates activity monthly through the National County Database (NCD). The model can calculate emissions for a variety of time periods; an entire year, one of four seasons, or any particular month. Emissions for the period selected are estimated either for the total period or for a typical day (weekday or weekend) in that period. Average Ozone Season Day (OSD) daily emissions were estimated using the month of July's weekends and weekdays emissions. The weekend and weekday emissions were multiplied by the fraction of weekend or weekday days for the month of July. (Note: fraction weekday portion for example is calculated by dividing day the number of weekdays in July (23 days in 2020) by the total number of days in July (31). The sum of the products (weekday daily emissions times weekday fraction plus weekend daily emissions times weekend day fraction), is the average of weekend day emissions.

Emissions Calculation

The MOVES-Nonroad model estimates the amount of pollution emitted by a particular type of equipment during a unit of use. Emission factors activity data are stored in MOVES-Nonroad's data input files. Adjustments are made within the model based on the age of equipment and controls applied for given time frames. Emission changes with the age of the engine, often called 'deterioration', are also applied by the model.

5.5.9 LOGGING EQUIPMENT

SCC:

2260007005	Gas,2-Stroke	Chain Saws : 6 HP
2265007010	Gas,4-Stroke	Shredders : 6 HP
2265007015	Gas,4-Stroke	Forest Equipt - Feller/Bunch/Skidder
2270007015	Diesel	Forest Equipt - Feller/Bunch/Skidder

Description

Logging equipment includes chainsaws, shredders, and skidders. Emissions results from operation of the internal combustion engines that power the equipment.

Pollutants

CO, NO_x, and VOC

Method and Data Sources

Data sources

- EPA's "MOVES3.0 User Guide" and "User's Guide for Nonroad Emissions Model NONROAD2008" both contain an overview of the model, equipment types, pollutants reported, geographic and temporal coverage, the model components, model inputs, and output options. The guides document how to install and run the models and the associated reporting utilities.
- MOVES3.0 Website: <https://www.epa.gov/moves/latest-version-motor-vehicle-emission-simulator-moves>
- NONROAD2008 Website: <https://www.epa.gov/moves/nonroad-model-nonroad-engines-equipment-and-vehicles>

Methods sources

Based upon EPA's requirements for determining nonroad emissions, the Department ran the MOVES-Nonroad Model to calculate nonroad emissions estimates for 2017. MDE-ARA opted to choose monthly seasonal (Annual and Summer) period totals as the output files from the model.

Point Source Adjustments

No subtraction of emissions from point sources is necessary.

Adjustments for Controls

The MOVES-Nonroad model automatically applies controls, when applicable, for a given year.

Spatial and Temporal Allocations

Spatial

The MOVES-Nonroad model spatially allocates equipment populations and emissions. Input files specify the state or county then sets up the population and allocation factor data files for the chosen state.

Temporal

The MOVES-Nonroad model allocates activity monthly through the National County Database (NCD). The model can calculate emissions for a variety of time periods; an entire year, one of four seasons,

or any particular month. Emissions for the period selected are estimated either for the total period or for a typical day (weekday or weekend) in that period. Average Ozone Season Day (OSD) daily emissions were estimated using the month of July's weekends and weekdays emissions. The weekend and weekday emissions were multiplied by the fraction of weekend or weekday days for the month of July. (Note: fraction weekday portion for example is calculated by dividing day the number of weekdays in July (23 days in 2020) by the total number of days in July (31). The sum of the products (weekday daily emissions times weekday fraction plus weekend daily emissions times weekend day fraction), is the average of weekend day emissions.

Emissions Calculation

The MOVES-Nonroad model estimates the amount of pollution emitted by a particular type of equipment during a unit of use. Emission factors activity data are stored in MOVES-Nonroad's data input files. Adjustments are made within the model based on the age of equipment and controls applied for given time frames. Emission changes with the age of the engine, often called 'deterioration', are also applied by the model.

5.5.10 RAILWAY MAINTENANCE

SCC: 22 85 002 015 (4-Stroke) Gasoline
22 85 004 015 (Diesel)
22 85 006 015 (LPG)

Description

Railway maintenance equipment is equipment specifically used for repair, maintenance, and construction of rail lines. Examples of some rail equipment are ballast handlers, rail and tie handlers, and rail straightening equipment.

Pollutants

CO, NO_x, and VOC

Method and Data Sources

Data sources

- EPA's "MOVES3.0 User Guide" and "User's Guide for Nonroad Emissions Model NONROAD2008" both contain an overview of the model, equipment types, pollutants reported, geographic and temporal coverage, the model components, model inputs, and output options. The guides document how to install and run the models and the associated reporting utilities.
- MOVES3.0 Website: <https://www.epa.gov/moves/latest-version-motor-vehicle-emission-simulator-moves>
- NONROAD2008 Website: <https://www.epa.gov/moves/nonroad-model-nonroad-engines-equipment-and-vehicles>

Methods sources

Based upon EPA's requirements for determining nonroad emissions, the Department ran the MOVES-Nonroad Model to calculate nonroad emissions estimates for 2017. MDE-ARA opted to choose monthly seasonal (Annual and Summer) period totals as the output files from the model.

Point Source Adjustments

No subtraction of emissions from point sources is necessary.

Adjustments for Controls

The MOVES-Nonroad model automatically applies controls, when applicable, for a given year.

Spatial and Temporal Allocations

Spatial

The MOVES-Nonroad model spatially allocates equipment populations and emissions. Input files specify the state or county then sets up the population and allocation factor data files for the chosen state.

Temporal

The MOVES-Nonroad model allocates activity monthly through the National County Database (NCD). The model can calculate emissions for a variety of time periods; an entire year, one of four seasons, or any particular month. Emissions for the period selected are estimated either for the total period or for a typical day (weekday or weekend) in that period. Average Ozone Season Day (OSD) daily emissions were estimated using the month of July's weekends and weekdays emissions. The weekend and weekday emissions were multiplied by the fraction of weekend or weekday days for the month of July. (Note: fraction weekday portion for example is calculated by dividing day the number of weekdays in July (23 days in 2020) by the total number of days in July (31). The sum of the products (weekday daily emissions times weekday fraction plus weekend daily emissions times weekend day fraction), is the average of weekend day emissions.

Emissions Calculation

The MOVES-Nonroad model estimates the amount of pollution emitted by a particular type of equipment during a unit of use. Emission factors activity data are stored in MOVES-Nonroad's data input files. Adjustments are made within the model based on the age of equipment and controls applied for given time frames. Emission changes with the age of the engine, often called 'deterioration', are also applied by the model.

5.7 RAILROADS

SCC: 22 85 002 006 (Class I - Line Haul)

SCC: 22 85 002 007 (Class II and III)

SCC: 22 85 002 008 (Passenger)

SCC: 22 85 002 009 (Commuter)

SCC: 22 85 002 010 (Yard Engines)

Description

Railroad locomotives used in the United States are primarily of two types: electric and diesel-electric. Electric locomotives are powered by electricity generated at stationary power plants. Emissions are produced only at the electrical generation plant, which is considered a point source and therefore not included here. Diesel-electric locomotives, on the other hand, use a diesel engine and an alternator or generator to produce the electricity required to power its traction motors. Emissions produced by these diesel engines are of interest in emission inventory development. Other sources of emissions from railroad operations include the small gasoline and diesel engines used on refrigerated and heated rail cars. These engines are thermostatically controlled, working independently of train motive power, and fall in the category of nonroad equipment, addressed elsewhere in this document.

Locomotives can perform two different types of operations: Line Haul and Yard. Line haul locomotives, which perform the line haul operations, generally travel between distant locations, such as from one city to another. Yard locomotives, which perform yard operations, are primarily responsible for moving railcars within a particular railway yard. The use of these engines can be further divided into subcategories such as, Class 1, Class 2, Class3, Passenger, and Commuter.

Rail Classification:

- 1. Class I railroad:** is a large freight railroad company, with annual operating revenue in excess of \$250 million dollars as defined by the Surface Transportation Board (STB) and Bureau of Labor Statistics (BLS)
- 2. Class II railroad:** mid-sized freight-hauling railroads with revenues greater than \$20.5 million, but less than \$250 million for at least three consecutive years. Switching and terminal railroads are excluded from Class II status
- 3. Class III railroad:** annual operating revenue is less than \$20 million. Class III railroads are typically local short line railroads, serving a few towns or industries; many Class III railroads were once part of larger railroads

Class II and Class III are also defined by different labor regulations creating the two classes.

- 4. Passenger Railroad:** passenger trains or passenger-carrying vehicles. It may be a self powered railcars, or else a combination of one or more engines and one or more unpowered trailers. These

trains travel station to station or to a depot where passengers board and get off, usually operate on a fixed schedule

5. Commuter rail: called **suburban rail**, transport passengers, but only between a city and outer suburbs or near by towns where people need to travel to on a daily basis, for reasons like working. Commuter trains also operate by schedules

Pollutants

CO, NOx, and VOC

Method and Data Sources:

The following eleven railroad companies operated in Maryland and were asked to provide the amount of fuel used in 2014, and the distribution of the company's track mileage by Maryland County:

Railroad Company	Railroad Classification
1. AMTRAK	Passenger Railroad
2. Canton Railroad Company	Class III - Yard Railroad
3. CSX Transportation, Incorporated	Class I – Yard Railroad
4. Bay Coast Railroad	Class II Railroad
5. Maryland & Delaware Railroad Company	Class I – Yard Railroad
6. Maryland Midland Railway, Incorporated	Class II – Yard Railroad
7. Norfolk and Southern Railway Company	Class I – Yard Railroad
8. Western Maryland Scenic Railroad	Class III Railroad
9. Winchester and Western Railroad Company	Class III Railroad
10. MARC	Commuter Railroad
11. Walkersville Southern Railroad	Passenger – Yard Railroad

Class 1 railroads CSX and Norfolk operating statistics contained in R-1 reports were obtained from the Surface Transportation Board under the Office of Economics, Environmental Analysis and Administration were used to add in estimating the amount of fuel used within the state.

MDE received fuel usage and track mileage data from all the railroads. Fuel usage was proportioned to each county by the amount of track miles each company utilized in a county.

Activity

A survey of railroad petroleum consumption and track mileage was conducted.

Emission Factor

Emission factors were obtained from the EPA's *Procedures for Emission Inventory Preparation, Volume IV: Mobile Sources, 1992*.

TABLE 4.4.1-a Emission Factor for Locomotives

	<u>Line Haul</u>		<u>Yard</u>
VOC	0.0179 lbs/gal	VOC	0.0325lbs/gal
NOx	0.3285 lbs/gal	NOx	0.5181 lbs/gal
CO	0.0587 lbs/gal	CO	0.0587 lbs/gal
SO2	0.0001 lbs/gal	SO2	0.0001 lbs/gal
PM10	0.0097 lbs/gal	PM10	0.0117 lbs/gal
PM25	0.0094 lbs/gal	PM25	0.0113 lbs/gal

SO₂ emissions were calculated based on a sulfur content percent weight.

EPA estimates that yard locomotives operate 365 days per year (assuming that when a yard engine is taken in for repairs it is replaced during this period) and consumes an average of 228 gallons per day.

Point Source Adjustments

No subtraction of emissions from point sources is necessary.

Adjustments for Controls

Controls through Tier regulations were included in the EPA estimated emission factors.

Spatial and Temporal Allocations

Spatial

Emission estimates are based on fuel consumption. Company supplied state total fuel usage was allocated to the county level by the proportion of track miles used in a particular county.

Temporal

Railroads/trains are expected to operate every day of the year. Daily emissions are equivalent to annual emissions divided by 365.

Emissions Calculation

When specific county information was not provided, the following equations were used to compute the amount of fuel consumed by each railroad in each Maryland County.

$$G_{CTY} = \frac{M_{CTY}}{M_{ST}} * G_{ST}$$

Where:

M_{CTY} = mileage of company tracks in the county

M_{ST} = mileage of company tracks in the state

G_{ST} = amount of total fuel used in gallons by the company in the state

G_{CTY} = amount of total fuel used in gallons by the company in the county

The following equation was used to calculate the emissions for line haul locomotives from each railroad company operating in a county.

$$E_{LH-i-CTYj} = \frac{Fuel_{CTY} * EF_{LH}}{2000}$$

Where:

$E_{LH-i-CTYj}$ = Emissions from line haul railroad locomotives for pollutant i in County j

$Fuel_{CTYj}$ = Total amount of fuel consumed by every railroad operating in the calculated county

$Fuel_{CTYj}$ = ($G_{cty1} + G_{cty2} + \dots + G_{cty12}$)

EF_{LH} = line haul locomotive emission factor for a given pollutant

The following equation was used to calculate the yearly emissions for yard locomotives from each railroad company operating in a county.

$$E_{YL-i-CTYj} = \frac{N_{YL-i-CTYj} * 228 * EF_{YL} * 365}{2000}$$

Where:

$E_{YL-i-CTYj}$ = Emissions from yard locomotives for pollutant i in County j

$N_{YL-i-CTYj}$ = number of yard locomotives operated by each railroad company in county j

$N_{YL-i-CTYj}$ = ($N_{cty1} + N_{cty2} + \dots + N_{cty12}$)

EF_{YL} = Yard locomotive emission factor for a given pollutant

5.8 AIRCRAFT

SCC: 22 75 020 000 (Commercial Aircraft)

SCC: 22 75 050 000 (General Aviation)

SCC: 22 75 060 000 (Air Taxi)
SCC: 22 75 001 000 (Military Aviation)

Description:

This category includes three sub-categories identified as: commercial aircraft, general aviation, and military aircraft. Commercial aircraft are used in regularly scheduled flights transporting passengers, freight, or both. General aviation, which includes air taxis and commuter aviation, is used for recreational flying, business travel, personal transportation, and various other activities. Military aviation is the operation and activities of military aircraft at airports in Maryland. Air Taxi operation can be separated into its own subcategory.

Pollutants

CO, NO_x, and VOC

Method and Data Sources

ARA used a variety of sources for data and emission calculation methods as follows:

Data sources

- 1) Federal Aviation Administration (FAA) website contains airport activity statistics for some Maryland airports and air fields by subcategory description, plane, and engine types.
- 2) Landing and takeoff cycle information was obtained from the Maryland Aviation Administration for BWI, Martin State, Military Bases, several large, and several small airport and air fields.
- 3) The MDE's Emission Inventory section also performed a statewide survey to obtain LTO, engine type, location, and usage data from over 200 individual airports and air fields.

Methods sources

- 1) For general aviation ARA used emission factors supplied in Procedures for Emission Inventory Preparation, Volume IV: Mobile Sources, EPA's Office of Mobile Sources, 1992. This source provided emission factors for specific commercial engine types, and alternative fleet average factors for general aviation, air taxis, and commuter aircraft.
- 2) For military aircraft ARA used a composite factor from section 5.2.5, Table 5-7 of Procedures for Emission Inventory Preparation, Volume IV: Mobile Sources, 1988. This method required ARA to collect LTO data rather than specific aircraft data. For the 2011 inventory ARA requested operation data for military aircraft from Maryland Army, Navy, and Air Force base environmental support offices.
- 3) For commercial aviation ARA used FAA's EDMS⁴ emissions model and databases. EDMS is designed to assess the air quality impacts of airport emission sources, particularly aviation sources, which consist of aircraft, auxiliary power units, and ground support equipment. EDMS features the latest aircraft engine emission factors from the International Civil Aviation

⁴ Emissions & Dispersion Modeling System (EDMS) Version 5.1 for Windows from CSSI, Inc.

Organization (ICAO) Engine Exhaust Emissions Data Bank, vehicle emission factors from EPA MOBILE 6.2, and EPA-validated dispersion algorithms. Aircraft activity includes landside and airside operations. EDMS defines four distinct modes of aircraft operation based upon EPA and FAA guidance: approach, taxi/idle, takeoff, and climb out. Together, these four modes constitute one Landing and Takeoff (LTO) cycle. EDMS calculates aircraft emissions based on these four modes.

- 4) For all aircraft types, ARA used a default mixing height value of 3,000 feet above ground level. The mixing height is the layer of air where airplane emissions affect ground level emission concentrations. Above the mixing level, pollutants are transported away according to sections 5.2.2 of the 1992 Procedures. Because of the mixing height, ARA assigned all aircraft emissions from a particular airport to the county where that airport was located. We assumed no seasonal variation and a seven day per week activity level.

Point Source Adjustments

No subtraction of emissions from point sources is necessary.

Adjustment for Controls

No controls are available for this source category.

Spatial and Temporal Allocations

Spatial

Data for spatial allocation is not available for this source.

Temporal

Aircraft are expected to operate every day of the year. Daily emissions are equivalent to annual emissions divided by 365.

5.8.1 COMMERCIAL AIRCRAFT

SCC: 22 75 020 000

Steps in Creating and Airport Emission Inventory in EDMS:

- 1) Open the EDMS model and create a new study for the airport in question. Choose the airport identification code. Enter the parameters (name, measuring and reporting units, and analysis year you want modeled).
- 2) Provide EDMS with information to compute the emissions inventory. Begin by matching engines with aircraft and assigning them to the study. Select the aircraft to be used in the study (data that is collected from the airport) by picking the aircraft name from the menus. EDMS automatically associates specific aircraft with certain engine types (Choose from list).
- 3) For each aircraft fill in the yearly LTO cycles provided by surveying the airport.
- 4) Each time you fill in LTOs the model will automatically default the taxi time and queue time specific to the specified airport or use the EDMS provide default values.

- 5) Continue to add each aircraft/engine type, LTO cycle until all are LTOs are entered for that study.
- 6) EDMS has tables built into the model that associate aircraft type with the number of engines, auxiliary power units and ground support equipment. The model also assigns default values for Takeoff Time (typically 0.3 minutes), Climbout Time (typically 5 minutes), and Approach Time (typically 6 minutes).
- 7) If emissions from parking lots, roadways, stationary sources, and training fires are also required, complete the dialog boxes associated with each of these subcategories.
- 8) Run the EDMS emission inventory program and view the results.

Emissions Calculation

The data for aircraft engines listed below in Table 4.5.1-a are defaults used to calculate emissions within the EDMS Model. Each mode of operation, such as, annual LTO operations, average taxi time, approach, climb-out, takeoff, and annual queue times are used in the estimation of emissions, but LTO operations was taken from FAA and airport records.

TABLE 4.5.1-a EDMS Aircraft & Engine Estimated Averages and Defaults Data

Aircraft Name	Aircraft Type	Engine Assigned	Approach Time (min)	Climbout Time (min)	Takeoff Time (min)	Annual LTO	Taxi Time (min)	Queue Time (min)
Falcon 100	GA	TFE731-3	1.60	0.50	0.40	1825	10.50	3.00
P-337P Skymaster	GA	TSIO-360C	4.50	2.50	0.50	9490	10.50	3.00
550 Citation	GA	JT15D-4 (B,C,D)	1.60	0.50	0.40	2190	10.50	3.00
A320	Comm	CFM56-5B4	4.00	2.20	0.70	2555	10.50	3.00
AH-1	Military	T53-L-11D	6.80	6.80	0.00	1825	10.50	3.00
ATR42	Comm	PW120	4.50	2.50	0.50	2190	10.50	3.00
B727-100	Comm	JT8D-7A	4.00	2.20	0.70	8030	10.50	3.00
B737-200	Comm	JT8D-15A	4.00	2.20	0.70	21900	10.50	3.00
B737-300	Comm	CFM56-3B	4.00	2.20	0.70	13140	10.50	3.00
B737-400	Comm	CFM56-3B	4.00	2.20	0.70	3650	10.50	3.00
B737-500	Comm	CFM56-3B	4.00	2.20	0.70	8030	10.50	3.00
B737-700	Comm	CFM56-3C-1	4.00	2.20	0.70	730	10.50	3.00
B747-100	Comm	JT9D-7A	4.00	2.20	0.70	183	10.50	3.00
B757-200	Comm	PW2037	4.00	2.20	0.70	7665	10.50	3.00
B767-200	Comm	CF6-80A (A1)	4.00	2.20	0.70	1095	10.50	3.00
BAE ATP	Comm	PT6A-45	4.00	2.20	0.70	2555	10.50	3.00
BH-1900	Comm	PT6A-65B	1.60	0.50	0.40	3285	10.50	3.00
C-12A/B/C	Military	PT6A-41	3.50	0.80	0.40	730	10.50	3.00
C-130 Hercules	Military	T56-A-16	5.10	1.20	0.40	365	10.50	3.00
C-9A	Military	JT8D-9	5.10	1.20	0.40	365	10.50	3.00

Canadair Reg-100	Comm	CF34-3A1	4.00	2.20	0.70	730	10.50	3.00
Cessna 150	GA	O-200	6.00	5.00	0.30	5110	10.50	3.00
Convair liner	Comm	RDA10	4.50	2.50	0.50	365	10.50	3.00
DC10-10	Comm	CF6-50C	4.00	2.20	0.70	730	10.50	3.00
DC9-10	Comm	JT8D-7A	4.00	2.20	0.70	4380	10.50	3.00
DHC-8	Comm	PW120	4.50	2.50	0.50	3650	10.50	3.00
DHC-8-400	Comm	PW123	4.50	2.50	0.50	18250	10.50	3.00
F-16	Military	F100-PW-100	3.50	0.80	0.40	183	10.50	3.00
F-27 Series	Military	RDa7	4.50	2.50	0.50	365	10.50	3.00
Fokker 100	GA	TAY650	4.00	2.20	0.70	365	10.50	3.00
H-46 Sea Knight	Military	T58-GE-8F	6.80	6.80	0.00	183	10.50	3.00
Kingair B200	GA	PT6A-41	1.60	0.50	0.40	5840	10.50	3.00
Learjet 25B	GA	CJ610-6	1.60	0.50	0.40	1460	10.50	3.00
MD-11	Comm	CF6-80C2D1F	4.00	2.20	0.70	730	10.50	3.00
MD-80	Comm	JT8D-209	4.00	2.20	0.70	4563	10.50	3.00
MD-80-88	Comm	JT8D-217	4.00	2.20	0.70	1825	10.50	3.00
MD-90-10	Comm	V2525-D5	4.00	2.20	0.70	365	10.50	3.00
Porter PC6/B2	Military	PT6A-27	4.50	2.50	0.50	730	10.50	3.00
SF-340-A	Comm	CT7-5	4.50	2.50	0.50	730	10.50	3.00
Swearingen Merlin	Comm	TPE331-3	4.50	2.50	0.50	2920	10.50	3.00
Swearingen Merlin	Comm	TPE331-3	4.50	2.50	0.50	365	10.50	3.00

Once all of the data is entered into the model, the model produces an emission inventory. **Defaults data is updated as new revisions of the model are posted.** For the latest Annual emission totals inventory are listed in the table below:

The model will also produce an inventory specific to each aircraft type, which allows the data to be separated into types (commercial, general aviation, and military) of operation. For BWI the separation results in the following:

The model was run for all aircraft at BWI, Martin State, Hagerstown Regional, Ocean City Municipal, Frederick County, Phillips Air Field, Weide Army Air Field and Andrews Air Force.

5.8.2 GENERAL AVIATION

SCC: 22 75 050 000

Emission Calculation

A estimate of emissions were calculated after information on the LTO operations of aircraft operation type was obtained from Maryland's airports. This method used the alternative fleet-average procedure of Section 5.2.4.2 of Procedures, 1992. The composite emission factors used are listed in the table below.

TABLE 4.5.2-a EPA Emission Factors for Aircraft

Aviation Category	CO (lbs./LTO)	VOC (lbs./LTO)	NOx (lbs./LTO)	SO2 (lbs./LTO)	PM10-PRI (lbs./LTO)	PM2.5-PRI (lbs./LTO)
General Aviation	12.014	0.382	0.065	0.100	0.020	0.020
Air Taxis	28.130	1.223	0.158	0.015	0.020	0.020
Military	48.800	27.10	9.160	1.430	15.23	15.23

* Requires Hydrocarbon to VOC conversion factor of 0.9708 for General Aviation and 0.9914 for Air Taxis.

$$1) \text{Emiss}_{\text{VOC}} = \text{LTO (GA)} * \text{EF (GA)}_{\text{VOC}}$$

Where:

LTO (GA) = LTOs for General Aviation

EF (GA)_{xx} = Emission Factors for General Aviation

$$2) \text{Emiss}_{\text{VOC}} = \text{LTO (AT)} * \text{EF(AT)}_{\text{VOC}}$$

Where:

LTO (AT) = LTOs for Air Taxis

EF (AT)_{xx} = Emission factors for Air Taxis

5.8.3 MILITARY AIRCRAFT

SCC: 22 75 001 000

There are five military airports in Maryland. They are Andrews Air Force Base, Fort Meade/Tipton, Aberdeen, Patuxent River Naval Air Station, and Martin State Airport. ARA received LTO and onsite emission information from some military airports and emission totals from others due to national security concerns. Most of the county airports also receive a small number of military operations.

Method and Data Sources

Since ARA asked for and received LTO information by aircraft operation type, ARA used composite emission factors from Procedures for Emission Inventory Preparation, Volume IV: Mobile Sources, 1988 and the EDMS model (version 5.1).

TABLE 4.5.3-a EPA Emission Factors for Military Aircraft

	CO (lbs./LTO)	VOC (lbs./LTO)	NOx (lbs./LTO)	SO2 (lbs./LTO)	PM (lbs./LTO)
Military Aircraft	48.80	27.10	9.160	1.43	15.230

$$1) \text{Emiss}_{\text{VOC}} = L(\text{MA}) * \text{EF}(\text{MA})_{\text{VOC}}$$

Where:

L(MA) = LTOs for Military Aircraft

EF(MA)_{xx} = Emission factors for Military Aircraft

5.9 MARINE VESSELS

SCC: 2280002100 (Diesel Oil – Port)
2280002200 (Diesel Oil – Underway)
2280003100 (Residual Oil – Port)
2280003200 (Residual Oil – Underway)

Pollutants Description

Commercial Marine Vessels (CMV) includes all boats and ships used either directly or indirectly for commerce or military activity. These include vessels ranging in size from 20-foot charter boats to the largest tankers and military vessels, which can exceed 1,000 feet in length. “The CMV source category does not include recreational marine vessels, which are generally less than 100 feet in length, most being less than 30 feet, and powered by either inboard or outboard. These emissions are included in those calculated by the NONROAD model.”
CO, NOx, and VOC

Method and Data Sources

Historically, MDE used marine vessels data prepared by the Baltimore Maritime Exchange (BME) to develop and calculated commercial marine vessels emissions inventory and referred to the marine emission inventory guidance method outlined in Analysis of Commercial Marine Vessels Emissions and Fuel Consumption Data (EPA-450-R-00-002), February 2000. However, EPA offers the most recent descriptions and current methodologies used for the calculations for CMV inventory. As an as result, MDE performed analysis comparison between MDE and EPA’s 2014 CMV emissions estimates. After these analysis comparisons, The Department decided to adopt EPA’s emissions estimates and methodology for Maryland’s 2017 CMV inventory cycle.

To calculate the 2017 CMV emission inventory estimates, the EPA used a bottom up methodology approach. The EPA’s bottom up methodology approach was base on EPA collecting 1) national activity data (kilowatt hours or kW) of CMV, 2) engine operating load factors, and 3) emission factors and HAPs speciation profiles.

EPA then incorporated informational data sets on vessels movement/waterway-route segments and speeds were used to estimate emissions by ship types for a given port.

The data sets on vessels movement/waterway-route segments and speeds by ship types then were intersected with EPA’s NEI shapefiles of ports and shipping lanes. Shipping lanes associated with RSZs were coded to allow for adjustment in vessel speed, time spent transiting the RSZ, and engine operating load.

EPA also used Emissions Modeling Platform Criteria pollutant estimates to allocated and determine shapeID files ratio for underway and port county combinations. In cases where model files had emissions in counties with shape IDs, emissions were allocated to shapes in those counties proportionately to shape area. However, in cases where model files had emissions in counties for which EPA had no shapeIDs, the model file emissions were dropped. In all these cases, emissions were very small and considered to be negligible.

To derived HAP estimates, the EPA applied toxic fractions to VOC or PM estimates. HAP speciation fractions based on VOC and PM were employed to calculate HAPs.

For each of the commercial marine vessels SCCs, an appropriate emissions type (M=maneuvering, H=hotelling, C=cruise, Z=reduced speed zone) was applied because emission factors vary by emission type. Each SCC and emissions type combination was allocated to a shape file identifier in the nonpoint inventory. The allowed combinations are shown in Table 4.6.1. The default values are those assumed when the actual emission type may be unknown; for example, emissions that occur in shipping lanes are assumed to be 'cruising' and cannot be 'hotelling', which only occurs at ports. See Table 4.6.1. Also see Table 4.6.2 for CMV Vessel Types, Table 4.6.3 for Vessel Speed Data, and Table 4.6.4 for Vessel Power Attributes by Vessel Type.

TABLE 4.6.1 Commercial Marine Vessel SCCs and emission types

SCC	SCC Description	Allowed	Default
2280002100	Marine Vessels, Commercial Diesel Port	M	M
2280002200	Marine Vessels, Commercial Diesel Underway	C	C
2280003100	Marine Vessels, Commercial Residual Port	H	H
2280003100	Marine Vessels, Commercial Residual Port	M	H
2280003200	Marine Vessels, Commercial Residual Underway	C	C
2280003200	Marine Vessels, Commercial Residual Underway	Z	C

TABLE 5.2 Marine Vessel Ship Types

Ship Types	
Bulk Carrier (Laker)	Bouy Tender
Barge	Ferries
Coast Guard	Fishing
Container	FPSO
Dredger	Passenger
Drilling	Pipelaying
General Cargo	Refrigerated Cargo (Reefer)
Icebreaker	Research
Roll On-Roll Off (RORO)	Tug
Tanker (Oil/LNG/LPG)	Vehicle Carrier
Miscellaneous	Supply
Well Stimulation	Support

TABLE 5.3 Vessel Speed Data

Ship Type	Size Category	Size Units	Ratio of average at-sea speed to design speed	Percent of total population	Weight amount	Weighted Cruising Speed Factor
Bulk Carrier	0-9999	dwt	0.84	0.9%	0.007403	0.822751023
	10000-34999		0.82	25.1%	0.20571	
	35000-59999		0.82	36.0%	0.295272	
	60000-99999		0.83	31.7%	0.26308	
	100000-199999		0.81	6.2%	0.050227	
	200000+		0.84	0.1%	0.001058	
Container	0-999	TEU	0.77	4.9%	0.038087	0.681508656
	1000-1999		0.73	11.8%	0.086059	
	2000-2999		0.7	12.5%	0.087716	
	3000-4999		0.68	32.8%	0.223116	
	5000-7999		0.65	28.6%	0.185944	
	8000-11999		0.65	9.0%	0.058409	
	12000-14500		0.66	0.3%	0.002176	
	14500+		0.6	0.0%	0	
Oil Tanker	0-4999	dwt	0.8	0.1%	0.001094	0.782982216
	5000-9999		0.75	0.3%	0.002052	
	10000-19999		0.76	0.0%	0.0	
	20000-59999		0.8	3.6%	0.028454	
	60000-79999		0.81	15.6%	0.12632	
	80000-11999		0.78	43.4%	0.338249	
	120000-199999		0.77	32.6%	0.250698	
	200000+		0.8	4.5%	0.036115	

dwt = dead weight tonnage;

TEU = twenty foot equivalent units

Note: For RSZs, a vessel's speed was assumed to be the zone's speed unless the vessel's cruising speed was lower. For example, a vessel with a cruising speed of 12 knots traveling through a waterway segment with a reduced speed of 14 knots was assumed to be operating at 12 knots.

The hours of operation were applied to the vessel's power, which was adjusted for typical engine operating loads to get kilowatt hours. In turn, the kilowatt hours were applied to the appropriate EPA emission factor based on the vessel engine's category to estimate criteria pollutant emissions.

TABLE 5.4 Vessel Power Attributes by Vessel Type

Standard Type	Count	Avg Main (hrs)	Avg Aux Power (kW)	Avg Max Speed (knots)	Default Vessel Category
Bulk Carrier	3,177	8,990	1,935	14.3	3
Bulk Carrier, Laker	80	7,069	2,216	13.7	3
Buoy Tender	4	4,266		12.6	2
Container	1,218	39,284	7,851	23.2	3
Crude Oil Tanker	731	15,070	2,888	15.1	3
Drilling	7	15,806	12,840	11.7	2
Fishing	123	1,262	272	2.3	1
FPSO	2	18,123		11.5	3
General Cargo	1,020	6,130	1,619	14.6	3
Icebreaker	2	21,844		12.0	2
Jackup	4	1,643	270	3.5	1
LNG Tanker	44	29,607	8,129	19.2	3
LPG Tanker	151	8,557	3,021	15.8	3
Misc.	35	2,805	631	10.0	1
Passenger	168	45,760	4,477	20.4	3
Pipelaying	14	11,355	5,037	12.6	2
Reefer	182	8,930	3,328	18.9	3
Research	55	5,395	1,905	11.2	2
RORO	72	9,479	4,006	16.7	3
Supply	255	3,201	662	10.1	1
Support	73	6,590	2,305	9.7	2
Tanker	1,423	8,474	2,730	14.5	3
Tug	396	3,440	348	7.7	2
Vehicle Carrier	441	13,829	3,729	19.8	3
Well Stimulation	3	7,697	340	8.2	3

Activity

- National activity data (kilowatt hours or kW) of CMV.
- Vessel characteristics data.
- The time spent, by ship type, in each of four operating modes defines as: normal cruise, slow cruise, maneuvering, and hostelling.
- The engine operating load factors.
- The engine power of each vessel types.

Note: All activity data were adjusted for typical engine loads for the modes of operation (i.e., cruising, reduced speed zone (RSZ), maneuvering, and hoteling).

Vessel characteristics data were compiled and linked to the vessel types. The vessel characteristics included the following data:

- Vessel identification codes
- Vessel name

- Country of registry
- Call sign
- Vessel type
- Gross/net tonnage
- Vessel power
- Auxiliary engine power
- Piston stroke length/cylinder diameter (to calculate vessel category)
- Maximum vessel speed.

EPA's Emission Factors:

Note: The hours of operation were applied to the vessel's power, which was adjusted for typical engine operating loads to get kilowatt hours. In turn, the kilowatt hours were applied to the appropriate EPA emission factor based on the vessel engine's category to estimate criteria pollutant emissions.

Below are defaulted emission rates per pollutant per engine per fuel per vessel type per mode of operation.

Vessels equipped with Category 3 propulsion engines:

As the dominant propulsion engine configuration for large Category 3 vessels is the slow speed diesel (SSD) engine, the following SSD emission factors were used for Category 3 propulsion engines. Medium speed diesel (MSD) emission factors were used for auxiliary engines associated with these larger vessels. For the 2017 inventory, it was assumed that Emission Control Area (ECA) compliant fuels were used while transiting U.S. waters. Emission factors for vessels equipped with Category 3 propulsion engines are presented in Table 4.6.5.

TABLE 5.5 Category 3 Emission Factors (g/kW-hrs)

Type	Engine	Fuel	NOX	VOCa	HC	CO	SO 2	CO 2	PM10	PM25
SSD	Main	1% Sulfur	14.7	0.6318	0.6	1.4	3.62	588.86	0.45	0.42
MSD	Aux	1% Sulfur	12.1	0.4212	0.4	1.1	3.91	636.6	0.47	0.43

From: U.S. EPA/OTAQ, Regulatory Impact Analysis: Control of Emissions of Air Pollution from Locomotive Engines and Marine Compression Ignition Engines Less than 30 Liters Per Cylinder, March 2008.

^a Hydrocarbon (HC) was converted to VOC using a conversion factor of 1.053 as provided in the above reference

^b PM_{2.5} was assumed to be 97 percent of PM₁₀ using the above reference

Vessels equipped with Category 1 or 2 propulsion engines and Tier types:

TABLE 5.6 Tier Emission Factors for Vessels Equipped With Category 1 / Category 2 Propulsion Engines (g/kW-hrs)

Tier	PM10	NOx	HC	CO	VOCa	PM25 b	SO 2	CO 2
0	0.32	13.36	0.134	2.48	0.141102	0.3104	0.006	648.16
1	0.32	10.55	0.134	2.48	0.141102	0.3104	0.006	648.16
2	0.32	8.33	0.134	2.00	0.141102	0.3104	0.006	648.16
3	0.11	5.97	0.07	2.00	0.073710	0.1067	0.006	648.16

Engines and Marine Compression Ignition Engines Less than 30 Liters per Cylinder, March 2008.

^a HC was converted to VOC using a conversion factor of 1.053 as provided in the above reference.

^b PM_{2.5} was assumed to be 97 percent of PM₁₀ using the above reference.

Emissions

Calculation

The general **Mode Equations Calculation:** equation for estimating CMV emissions is:

$$\text{Emissions} = Vp_i \text{ (kW)} \times LF \times \frac{D \text{ (NM)}}{Vs \text{ (NM/hr)}} \times EF \frac{\text{(g)}}{\text{(kWh)}}$$

Where:

- D_i = Distance along Segment, NM / C or RSZ Knots by vessel (i) and engine type (h)
- Vp_i = rated power of propulsion engine by vessel (i) and engine type (h)
- LF_{ig} = Load factor (fraction less than 1) in mode g (cruise, slow cruise or maneuvering)
- Vs_{ig} = 0.94 x maximum vessel speed = cruising speed or RSZ speed (i) and mode (g) (hrs)
- EF_{ih} = Emission factor in mode (i) and by engine type (h)

Note: D/Vs are used to estimate operating hours and 0.94 is Cruising Speed (knots), 94% of the max rated speed. Also, if vessel speed is unknown, typical speed by vessel type was used (nautical miles/hr or knots).

RSZ Mode:

RSZ Criteria

- E&C RSZName <> "Cruising"
- EF Mode = "Cruising"
- EF Engine Type = "Main"
- IF (CruiseSpeed(94%Max)Revised < RSZ_Speed_kn, ○ then CruiseSpeed(94%Max)Revised otherwise RSZ_Speed_kn

RSZ Linkage

- ShipType
- CatLookup
- RSZ

RSZ Emission Equation

EM = SumofLength_nm / IF(CruiseSpeed(94%Max)Revised < RSZ_Speed_kn, then CruiseSpeed(94%Max)Revised, otherwise RSZ_Speed_kn)* MainkW * EF-g/kWhr

Maneuvering Mode:

Maneuvering Criteria

- EF Mode = "Man"
- EF Engine Type = IF(Engine Type = "Main" ○ Then, kW-hrs = MainkW* Maneuvering Time, Otherwise, kW-hrs = AuxkW*Maneuvering Time (where Engine Type = "Aux")

Maneuvering Linkage

- ShipType
- CatLookup
- Engine Type

Maneuvering Emission Equation

EM = If Engine Type = "Main"

- Then, MainkW-hrs* EF-g/kWhr,
- Otherwise AuxkW-hrs * EF-g/kWhr (where Engine Ttype = "Aux")

Hoteling Mode:

Hoteling Emission Equation

$$EM = \text{AuxkW-hrs} * EF\text{-g/kWhr}$$

Cruising Mode:

Cruising Emission Equation

$$EM = \text{TRIP_MILES} / \text{Speed(knots)} * \text{SUMorTRIPS} * \text{Percent} * \text{HORSEPOWER} * \text{HP to kW conversion factor} * EF\text{-g/kWhr.}$$

Point Source Adjustments

No point source emissions were subtracted from the area source inventory.

Adjustment for Controls

Controls were applied when applicable to a particular source category.

Spatial and Temporal Allocations

Spatial

National level CMV information was broken down to shapeID# using spatial allocation documented and assigned by EPA.

Temporal

Data for temporal allocation was based on EPA's annual emissions and were divided by 312 to estimate daily emissions.

6.0 ONROAD MOBILE SOURCES

6.1 INTRODUCTION

This document detailed the methodology, assumptions and results of work performed by MSCP, ARA of MDE to generate the 2017 ozone and the greenhouse gases (GHG) precursor emissions inventories for highway vehicles using the MOVES2014a modeling tools. As detailed in the following sections, the 2017 inventories of highway vehicles had been developed based on daily and annual Highway Performance Monitoring System (HPMS) inventories.

The emission inventory methodology for onroad mobile sources has been updated to include emission estimates from the latest on-road vehicle emissions model, MOVES3, per EPA SIP guidance.

The revised methodology is included in Appendix E.

The official 2017 ozone and GHG precursor inventory of highway vehicles for the Baltimore Ozone Nonattainment Area, which comprises Baltimore City, and the counties of Anne Arundel, Baltimore, Carroll, Harford and Howard were the daily and annual HPMS-based inventories. The official 2017 ozone and GHG precursor inventory of highway vehicles for the Maryland portion of the Metropolitan Washington Council of Governments (MWCOC) Nonattainment Area, which comprises the counties of Calvert, Charles, Frederick, Montgomery and Prince George's, were also the daily and annual HPMS-based inventories.

The official 2017 ozone and GHG precursor inventories of highway vehicles for the Maryland portion of the Philadelphia, Pennsylvania Ozone Nonattainment Area, which comprises Cecil County, and the counties of Kent and Queen Anne's Nonattainment Area were also the daily and annual HPMS-based inventories.

The official 2017 ozone and GHG precursor inventory for the remaining portion of the State, which comprises the counties of Allegany, Caroline, Dorchester, Garrett, Saint Mary's, Somerset, Talbot, Washington, Wicomico and Worcester, were also the daily and annual HPMS-based inventories.

6.1.1 HIGHWAY VEHICLE EMISSIONS INVENTORY

This inventory documented herein described specifically how United States Environmental Protection Agency's (USEPA's) MOVES2014a (MOVES) was used to estimate the 2017 annual criteria pollutants' and GHG's emissions as well as 2017 daily criteria pollutants from on-road vehicles and total energy consumption in the State. MOVES2014 is the best tool used in developing these criteria pollutants and GHG emission estimates. Moreover, MOVES was used at the County scale to estimate the emissions of carbon dioxide (CO₂), nitrous oxide (N₂O) and methane (CH₄) as these pollutants basically make up the GHG pollutants.

Emissions were estimated based on emission factors and vehicle activity. Consequently, emission factors for vehicles were based on vehicle type such as passenger cars, passenger trucks, vehicle age and the vehicle's operating modes. Operating modes for running, start, and idle emissions are included in MOVES. It should be noted that operating modes for running emissions were based on vehicle speed as well as whether the vehicle was accelerating, decelerating or cruising. In addition, the emission factors from all vehicles varied over the entire range of conditions these vehicles operate such as the ambient air temperature, speed, traffic conditions, road types, road topography, etc. Furthermore, these generated emission factors were then multiplied by the appropriate VMT to estimate the criteria pollutants' and GHG's emissions and energy consumption. Moreover, the inventory must also account for non-exhaust or evaporative emissions. It is also important to look at the fleet, which is composed of several generations, types of vehicles and their emission control technologies, each of which performs differently.

In order to estimate both the rate at which emissions are being generated and to calculate VMT, MDE examined its road network and fleet to estimate vehicle activity. For the annual inventories, this was done for each of the twelve months in 2017 and aggregated for the entire year. The entire process was extremely complex and involved large amounts of various data sets.

Computer models were developed to perform these calculations by simulating the travel of vehicles on the State's roadway system.

These models then generated emission factors for different vehicle types for area-specific conditions and then combined them in summary form. The "area-specific conditions" included fleet characteristics such as vehicle population and vehicle age distribution, roadway and travel characteristics, meteorology, control programs in place, mandated fuel requirements, etc.

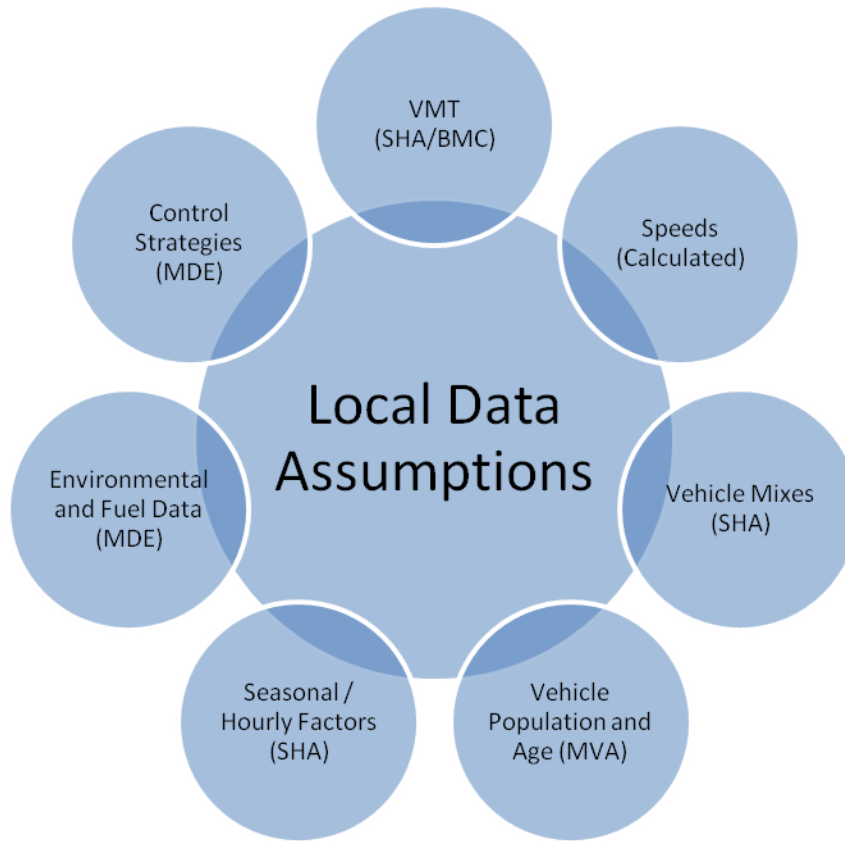
6.1.2 PERIODIC INVENTORY METHODOLOGY

MSCP used USEPA's Guidance documents to develop the 2017 highway emissions inventory. These documents include inter-alia the following:

Using MOVES for Estimating State and Local Inventories of On-Road Greenhouse Gas Emissions and Energy Consumption, EPA-420-B-12-068, November 2012. *Motor Vehicle Emission Simulator, User Guide for MOVES2014a*, EPA-420-B-14-055, July 2014

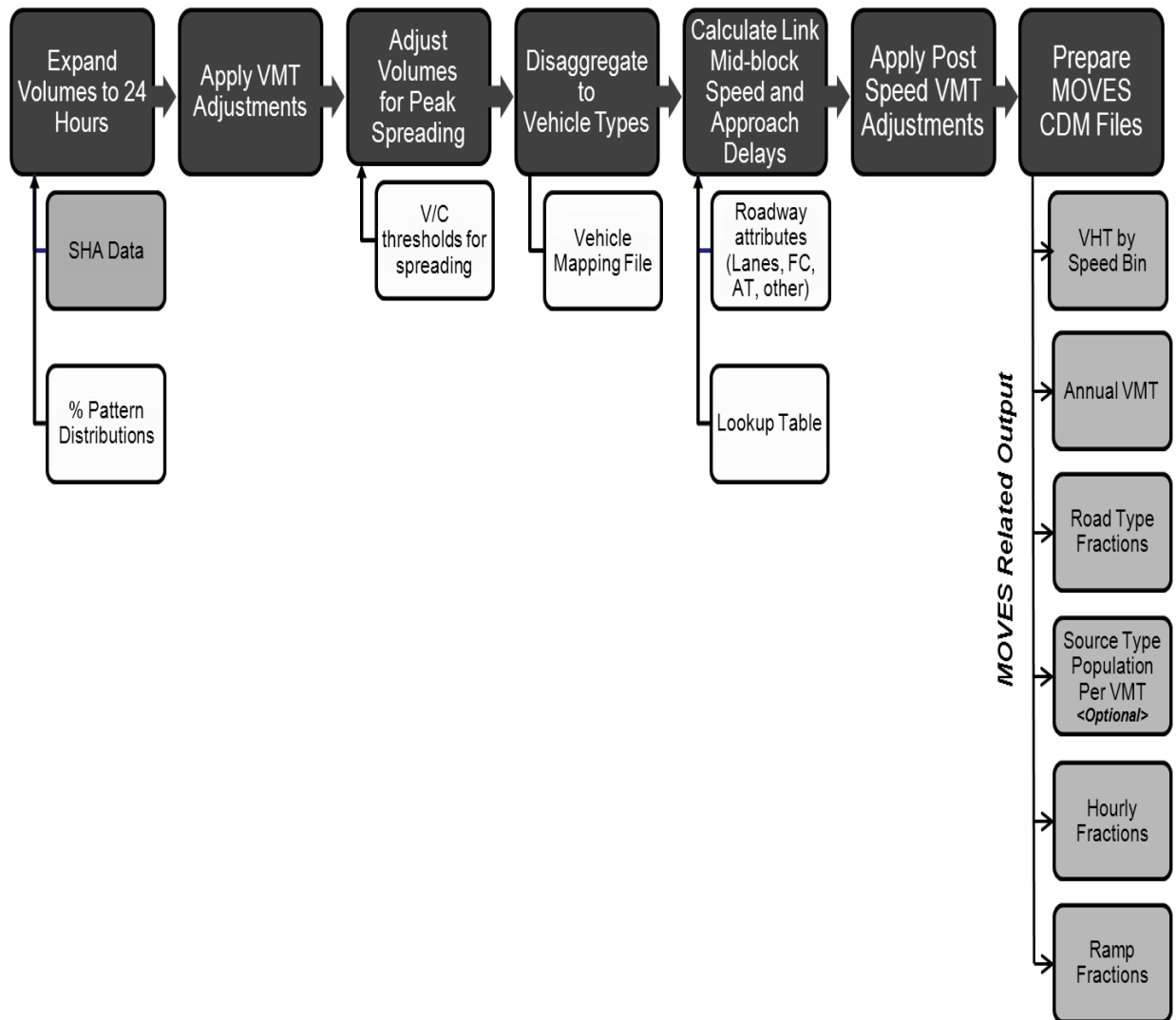
The methodologies used to produce the emission data conform to the recommendations provided in USEPA's Technical Guidance as well as in other documents enumerated above. A mix of local data and national default (internal to MOVES2014a) data had been used for the inventory documented herein. As illustrated in Figure 6.1.2-a, local data had been used for the primary data items, which had a significant impact on emissions. Local data inputs to the inventory process reflected the latest available planning assumptions using data obtained from MDE, MVA, SHA, BMC, MWCOG and other local/national sources. This inventory document herein reflected the 2017 PEI for the Baltimore Ozone Non-Attainment Area and the rest of Maryland using USEPA's latest MOVES2014a emission model.

Figure 6.1.2-a: Local Data Inputs Used for Emissions' Inventory



PPSUITE is a post-processor modeling tool used for estimating speeds and processing emission rates. Section 6.7 describes in detail this modeling tool known as PPSUITE. Figure 6.1.2-b. summarizes the key functions of PPSUITE and the traffic-related input files prepared for MOVES.

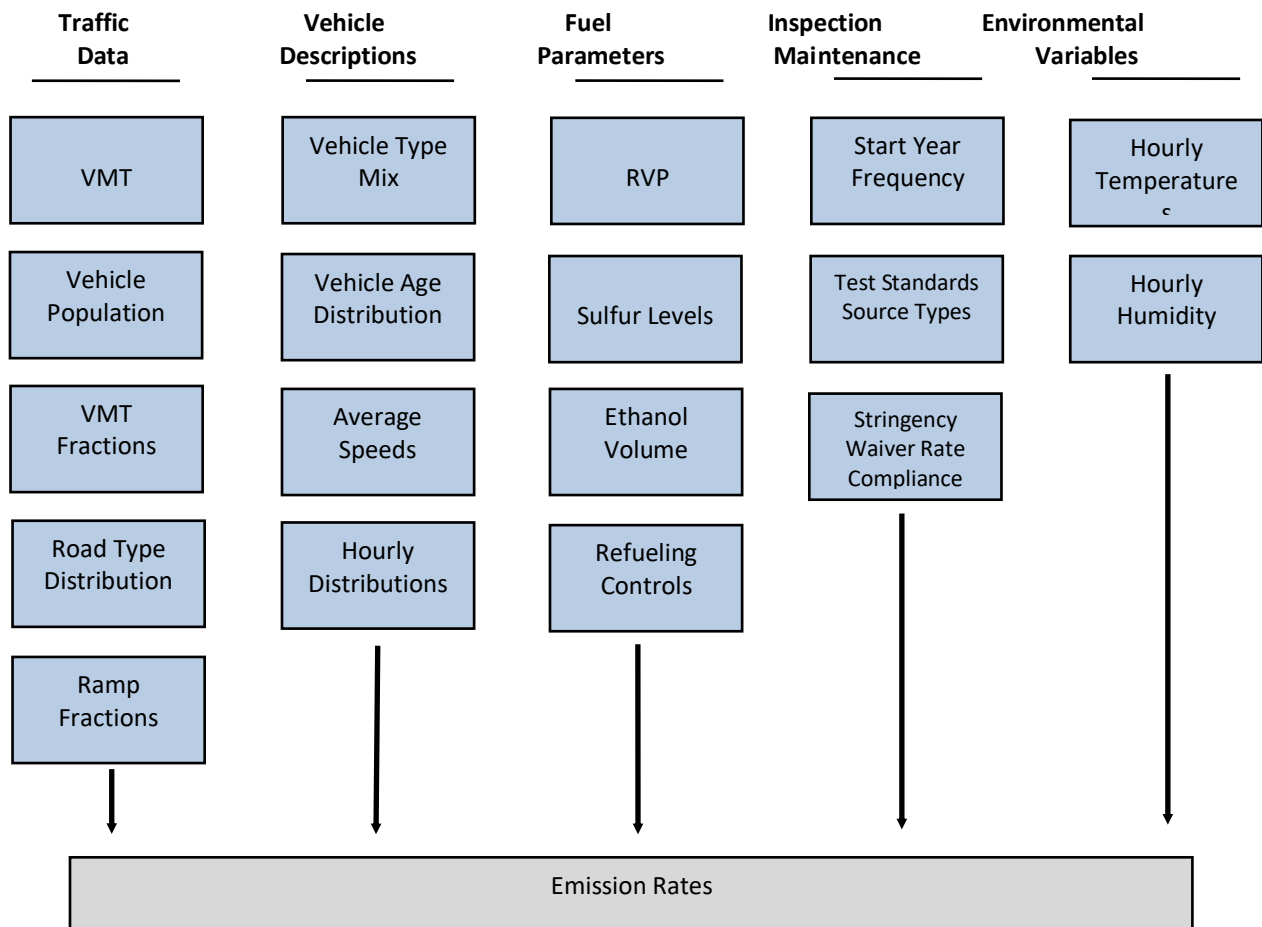
Figure 6.1.2-b: Emission Calculation Process



6.1.3 DATA SOURCES

A large number of inputs to MOVES are needed to fully account for the numerous vehicle and environmental parameters that affect emissions levels. These include traffic flow characteristics, vehicle descriptions, fuel parameters, Inspection/Maintenance (I/M) Program parameters, and environmental variables as shown in Figure 6.1.3.

Figure 6.1.3 : Examples of Key MOVES Input Data



MOVES2014a includes a default national database of meteorology, vehicle fleet, vehicle activity, fuel, and emission control program data for every county, but EPA cannot certify that the default data is the most current or best available information for any specific area. As a result of this, EPA recommended the use of local data for inventory's preparation and SIPs analyses. These data items are discussed in the following sections.

6.2 DESCRIPTION OF INPUT DATA

This section described the data inputs to the emission calculation process. 15 or 14 MOVES data files were required for input to MOVES Graphical User Interface (GUI) through the MOVES' County Data Manager (CDM). These data files were either created by the staff of MSCP or generated by PPSUITE software. These data files were:

- Roadway Data and VMT
- Month VMT Fractions
- Day VMT Fractions
- Hour VMT Fractions
- Average Speed Distribution
- Road Type Distribution
- Ramp Fraction
- Source Types Population
- Source Types Age Distribution
- Fuel Formulation
- Fuel Supply
- Fuel Usage Fraction
- I/M Programs
- Meteorology Data
- Alternate Vehicle Fuel Technology (AVFT)

6.2.1 ROADWAY DATA AND VMT

The roadway data input to emissions calculations for this inventory was based on information from the “universal” highway database maintained by the Maryland’s State Highway Administration (SHA). SHA obtained this information from periodic visual and electronic traffic counts. The SHA’s data is dynamic, since it is continually reviewed and updated from new traffic counts. Information on roadways included in the National Highway System (NHS) is reviewed at least annually, while information on other roadways is reviewed at least biennially.

On a triennial basis, a current “snapshot” of the SHA's database was taken and downloaded to provide an up-to-date record of the State’s highway system for estimating emissions. This emissions inventory was based on 2017 data, which is the most current “snapshot” of the SHA’s data.

The following information was extracted from the database for emission calculations:

- Lanes and distances
- volumes representing Average Annual Daily Traffic (AADT)
- truck percentages and urban/rural classifications
- functional class codes

The PPSUITE software used the traffic data to prepare key inputs to the MOVES emission model. This software used roadway segment distances and traffic volumes to prepare estimates of VMT that is the primary traffic input that affects emission results. Before the SHA’s data could be used by PPSUITE for speed and emission calculations, several adjustments and additions should be made to the roadway data.

The lane values, area type, and functional class were important inputs for determining the congestion and speeds for individual highway segments. Truck percentages were used in the speed determination process and were used to split volumes to individual vehicle types used by the MOVES2014a software.

Maryland classifies its road segments by function, as well as whether it is located in an urban or rural area, as indicated below in Figure 6.2.1. The urban/rural (UR) and functional classes (FC) are important indicators

of the type and function of each roadway segment. These values were also used to determine the MOVES Road Type classification, which had an important impact on the emission factors for each roadway segment. Equivalencies between the SHA's and MOVES' indices were discussed in later sections.

Figure 6.2.1: MDOT Urban/Rural and Functional Class Codes

Urban/Rural Code	1=Rural 2=Small Urban 3=Urban	
Functional Class	Rural Functional Classes Used For Rural Areas	Urban Functional Classes Used For Urban Areas
	----- 1=Rural Freeway 2=Rural Other Principal Arterial 6=Rural Minor Arterial 7=Rural Major Collector 8=Rural Minor Collector 9=Rural Local	----- 11=Urban Freeway 12=Urban Expressway 14=Urban Principal Arterial 16=Urban Minor Arterial 17=Urban Collector 19=Urban Local

The PPSUITE processing software uses other additional variables other than those available in the SHA's database. Using these variables improves the calculation of congested speeds. Such variables include information regarding free-flow speeds and capacities and other physical roadway features (e.g. traffic signals) that could affect a roadway's calculated congested speed.

This data could be determined from lookup tables based on a roadway segment's urban/rural code and functional class. Much of the lookup table data was developed from information contained in the Highway Capacity Manual (HCM).

6.2.2 OTHER SUPPORTING TRAFFIC DATA

Other traffic data were used to adjust and disaggregate traffic volumes. Key sources used in these processes include the following:

6.2.3 HPMS VMT ADJUSTMENTS

According to EPA's guidance, baseline inventory VMT computed from the SHA's highway segment volumes must be adjusted to be consistent with HPMS VMT totals. Although it has some limitations, the HPMS system is currently in use in all 50 states and is being improved under Federal Highway Administration's (FHWA's) direction. These adjustments were obtained by dividing the HPMS VMT by the analysis run's VMT for each county functional class grouping. These calculated VMT adjustment factors were provided as ASCII input files to PPSUITE, and were applied to each of the roadway segment volumes.

These factors could be applied to any future year runs. The VMT added or subtracted to the SHA's database assumed the speeds calculated using the original volumes for each roadway segment for each hour of the day.

6.2.4 SEASONAL ADJUSTMENTS

The seasonal factors were used to adjust the average annual day traffic (AADT) to represent an average July weekday, an average January weekday, or an average day of any month. Both the seasonal and monthly VMT adjustment factors were developed from the traffic flow data available by day and month from Automatic Traffic Recording (ATR) Station Reports in the Traffic Trends System Report Module, which was obtained from the SHA's website. The report entitled, *Traffic Flow by Day by Month by Group* was used to obtain the monthly variation of traffic flow.

The 4 functional classes for which the seasonal factors were available are: Rural Interstate, Rural other, Urban Interstate and Urban other. This report also contained the AADT's percentage, which was available for the 7 days of the week as well as for the 12 months of the year. An average summer seasonal factor was obtained from the average July weekdays' calculations. In addition, an average winter seasonal factor was obtained from the average January weekdays' calculations. These seasonal factors' calculations were repeated for all the 4 functional classes.

6.2.5 HOURLY PATTERNS

Speeds and emissions vary considerably depending on the time of day as a result of temperature variations and congestion. Therefore, it is important to estimate the pattern by which roadway volume varies by hour of the day. Pattern data is in the form of a percentage of the daily volumes for each hour. In addition, the hourly pattern distributions were a key input file to PPSUITE for hourly congested speeds' estimation. Hourly mixes of vehicles for each area and facility type combination were also input to PPSUITE. These hourly mixes were used to determine the proportion of the daily volume in each hour of the day, so separate hourly speeds could be prepared as input to PPSUITE process.

Consequently, hourly pattern data was obtained from a report entitled, *Traffic Trends System Report Module* from the SHA's website. However, the hourly distribution data could be obtained from the report entitled, *Hour Percent of Traffic by Month-Weekday*. The factors for the 4 functional classes (Rural Interstate, Rural other, Urban Interstate and Urban other) could also be obtained from the aforementioned report. Furthermore, the hourly pattern data for the 4 primary functional classes were used to create the PPSUITE input files that were needed in the emission calculation process. For instance, to obtain an hourly percentage of vehicles for a summer weekday, an average hourly factor was calculated for the months of June, July and August.

6.2.6 VEHICLE MIX INPUTS

The vehicle distribution file was a key input file that could have a significant impact on emissions. Moreover, the vehicle mixes were input to PPSUITE as hourly distributions of vehicles by vehicle type. These mixes were developed by using the 2017 data, which were available from the SHA's website.

6.2.7 VEHICLE TYPE PROCESSING

Emission rates within MOVES vary significantly by the type of vehicle. The MOVES2014a model produces emissions and rates by thirteen MOVES source types. However, VMT is input to MOVES by 5 HPMS vehicle groups. Figure 6.2.7 below summarizes the distinction between each classification scheme.

Figure 6.2.7: MOVES Source Types and HPMS Vehicle Groups

<u>SOURCE TYPES</u>		<u>HPMS Class Groups</u>	
11	Motorcycle	10	Motorcycle
21	Passenger Car	25	Light Duty Vehicles
31	Passenger Truck	40	Buses
32	Light Commercial Truck	50	Single Unit Trucks
41	Intercity Bus	60	Combination Trucks
42	Transit Bus		
43	School bus		
51	Refuse Truck		
52	Single Unit Short-haul Truck		
53	Single Unit Long-haul Truck		
54	Motor Home		
61	Combination Short-haul Truck		
62	Combination Long-haul Truck		

The PPSUITE process included a method to disaggregate the SHA's traffic volumes to the MOVES2014a thirteen source types and then recombined the estimates to the 5 HPMS vehicle classes. This was done to support the alternative MOVES2014a "rate-based" application method, which could also be handled by the PPSUITE's software. Under the "rate-based" application method, VMT should be estimated for each of the MOVES2014a thirteen source types. PPSUITE used the vehicle type pattern data to divide the hourly roadway segment volumes to the MOVES2014a thirteen source types. This data contained the percentage splits to each source type for every hour of the day, which was similar to the 24-hour pattern data.

6.2.8 VMT FRACTIONS

Month, day and hour VMT fractions were required as inputs to MOVES. Month and day VMT fractions were calculated based on seasonal adjustment factors. It should be noted that the month VMT fractions were used to disaggregate the annual VMT into monthly VMT, while day VMT fractions were used to disaggregate monthly VMT to daily weekdays or weekends VMT. PPSUITE was used to calculate hour VMT fractions, which were based on hourly pattern inputs. These hourly VMT fractions were inputs to MOVES and were responsible to distribute the daily VMT into 24-hourly pattern.

6.2.9 MONTH VMT FRACTIONS

These are the fractions of annual VMT per source type occurring per month. These fractions must sum to 1 within each source type over a 12-month period. In addition, these fractions were used in MOVES input to disaggregate annual VMT to monthly VMT as stated in the previous section.

6.2.10 DAY VMT FRACTIONS

These fractions are the fractions of annual VMT per source type, which occur on either the weekday or weekend. These fractions were also used in MOVES input to disaggregate the monthly VMT to daily VMT per weekdays and weekends as stated in the previous section. These fractions must sum to 1 within each source type, month and road type.

6.2.11 HOUR VMT FRACTIONS

These fractions are the fractions of annual VMT per source type, which occur per hour. These fractions were used in MOVES input to distribute the daily VMT by weekdays and weekends into a 24-hourly pattern. These fractions must sum to 1 within each source type, road type and type of day combination. These fractions were applied to all months.

6.2.12 AVERAGE SPEED DISTRIBUTION

Emissions for many pollutants such as VOC and NO_x vary significantly with travel speed. Generally, VOC's emissions decrease as speed increases, while NO_x emissions decrease at low speed and increase at higher speeds. The emission process uses the PPSUITE set of programs to obtain the best estimate of vehicle speeds. These PPSUITE sets' primary function was to organize and simplify the handling of large amounts of data, which were needed for the calculations of speeds and preparation of MOVES input files. Furthermore, the PPSUITE's software prepares the MOVES vehicle hours of travel (VHT) by speed bin and summarizes the distribution of speeds across all links into each of 16 MOVES speed bins for each hour of the day.

6.2.13 ROAD TYPE DISTRIBUTION

Typical drive cycles and associated operating conditions vary by the type of roadway in MOVES. MOVES define the following road types:

1. Off-Network,
2. Rural Restricted Access,
3. Rural Unrestricted Access,
4. Urban Restricted Access, and
5. Urban Unrestricted Access.

The off-network road type includes emissions from vehicle starts, extended idle activity and evaporative emissions. Off-network activity is primarily determined by the source type population input. The remaining distribution among road types is determined by associating the Maryland Department of Transportation's (MDOT's) functional class with each MOVES road type:

- MOVES Road Type (2) = MDOT Functional Class (1),
- MOVES Road Type (3) = MDOT functional Class (2, 6, 7, 8, 9),
- MOVES Road Type (4) = MDOT Functional Class (11, 12), and
- MOVES Road Type (5) = MDOT Functional Class (14, 16, 17, 19).

6.2.14 RAMP FRACTIONS

Since ramps are not directly represented within the SHA's database, it is assumed that 8% of the Freeway VHT is Ramp's VHT. This assumption is consistent with the recommendations given in EPA's Technical Guidance. This ramp fractions file was also input to MOVES. The vehicle type percentages are also provided to the capacity analysis section of PPSUITE to adjust the speeds in response to trucks. That is, a given number of larger trucks take up more roadway space than a given number of cars, and this is accounted for in the speed estimation process by adjusting capacity using information from the Highway Capacity Manual.

6.2.15 SOURCE TYPE AGE DISTRIBUTION

Age distribution could be described as mix of vehicles of different ages. MOVES covers a 31-year range of vehicle ages, while vehicles 30 years and older were grouped together. In MOVES, user could specify the fraction of vehicles in each of the 30 vehicle ages for each 13 source types. It is also known that the age distribution of vehicle fleets could vary extensively from area to area and could affect emissions. As a result of older vehicles to have been driven more miles and experiencing more deterioration in their emission control systems, such vehicles tend to have higher emissions. Therefore, fleets with a higher percentage of older vehicles would have higher emissions. In addition, a higher percentage of older vehicles in the fleet indicate that these vehicles would not be able to meet newer and more stringent emission standards or CAFE standards.

It should be noted that if the user wants to apply rates to multiple counties, the user should use a single age distribution that is appropriate for all those counties. However, if the multiple counties that need to be modeled have different age distributions, it is advisable that the user should model each county separately.

MSCP was able to develop the 2017 source type age distribution from the MVA's motor vehicle registration database. MSCP obtained this MVA's registration database, which was then VIN-decoded, thereby, making it possible to obtain the 13 MOVES source types by model year. However, same age distribution was used for source types 31 and 32 because of the difficulty to split the data into source types 31 and 32. The same age distribution was also used for refuse trucks, single unit short-/long-haul trucks. Furthermore, the same age distribution was also used for combination short-/long-haul trucks. However, for source types 52, 53, 61 and 62, the default age distribution was superimposed on the local age distribution that was obtained from the MVA's processed data.

6.2.16 SOURCE TYPE POPULATION

MOVES uses source types' population to calculate evaporative, start and hotelling emissions. It should be noted that start and hotelling emissions depend on how many vehicles are parked and started than on how many miles of these vehicles are driven. As a result of this, source types' population played a significant role in calculating the aforementioned emissions. If in the absence of any other source of population data, users could still base population estimates on the VMT estimates for a particular source type. This VMT estimates was based on running MOVES at the national scale for a county of interest, but including VMT and population in the output.

Then, the local VMT would be multiplied by the ratio of default population to default VMT by source type to produce an estimate of the local population. This option was used to obtain the source type population for source types 52, 53, 61 and 62.

6.3 METEOROLOGY

In MOVES, ambient temperature and relative humidity data are essential inputs for estimating the on-road criteria and GHG pollutants' emissions. The temperature and relative humidity are significant factors in modeling emissions from motor vehicles as they affect air conditioner use. MOVES need a 24-hour temperature and humidity profile in order to model a full day of emissions based on every hour of the day. It should be noted that the temperature has to be in degrees Fahrenheit, while the relative humidity must be in percentage.

Moreover, EPA urges users to use the average daily temperature and relative humidity profile for each month in case modeling is to be performed for all the 12 months. Latest available information on temperature and relative humidity should also be used for criteria and GHG pollutants emissions' estimates.

MSCP obtained the 2017 local weather data from Air Monitoring Program from all the airports in Maryland. These weather data were then processed to produce the 24-hourly data for each month. For instance, the Thurgood Marshall-Baltimore Washington (BWI) airport data was used for the Baltimore area, which comprises the Baltimore City and the counties of Anne Arundel, Baltimore, Carroll, Harford and Howard. MSCP also used the same procedure to process the weather data for the remaining counties in Maryland. Based on the airport mapping that MSCP developed, the appropriate airport data were allocated to these counties.

6.4 I/M PROGRAM

In Maryland, I/M Program, also known as Vehicle Emissions Inspection Program (VEIP), tests model year 1977 and newer gasoline powered vehicles weighing up to 26,000 pounds. This test is done biennially, or on a change of ownership. There is a two year grace period for new vehicles. However, model year 1996 and newer light-duty vehicles, and model year 2017 and newer vehicles weighing up to 14,000 pounds get the onboard diagnostics' (OBD's) test. All other vehicles get an idle test with a gas cap pressure test and a visual check for the presence of a catalytic converter.

The fields in a typical I/M program are polProcessID, stateID, countyID, yearID, sourceTypeID, fuelTypeID, IMProgramID, inspectFreq, testStandardsID, begModelYearID, endModelYearID, useIMyn and complianceFactor. The field useIMyn allows the user to turn off ("N") or on ("Y").

6.4.1 POLLUTANT PROCESS ID

MOVES estimate emission reductions from VEIP for CO, hydrocarbons and NO_x. For exhaust emissions, I/M programs affect both running and start emissions. In addition, for evaporative emissions, I/M programs affect hydrocarbon emissions from fuel vapor venting and fuel leaks.

6.4.2 SOURCE TYPE AND FUEL TYPE IDS

These fields are used to describe the source (vehicle) and fuel types included in I/M program. The staff of the VEIP Division in MSCP when preparing I/M file, made sure that the source and fuel types match I/M

programs' parameters for the source types included in the VEIP. It should be noted that MOVES currently calculates I/M program's benefits only for gasoline source types or vehicles.

Furthermore, I/M programs have historically applied to vehicles by regulatory weight class; however, MOVES applies I/M program's benefits by source type. This idea could lead to discrepancies between the number of vehicles covered in the actual I/M program and the number of vehicles that MOVES assumes is covered. For instance, I/M program, which targets trucks less than 8,501 pounds Gross Vehicle Weight Rating (GVWR) such as regulatory classes LDT1, LDT2, LDT3 and LDT4 would include parts of two MOVES source types 31 (passenger trucks) and 32 (light commercial trucks).

Moreover, these source types enumerated in this section also include vehicles with GVWR greater than 8,501 pounds. Whenever I/M program is applied to source types 31 and 32 in MOVES, the benefits of I/M program would be applied to all the vehicles in these source types. Hence, there is a need to adjust the compliance factor to account for the fraction of vehicles within a source type that is actually covered by I/M program.

6.4.3 INSPECTION FREQUENCY

MOVES allow users to enter either annual or biennial test frequency. In accordance with Maryland's VEIP design, the MSCP utilized the input indicative of a biennial test frequency for all the inventory work that is documented herein.

6.4.4 TEST STANDARDS AND I/M PROGRAM ID

There are 13 exhaust and 7 evaporative emissions tests that MOVES allows users to choose from. In Maryland, MSCP chose for its VEIP four test standards, which are identified by I/M program IDs. The test standards are:

- 11 – This is an Unloaded Idle Test, which is a test performed while vehicle idles in park or neutral.
- 41 – This is an Evaporative Gas Cap Check, which is a test conducted by pressurizing the gas cap so as to identify any leaks in the gas cap.
- 43 – This is an Evaporative System OBD check, which is the test of the evaporative emission related systems and components performed by visual check of the Malfunction Indicator Light (MIL) as well as scan of the OBD computer.
- 51 – This is an Exhaust OBD Check, which is the test of exhaust-related systems and components performed by visual check of MIL and scan of OBD computer for system readiness, MIL status, and troubled codes are then stored. This test covers 1996 and newer OBD-equipped vehicles only.

It should be noted that in MOVES, I/M programs that have both exhaust and evaporative inspection components including OBD programs should be modeled as 2 separate and simultaneous programs. In addition, I/M Program ID numbers are used to identify these programs. MSCP followed this guideline in its VEIP's setup.

6.4.5 BEGINNING AND END MODEL YEARS

In I/M Program, MOVES uses these two columns to specify the beginning and ending model years of vehicles covered. In Maryland, there is a grace period of 2 years before new vehicles are tested. The ending model year depends on the year of evaluation and the grace period for vehicles as enumerated above. However, the beginning model year is 1977 for 3 of the 4 test standards, except OBD test that has the beginning model year as 1996.

6.4.6 COMPLIANCE FACTOR

MOVES uses the compliance factor input to account for I/M program compliance rates, waiver rates, and the adjustments needed to account for the fraction of vehicles within a source type that are covered by the I/M program. These adjustments would be referred to as 'regulatory class coverage adjustment'. The compliance factor ranges from 0 to 100, and the number that would be entered in this column depends on the calculation based on the compliance rate, waiver rate and the regulatory class coverage adjustment as illustrated below:

Compliance Factor = (percent compliance rate) * (100-percent waiver rate)* percent regulatory class coverage adjustment.

Furthermore, the compliance factor represents the percentage of vehicles within a source type that actually receive I/M program's benefits. In addition, the compliance factor could also be looked at as reflecting the observed fail and waiver rates in the program, combined with an assumed 96% compliance rate for vehicles showing up for testing. Heavy-duty vehicles have an additional factor, reflecting the fraction of vehicles in the weight range covered by the program.

6.4.7 COMPLIANCE RATE

The compliance rate is the percentage of vehicles in the fleet that are covered by I/M program, and which either receive a certificate of compliance or a waiver after taking the test. Moreover, the higher compliance rate for the gas cap check reflects the much higher retest pass rate for this check.

6.4.8 WAIVER RATE

The waiver rate is the percentage of vehicles that fail an initial I/M test, as well as retest, but they receive a certificate of compliance. It could also be calculated as follows:

$$\text{Waiver rate} = \frac{(\text{No. of vehicles that fail an initial test and do not pass retest})}{(\text{No. of vehicles that fail an initial IM test})}$$

6.4.9 REGULATORY CLASS COVERAGE ADJUSTMENT

In MOVES, I/M programs are applied to source types. The association of source types and I/M program could be inconsistent with state I/M program regulations that define I/M program by the vehicle weight classes. It should be noted that MOVES source types comprise several vehicle- weight classes, applying I/M's benefits to the entire MOVES' source types could be inappropriate. Table A.1 on page 61 of EPA's document entitled, *MOVES2014a Technical Guidance: Using MOVES to Prepare Emission Inventories for State Implementation Plans and Transportation Conformity* could be used to develop adjustments to the compliance factor to account for this discrepancy.

These adjustments are percentages of VMT by the various regulatory weight classes within a source type. After reviewing the table, users should sum the adjustments for weight classes within the source types, which are covered by I/M program. The sum of these adjustments provide users with a multiplicative factor that could be applied along with compliance and waiver rates as already discussed in Section 6.4.6.

6.5 FUELS

The four tables represented under fuel are Fuel Formulation, Fuel Supply, Fuel Usage Fraction and Alternative Vehicle Fuels and Technology (AVFT). These tables interact by defining the fuels used in the area being modeled. In MOVES2014a, the tables are accessed through a single tab in the County Data Manager (CDM). The Fuel Usage Fraction is the only new table that was not available in the previous MOVES versions. MOVES defaults for these tables are available and could be accessed using the Export Default Data button in the Fuel Tab of the CDM.

The MSCP developed the Fuel Formulation and Fuel Supply Tables, while it used the appropriate default Fuel Usage Fraction for the criteria and GHGs pollutants emissions' estimates because no local data were available. MSCP also used the modified AVFT file that EPA developed as part of the input file for MOVES. Moreover, the Fuel Supply Table identified the fuel formulations used in a region as well as its particular market share, while the Fuel Formulation Table itself defined the fuel properties such as RVP, sulfur level, ethanol volume, aromatic and olefin contents, etc. On the other hand, the Fuel Usage Fraction Table

defined the frequency at which E-85 capable vehicles also known as flex fuel vehicles use E-85 vs. conventional gasoline. The AVFT Table was used to enumerate the fraction of fuel types capable of being used by model year and source types.

Furthermore, when modeling an area, fuels should correspond to the temperature profile for a given month. For example, a wintertime diurnal temperature profile using the MonthID = 7 should not use July fuels, but rather such wintertime diurnal temperature profile to be used should be January fuels. If in a run, the user does not choose output that does not distinguish rates by fuel type, the mix of gasoline/diesel/CNG would be determined by the default AVFT (i.e. the fuel type and technology allocations). However, if in a run the user selects output that is distinguished by fuel type, the AVFT values would not be applied, instead an appropriate mix of activity by fuel type would be applied during post-processing.

6.5.1 REGIONAL FUELS

The main goal in the development of the regional fuels approach was to aggregate fuels into larger and more representative areas. By this methodology, eleven general fuel regions were created for the United States and major territories. These fuel regions were initially based on existing Petroleum Administration for Defense Districts' (PADDs') boundaries. These PADDs' boundaries were based on historic division of fuel supply areas, which were originally developed in the 1950s, and were then adjusted to account for broad fuel distribution corridors and the presence of bulk fuel pipelines and terminals. These PADDs are the geographic aggregations of the 50 states and the District of Columbia, which were divided into five districts as follows:

- a). PADD1- East Coast.
- b). PADD2 – Midwest.
- c). PADD3 – Gulf Coast.
- d). PADD4 – Rocky Mountain.
- e). PADD5 – West Coast.

The MOVES2014a regional fuel areas are defined by the region County table in the MOVES default database. Table 6.5.1-a below illustrates the MOVES2014a Fuel Regions, while Table 6.5.1-b identifies the regionID in MOVES2014a.

TABLE 6.5.1-a MOVES2014a Fuel Regions

Region ID#	Region Name	Description
1	East Coast	East coast states up to Appalachians, Florida, and gulf coast region
2	Midwest	Midwest states up to Appalachians (not including Wisconsin), Tennessee, Kentucky
3	South	Southern states not including gulf coast, Nebraska, Iowa
4	North	North and South Dakota, Minnesota, Wisconsin
5	Rocky Mtns	Pacific northwest, Rocky mountain states, Utah
6	CA/NV/AR	California, Nevada, Arizona, AK, and HI NOT using Reformulated Gasoline (RFG)
11	East Coast RFG	East coast states and regions using RFG fuel or under a controlled fuel program
12	MD/VA	Maryland and Virginia regions using RFG fuel or under a controlled fuel program
13	Texas RFG	Texas regions using RFG fuel or under a controlled fuel program
14	Midwest RFG	Midwest regions using RFG fuel or under a controlled fuel program
15	California	California using California fuel, Nevada and Arizona regions using California Fuel

TABLE 6.5.1-bRegionID in MOVES2014a

RegionID	AA, Base Region ID#	Base Region Name	BB, Maximum summer RVP (psi) or 00 for ASTM	CC, E10 RVP Waiver (00=1 psi waiver, 01=no waiver)	DD, Minimum ethanol volume, %	XX (Reserved for future use)
0	1	East Coast	0.0	0	0	0
100000000			0.0	0	0	0
100010000			0.0	1	0	0
170000000			7.0	0	0	0
178000000			7.8	0	0	0
178010000			7.8	1	0	0
200000000	2	Midwest	0.0	0	0	0
270000000			7.0	0	0	0
278000000			7.8	0	0	0
278010000			7.8	1	0	0
300000000	3	South	0.0	0	0	0
370000000			7.0	0	0	0
370010000			7.0	1	0	0
400000000	4	North	0.0	0	0	0
500000000	5	Rocky Mtns	0.0	0	0	0
578000000			7.8	0	0	0
600000000	6	CA/NV/AR/All Others	0.0	0	0	0
678000000			7.8	0	0	0
1170011000	11	East Coast RFG	7.0	1	10	0
1270011000	12	MD/VA RFG	7.0	1	10	0
1370011000	13	Texas RFG	7.0	1	10	0
1470011000	14	Midwest RFG	7.0	1	10	0
1570011000	15	California	7.0	1	10	0

6.5.2 FUEL SUPPLY

The Fuel Supply Table classifies the fuel formulation that is used in an area, and each formulation's respective market share. Once the fuel formulation for the area being modeled had been modified, the Fuel Supply Table could be populated. The populated table is indicated in Table 6.5.2, and due to its large size, only a portion of the entire table could be shown.

TABLE 6.5.2 Fuel Supply

fuelRegionID	fuelYearID	monthGroupID	fuelFormulationID	marketShare	marketShareCV
1270011000	2017	1	1401	1	0
1270011000	2017	2	1402	1	0
1270011000	2017	3	1403	1	0
1270011000	2017	4	1404	1	0
1270011000	2017	5	1405	1	0
1270011000	2017	6	1406	1	0
1270011000	2017	7	1407	1	0
1270011000	2017	8	1408	1	0
1270011000	2017	9	1409	1	0
1270011000	2017	10	1410	1	0
1270011000	2017	11	1411	1	0
1270011000	2017	12	1412	1	0
1270011000	2017	1	21501	1	0
1270011000	2017	2	21502	1	0
1270011000	2017	3	21503	1	0
1270011000	2017	4	21504	1	0
1270011000	2017	5	21505	1	0
1270011000	2017	6	21506	1	0
1270011000	2017	7	21507	1	0
1270011000	2017	8	21508	1	0
1270011000	2017	9	21509	1	0
1270011000	2017	10	21510	1	0
1270011000	2017	11	21511	1	0
1270011000	2017	12	21512	1	0
1270011000	2017	1	190	1	0
1270011000	2017	2	190	1	0
1270011000	2017	3	190	1	0
1270011000	2017	4	190	1	0
1270011000	2017	5	190	1	0
1270011000	2017	6	190	1	0
1270011000	2017	7	190	1	0
1270011000	2017	8	190	1	0
1270011000	2017	9	190	1	0
1270011000	2017	10	190	1	0
1270011000	2017	11	190	1	0
1270011000	2017	12	190	1	0

The Fuel Supply shown in Table 6.5.2 has six fields which are the fuelregionID, the fuelyearID, the monthgroupID, the fuelformulationID, the marketShare and the marketShareCV. These fields are briefly described as follows:

The fuelregionID field was created based on the new analysis of nationwide fuel use, which prompted a change in how fuels are defined at the county level in the default database. Consequently, the default fuel supply is divided into fuel regions instead of each county having a unique fuel supply. The noticeable impact of this change could be seen in the fuel supply table where the column for countyID has been replaced with the RegionID. MSCP had utilized the RegionIDs 1 and 12 for the inventory of the criteria pollutants and GHGs as contained in this document.

The monthgroupID field is the same as the monthID; for the monthgroupID field was built in to permit the possibility of seasonal fuels, but that option is not functional at present.

The fuelformulationID field identifies the fuel used in the area and this is the number that is entered in the fuel supply table.

The Marketshare field represents the fraction of the volume of each fuel's formulation that is consumed in the area. It is significant that the Marketshare should sum to one within each fuel type.

The MarketshareCV field represents the coefficient of variation for the market share. This field could be used when uncertainty calculations were enabled. In Maryland, the value is not required and a zero was entered.

6.5.3 FUEL FORMULATION

The Fuel Formulation Table describes the elements such as RVP, sulfur level, ethanol volume, etc. of each fuel. The MSCP prepared the elements of the 2017 Fuel Formulation Table from the Monthly Retail data obtained from the Fuel Tax Division of the Comptroller's Office. A database each was created to enter the values of the gasoline and diesel fuels from these monthly retail data for all the 12 months of 2017. After this, an access program was written to process the average monthly values for all the elements of the gasoline and diesel fuels. For instance, the gasoline fuel is in 3 grades (regular, mid-grade and premium). The weighted average of the gasoline fuel grade was calculated by using EPA's methodology. The diesel fuel is in one grade and access program was also used to calculate the monthly average for all the 12 months of 2017.

These average values represented the elements of the gasoline and diesel in the Fuel Formulation Table. The default values were used for CNG, E-85 and electricity. As a result of the large size of the formulation table, a portion of the fuel formulation table is shown in Table 6.5.3 of this documentation.

The key fields in the fuel formulation table as shown in Table 6.5.3 were briefly described as follows:

Fuel Formulation ID: This field identifies the fuel used in the area and this is the number that is entered in the fuel supply table. In MOVES2014a, the existing fuel formulation ID could be modified or a new formulation ID could also be created.

Fuel Subtype ID: This number provided a small level of detail about the type of fuel the formulation was describing, but in some cases, there could be more than one fuel subtype that also described the fuel

formulation. For instance, the fuel reformulation could be gasoline blended with 10% ethanol or the one blended with MTBE that was earlier used in the gasoline mixture. Hence, a different fuel subtype ID is assigned to this different gasoline mixture.

RVP means 'Reid Vapor Pressure', which was measured in pounds per square inch (psi). This field was used to define the volatility of gasoline.

Sulfur Level: The sulfur level was measured in parts per million (ppmw) in terms of weight. Sulfur levels should be entered for all gasoline and diesel fuels. It should be noted that the Tier2 gasoline sulfur rule established a national average of 30 ppmw sulfur and a cap of 80 ppmw. As for diesel fuel, the ultra-low sulfur rule requires that at least 80% of the highway diesel fuel sold should meet the 15 ppm, while the remaining 20% should meet the Low Sulfur Diesel Standard of 500 ppm.

Ethanol Volume: This field represents the percent by volume of ethanol in the gasoline/ethanol mixture.

MTBE Volume: This field represents the percent by volume of methyl tertiary butyl ether (MTBE) in the gasoline/MTBE mixture. The gasoline that is being supplied to Maryland does not contain any significant amount of MTBE because of the MTBE concentrations, which were found in water in some areas. So a zero value was entered in the MTBE Volume column.

ETBE Volume: This field represents the percent by volume of ethyl tertiary butyl ether (ETBE) in the gasoline/ETBE mixture. A value of zero was entered in the ETBE Volume column because there was no trace of ETBE concentrations in the gasoline that is being supplied to Maryland.

TAME Volume: This field represents the percent by volume of tertiary amyl methyl ether (TAME) in the gasoline/TAME mixture. A value of zero was entered in the TAME Volume column because there was no trace of TAME concentrations in the gasoline that is being supplied to Maryland.

Aromatic Content: This field represents the percent by volume of aromatic hydrocarbon compounds in gasoline. A value of zero was entered for diesel fuel, CNG, E-85 and electricity.

Olefin Content: This field represents the percent by volume of olefin hydrocarbon compounds in gasoline. A value of zero was entered for diesel fuel, CNG, E-85 and electricity.

Benzene Content: This field represents the percent by volume of benzene in gasoline. A value of zero was entered for diesel fuel, CNG, E-85 and electricity.

E200: This field represents the percent of gasoline that had evaporated at 200 degrees Fahrenheit. A value of zero was entered for diesel fuel, CNG, E-85 and electricity.

E300: This field represents the percent of gasoline that had evaporated at 300 degrees Fahrenheit. A value of zero was entered for diesel fuel, CNG, E-85 and electricity.

T50: This field represents the temperature at which 50 percent of the gasoline had evaporated. A value of zero was entered for diesel fuel, CNG, E-85 and electricity.

T90: This field represents the temperature at which 90 percent of the gasoline had evaporated. A value of zero was entered for diesel fuel, CNG, E-85 and electricity.

As a result of the large size of the formulation table, a portion of the fuel formulation table is illustrated in Table 6.5.3 of this documentation.

TABLE 6.5.3 Fuel Formulation

fuelFormulationID	fuelSubtypeID	RVP	sulfurLevel	ETOHVol	MTBEVol	ETBEVol	TAMEVol	aromaticC	olefinC	benzeneC	e200	e300	T50
1401	12	12.9	23	10.9	0	0	0	18.8	10.5	0.3	57.5	87.2	157.0
1402	12	12.9	22	12.2	0	0	0	18.7	10.4	0.3	57.6	87.2	156.7
1403	12	12.8	22	10.8	0	0	0	19.7	10.2	0.3	57.5	86.9	157.4
1404	12	11.7	21	10.7	0	0	0	19.9	10.1	0.4	55.8	87.5	165.7
1405	12	7.5	17	10.5	0	0	0	18.6	8.2	0.4	48.1	87.1	203.7
1406	12	6.9	22	10.4	0	0	0	19.9	8.6	0.3	47.0	86.2	209.1
1407	12	7.0	22	10.5	0	0	0	17.0	8.7	0.3	47.2	85.9	207.8
1408	12	6.9	22	10.4	0	0	0	16.8	8.5	0.3	46.7	85.6	209.3
1409	12	7.5	23	10.5	0	0	0	17.6	9.9	0.3	48.8	85.8	200.6
1410	12	10.7	23	10.6	0	0	0	18.2	10.1	0.4	54.5	86.6	173.1
1411	12	12.3	22	10.8	0	0	0	19.7	9.9	0.4	55.9	87.2	164.4
1412	12	12.9	23	10.7	0	0	0	18.9	10.1	0.3	57.2	88.4	160.5
21501	20	0	8	0	0	0	0	0	0	0	0	0	0
21502	20	0	8	0	0	0	0	0	0	0	0	0	0
21503	20	0	8	0	0	0	0	0	0	0	0	0	0
21504	20	0	8	0	0	0	0	0	0	0	0	0	0
21505	20	0	7	0	0	0	0	0	0	0	0	0	0
21506	20	0	9	0	0	0	0	0	0	0	0	0	0
21507	20	0	8	0	0	0	0	0	0	0	0	0	0
21508	20	0	7	0	0	0	0	0	0	0	0	0	0
21509	20	0	7	0	0	0	0	0	0	0	0	0	0
21510	20	0	7	0	0	0	0	0	0	0	0	0	0
21511	20	0	7	0	0	0	0	0	0	0	0	0	0
21512	20	0	8	0	0	0	0	0	0	0	0	0	0
190	90	0	0	0	0	0	0	0	0	0	0	0	0
230	30	0	0	0	0	0	0	0	0	0	0	0	0
251	51	7.7	8	74	0	0	0	0	0	0	49.9	89.5	200

6.5.4 FUEL USAGE FRACTION

A new table called 'Fuel Usage Fraction' became part of the fuel input files that need to be imported into the MOVES GUI through the CDM. This table contains the countyID, fuelYearID, modelYearGroupID, sourceBinFuelTypeID, fuelSupplyFuelTypeID and usageFraction, and each field is described later in this section. E-85 capable vehicles, which are also known as flex-fuel vehicles, (FFVs) do exist throughout the nation.

These vehicles are capable of using either conventional gasoline or E-85 fuel, which is a blend of 85% ethanol and 15% gasoline by volume. The Fuel Usage table classifies the fraction of E-85 use among E-85 capable vehicles but it is not the fraction of use among all vehicles or the fraction of E-85 capable vehicles in the fleet. It should also be noted that the fuel E-85 should always be selected in the On-road Vehicle Equipment Panel because FFVs are there in the national fleet.

Therefore, the Fuel Usage Fraction inputs turn out to be the appropriate place to account for the amount of actual E-85 usage by the FFVs. Since local data is not available, the MSCP utilized the appropriate default Fuel Usage Fraction Table for the inventory of the 2017 criteria and GHGs pollutants as shown in Table 6.5.4 of this document.

TABLE 6.5.4 Fuel Usage Fraction

countyID	fuelYearID	modelYearGroupID	sourceBinFuelTypeID	fuelSupplyFuelTypeID	usageFraction
24003	2017	0	1	1	1
24003	2017	0	2	2	1
24003	2017	0	3	3	1
24003	2017	0	4	4	1
24003	2017	0	5	1	0.982134
24003	2017	0	5	5	0.017866
24003	2017	0	9	9	1

The fuel usage fraction in Table 6.5.4 of this document contains the following fields:

CountyID: This identifies the county that is being modeled.

fuelYearID: This identifies the year of evaluation.

modelYearGroupID: This is sometimes refers to as the engine size. However, a value of zero is entered.

sourceBinFuelTypeID: This identifies all the available fuels including placeholder's fuels.

fuelSupplyFuelTypeID: This identifies the fraction of fuel mixtures. For instance, if the fuel is gasoline only, the fuelSupplyFuelTypeID is equal to 1, which means that the fuel is 100% gasoline.

usageFraction: This identifies the fraction of fuel that is being used in the area that is being modeled by capable E-85 vehicles. For example, if the fuel usage fraction was 1.0 in the

fuelSupplyFuelTypeID = 5 column, showed that E-85 capable vehicles (FFVs) were using E-85 100% of the time. On the other hand, if the fuel usage fraction was zero in the fuelSupplyFuelTypeID = 5 column, showed that FFVs were using gasoline 100% of the time. It could also indicate that there was no E-85 available in the local fuel supply.

6.5.5 ALTERNATE VEHICLE FUEL TECHNOLOGY (AVFT)

This table contains the 13 MOVES source types with the fuel engine fraction of each vehicle using different fuels and technologies in each model year. This table permits the users to modify the fraction of vehicles using different fuels and technologies in each model year. This means that the Fuel Tab allows users to define the split between diesel, gasoline, ethanol, CNG and electricity for each vehicle type and model year. For instance, if in a certain county, it was found that the sales data showed that more diesel vehicles were sold than gasoline vehicles, this tab could be used to make the necessary adjustment to reflect the sales data for this particular county.

The State has adopted both the California Low Emission Vehicle (CALEV) and Zero Emission Vehicle (ZEV) Programs. Moreover, the portion of this table reflects the impact of the modeling of the evaporative portion of the ZEV Program, which affects only source types 21, 31 and 32. It should be noted that each state should make sure that the fuel engine fraction of each fuel should be adjusted in this table according to EPA's Guidance. Based on this information, MSCP appropriately adjusted the AVFT Table for source types 21, 31 and 32 to reflect the implementation of the ZEV Program in the State beginning in model year 2011.

Furthermore, for transit buses, the default table assumed that gasoline, diesel and CNG buses were present in the fleet for most model years. However, if the user has the information about the fuel used by the transit bus fleet in a particular county, the user should make sure that this information is reflected in the AVFT table. For example, if in the modeling area, there are no CNG transit buses, the user needs to allocate zero activity to GNG transit buses in the AVFT Table in order to calculate the correct emission results for transit buses. If this is not done, some VMT would be allocated to CNG transit buses, and the emissions associated with this VMT would not be included in the output, since only gasoline and diesel vehicles were selected in the On-road Vehicle Equipment Panel of the MOVES GUI.

As a result of the enormous size of the AVFT Table, Table 6.5.5 of this document could only show a portion of the AVFT Table. In addition, Table 6-6 specifically showed the fuel engine fraction for source type 21, which was one of the source types that were affected by the implementation of the CALEV and ZEV Programs that began in the State in calendar year 2011, which also coincided with model year 2011.

Other inputs files that were imported into the MOVES GUI include starts, hotelling and retrofit data. MSCP opted for the default values of these input files because local data were not available.

TABLE 6.5.5 AVFT

SourceTypeID	modelYearID	fuelTypeID	engTechID	fuelEngFraction
21	2009	1	1	0.948159
21	2009	2	1	0.007368
21	2009	5	1	0.044473
21	2009	9	30	0
21	2010	1	1	0.935791
21	2010	2	1	0.010123
21	2010	5	1	0.054087
21	2010	9	30	0
21	2011	1	1	0.812126
21	2011	2	1	0.011746
21	2011	5	1	0.066128
21	2011	9	30	0.11
21	2012	1	1	0.786923
21	2012	2	1	0.011746
21	2012	5	1	0.081331
21	2012	9	30	0.12
21	2013	1	1	0.823469
21	2013	2	1	0.011746
21	2013	5	1	0.044785
21	2013	9	30	0.12
21	2014	1	1	0.823632
21	2014	2	1	0.011746
21	2014	5	1	0.044622
21	2014	9	30	0.12
21	2015	1	1	0.804509
21	2015	2	1	0.011746
21	2015	5	1	0.043745
21	2015	9	30	0.14

6.5.6 FUEL WIZARD

This is a new feature in MOVES2014a. It is a tool for modifying interrelated properties in a user fuel formulation table when analysis of a change in fuel is desired. For instance, the fuel wizard was used to change the current gasoline sulfur content to 10 ppm to model the effects of gasoline sulfur as required by the Tier3 sulfur content standard, which could also affect other fuel properties. In this case, the Fuel Wizard would appropriately modify related fuel formulation properties, based on refinery modeling, to reflect the change made to sulfur content level.

Once the Wizard is opened, the user could select the desired fuel formulation from the fuel formulation table of the importer database, and from the drop-down field, select the property that needs to be changed, which in this case, is the sulfur content. Then, the Fuel Wizard would automatically adjust related fuel properties in a manner that is consistent with refinery modeling results. As a result of this, the Wizard would display the old and new fuel properties, and the user may accept or reject the change. Furthermore, it is recommended that fuel property changes should be made in ascending order of priority, as the Wizard is only capable of changing one property at a time. In addition, it should be noted that by changing a single fuel property such as sulfur content or RVP, other properties like aromatics or the distillation properties change as well.

Furthermore, the Fuel Wizard contains adjustment factors for three fuel properties (ethanol, sulfur and RVP), which are the most commonly analyzed fuel properties for state and local programs. Moreover, the Fuel Wizard is also currently capable of creating fuels with ethanol variations (E0-E15), sulfur from 5 ppm to 80 ppm and RVP from 5 psi to 14 psi.

6.6 OTHER VEHICLE TECHNOLOGY AND CONTROL STRATEGY DATA

6.6.1 FEDERAL PROGRAMS

Current federal vehicle emissions control and fuel programs had been incorporated into the MOVES2014a software. These include the National Program standards covering model year vehicles through 2016. Modifications of default emission rates were required to reflect the early implementation of the National Low Emission Vehicle (NLEV) Program in Maryland.

6.6.2 STATE VEHICLE TECHNOLOGY PROGRAMS

MD Clean Car Program: Under the Maryland Clean Cars Act of 2007, Maryland adopted the California Low Emission Vehicle (LEV II) Program (CALEV). CALEV was implemented beginning in 2011. CALEV also required all 2011 model year and newer vehicles gross vehicle weight rating (GVWR) to be up to 14,000 lbs. registered in Maryland to meet California emission standards for both criteria and greenhouse gas pollutants. In addition, CALEV also contains a zero emission vehicles' (ZEVs') component that required the manufacturers to produce a certain percentage of zero emission vehicles such as electric, fuel cell, etc., to be purchased in the State. California had just adopted new amendments to the Low-Emission Vehicle regulations entitled, California Low Emission Vehicle III (CALEVIII), which is known as third generation low emission vehicle standards. These amendments created more stringent emission standards for new motor vehicles. These new standards would be phased-in over the 2015-2025 model years in the State.

The impacts of CALEVIII were modeled for all analysis years using USEPA's Guidance document entitled, *Instructions for Using LEV and NLEV Inputs for MOVES2014a*, EPA-420-B-14-060a October 2017. To reflect the impact of both NLEV and CALEVIII programs, USEPA had provided inputs in the form of two databases and one spreadsheet file. The emission rates in these files were to be used only in states other than California, which had adopted the California LEV standards, as well as states in the Ozone Transport Commission (OTC), which also received early implementation of NLEV standards. The ZEV file and the CA

LEVIII's database were modified according to USEPA's Guidance in the State of Maryland, to reflect the start date that began in 2011.

6.7 POST-PROCESS SUITE (PPSUITE)

PPSUITE is a software tool that is widely used for estimating speeds and processing emission rates. It is a process that is integral to produce key input files to the MOVES emission model. Moreover, PPSUITE utilizes a number of programs and operations, which are assembled into a chain of jobs and steps. Michael Baker Jr. Intl. Inc. has utilized the CENTRAL software to provide MDE with the ability to manage efficiently the emission calculation process.

6.7.1 OTHER PPSUTE INPUTS

The other files required by PPSUITE, which are used for all yearly analysis runs include:

- EQUIV.DBF, which is used for input pattern files and output aggregation.
- NAME.DBF, which is used for the output emission reports. It also relates the coded facility and area type numbers to txt names.
- VEHFC2_14SHA.DAT, which contains the impacts of truck percentages on roadway capacity. Consequently, the amount of trucks could have an impact on calculated congested speeds.
- SPDCAP05.DBF. This file contains the free flow speeds, free flow capacities and BPR parameters , which represents the relationship between speed and congestion for each facility and area types as well as lane combination.

6.7.2 SPEED/CAPACITY LOOKUP INFORMATION

The speed-lookup table has a significant impact on calculated speeds and capacities for each roadway link. This file is used to determine free-flow speeds for links without coded speed limits, link "ideal" capacity, signal densities and characteristics and speed/congestion relationships. The speed capacity fields include inter alia AREATYPE, which is used to indicate area type code, FACTYPE, which represents facility code, LANES, which indicates number of directional lanes, etc.

6.7.3 RUNNING THE AIR QUALITY PROCESS IN CENTRAL

The statewide emission calculation process had been set up to use CENTRAL to assist the user in running the individual program steps. This CENTRAL Program provides a customized windows user-interface with dialog boxes, edit fields and buttons, which are designed specifically for this process. The CENTRAL software had been licensed to MDE, which is always renewed every year and had been used for past regional air quality and conformity analyses as well as the inventories documented herein. This process

also requires the PPSUITE software had to be installed in conjunction with MOVES2014a on the computer hard-drive.

6.7.4 DIRECTORY AND FILE STRUCTURE

The CD-ROM that Michael Baker Jr. Intl. Inc. provided contains the MDMOVES14's directory. This directory contains the input files and program driver files that were needed for producing the emission runs. This directory also contains the following sub-directories:

- ! CENTRAL.
- COMMON.
- DRIVERS.
- MOVESINPUTS.
- OUT.
- OUT_RATETABLE.
- OUT_SUMMARY.
- PROGRAMS.
- TRAFFICINPUTS.

6.7.5 ZONE/AREA EQUIVALENCY

The Zone/Area equivalency file is used to provide equivalency between each link and the fields used for hourly and vehicle mix pattern indexing and output emission indexes. The user is not required to make any adjustments to the file, and even updates to the network and pattern data area.

The fields included in the equivalency file are as follows:

The fields that PPSUITE used in the analysis consist of COUNTY, which defines the county number for pattern and VMT area indexing and NAME that provides the county name.

On the other hand, the fields that are not used in the analysis, but kept for reference include the following:

- ZONE represents traffic zone number, which is linked to the network database field with the same name. This field represents a combination of the county number and the urban-rural code value in the RURURB field. This is calculated as $(\text{COUNTY} * 10) + \text{RURURB}$.
- UR is related to the RURURB field values.
- FLIPS_CO represents county FIPS code.
- DISTRICT defines the district the county falls under.
- CO_CODE represents county code.

6.7.6 NAMES DATABASE FILE

This file is used in generating output emission reports. It transmits the coded facility and area type numbers to text names. This file should only be updated if the area and facility index numbering scheme had been changed from its present values. The NAMES.DBF file contains the emission county totals generated emission reports.

6.7.7 RUNNING THE CENTRAL PROCESS

The CENTRAL menu system, which is basically a screen menu system, has been setup to produce emission estimates. This screen menu system comprises the work area directory specified as C:\MDMOVES14, while all output files would be placed in "OUT" subdirectory. It should also be noted that the "Primary Control File" should always be specified as the MDMOVES.CTL file, which could be found in the CENTRAL subdirectory. Furthermore, the user could also select the appropriate directories and files by using the "Select" button on the right side of each input option. After the completion/verification of the "Work Area Directory" and the "Primary Control File", the user could select the "GO" button, which would open other menu screens. This screen allows the user, in this case MSCP to choose between the "Run Emission Process" and the "Run Post Processing Steps". The "Run Post Processing Step" is used to combine emission results for multiple counties.

6.8 ANALYSIS METHODOLOGY

The previous sections summarized the input data used for computing speeds and emission rates for 2017 motor vehicle highway emission estimates' inventories. This section describes how PPSUITE and MOVES used the MOVES input data to produce criteria and GHG emission estimates. Figure 6.6 presents a more detailed overview of the PPSUITE analysis procedure using the available traffic data information described in the previous section.

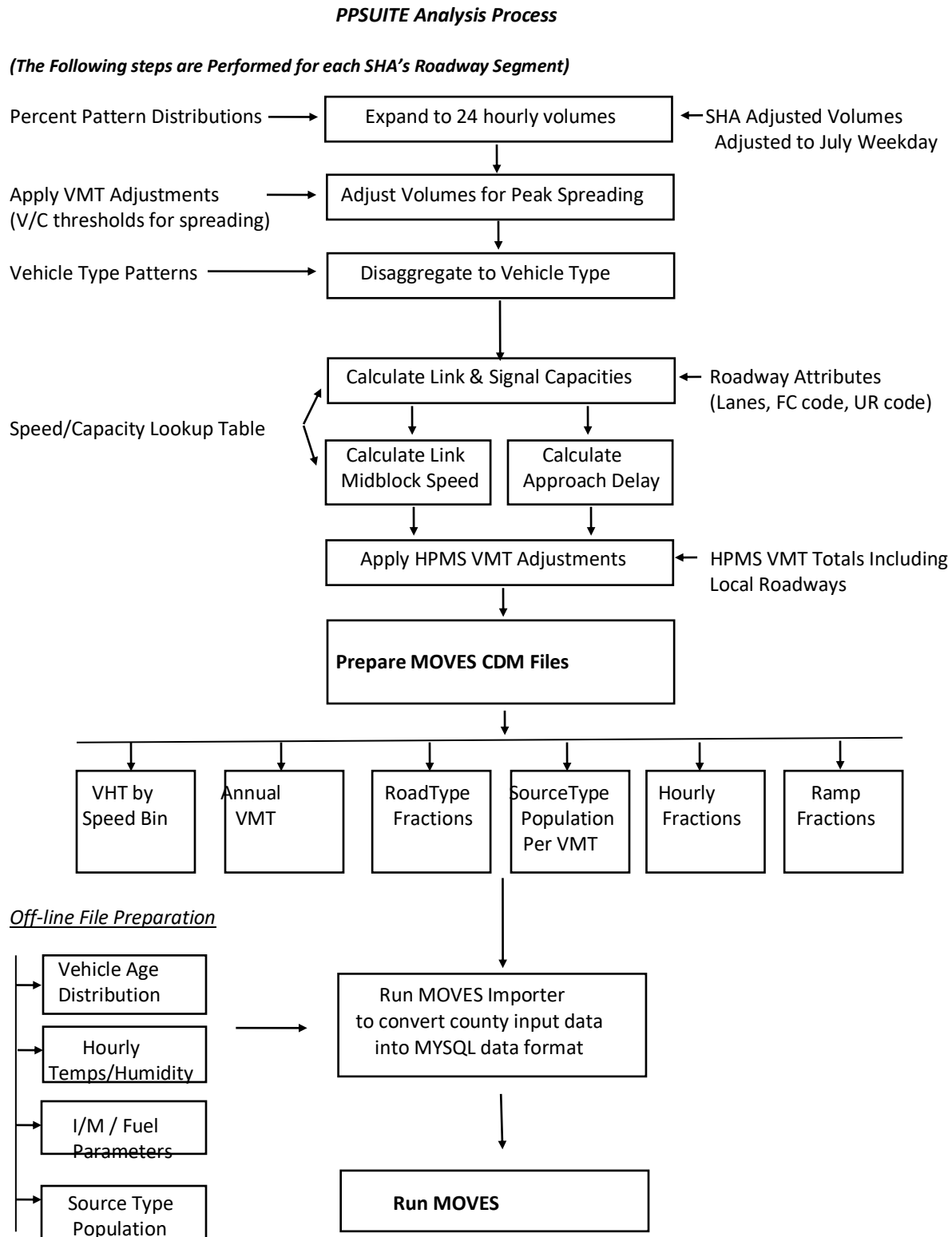
6.8.1 VMT PREPARATION

Producing an emissions' inventory with PPSUITE requires a complex process of disaggregation and aggregation of vehicle activities. The data that was available was used on a very small scale -- individual ½ mile roadway segments for each of the 24 hours of the day. This data needed to be processed individually to determine the distribution of vehicle hours of travel (VHT) by speed and then aggregated by vehicle class to determine the input VMT to the MOVES' emission model. The key steps in the preparation of VMT for a summer daily run include:

- *Application of Seasonal Adjustments* - PPSUITE took the input daily volumes from SHA (which represents AADT traffic) and seasonally adjusted the volumes to an average weekday in July. This adjustment utilized factors developed for each functional class and urban/rural code. VMT could then be calculated for each link using the adjusted weekday volumes.
- *Disaggregation to Hours* - After seasonally adjusting the link volumes, the volumes were split to each hour of the day. These seasonal adjustments allowed for more accurate speed calculations factoring in the effects of congested hours, thereby allowing PPSUITE to prepare the hourly VMT and speeds for input to the MOVES model.

1. *Peak Spreading* - After dividing the daily volumes to each hour of the day, PPSUITE identified hours that were unreasonably congested. For those hours, PPSUITE then extended a portion of the volume to other hours within the same peak period, thereby approximated the “peak spreading” that normally occurred in such over-capacity conditions.
 - *Disaggregation to Vehicle Types* - USEPA requires VMT estimates to be prepared by source types, reflecting specific local characteristics. As a result, for Maryland’s emission inventory runs, the hourly volumes were disaggregated to the five HPMS MOVES vehicle grouping based on count data assembled by SHA in combination with MOVES defaults as described in the previous section.
 - *Application of HPMS VMT Adjustments* - Volumes must also be adjusted to account for differences with the HPMS VMT totals, as described previously. VMT adjustment factors were provided as input to PPSUITE, and were applied to each of the roadway segment volumes. These factors were developed from the latest HPMS download (conducted triennially); however, they are also applied to any future year runs. The VMT that is added or subtracted to the SHA’s database assumed the speeds calculated using the original volumes for each roadway segment for each hour of the day.

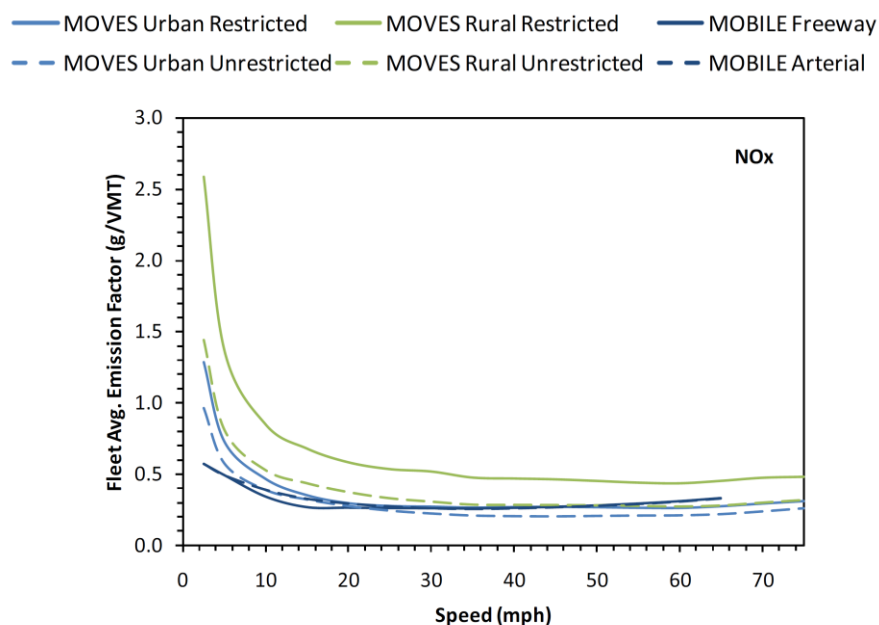
Figure 6.8.1: PPSUITE Speed/Emission Estimation Procedure



6.8.2 SPEED ESTIMATION

Emissions for many pollutants (including both VOC and NO_x) vary significantly with travel speed. VOCs generally decrease as speed increases, while NO_x decreases at the low speed range and increases at higher speeds, as illustrated in Figure 6.8.2.

Figure 6.8.2: Emission Factor vs. Speed Variances (NO_x)



Source: Figure 3 from *Implications of the MOVES2010 Model on Mobile Source Emission Estimates*, Air & Waste Management Association, July 2010.

USEPA recognizes that the estimation of vehicle speeds is a difficult and complex process. Moreover, it recommends that special attention should be given to developing reasonable and consistent speed estimates, knowing that emissions are so sensitive to speeds. Furthermore, it also recommends that VMT be disaggregated into subsets that have roughly equal speed, with separate emission factors for each subset. At a minimum, speeds should be estimated separately by road type.

The computational framework used for this analysis met and exceeded that recommendation. Speeds were individually calculated for each roadway segment by hour, and they included the estimated delays encountered at signals. Rather than accumulating the roadway segments into a particular road type and calculating an average speed, each individual link hourly speed was represented in the MOVES vehicle hours of travel (VHT) by speed bin file. This MOVES input file allows the specification of a distribution of hourly speeds. For example, if 5% of a county's arterial VHT operates at 5 mph during the AM peak hour and the remaining 95% operates at 65 mph, this could be represented in the MOVES speed input file. For the motor vehicle highway emissions' inventory, distributions of speeds were input to MOVES by both road type and source type by each hour of the day.

To calculate speeds, PPSUITE first obtained initial capacities (how much volume the roadway could serve before heavy congestion), and free-flow speeds (speeds assuming no congestion) from the speed/capacity

lookup data. As described in previous sections, this data contained default roadway information indexed by the urban/rural code and functional class. For areas with known characteristics, values could be directly coded to the SHA's database, and the speed/capacity data could be overwritten.

However, for most areas where known information is not available, the speed/capacity lookups provide valuable default information regarding speeds, capacities, signal characteristics, and other capacity adjustment information used for calculating congested delays and speeds. The result of this process was an estimated average travel time for each hour of the day for each highway segment. The average time multiplied by the volume produced by VHT.

6.8.3 DEVELOPING THE MOVES TRAFFIC INPUT FILES

The PPSUITE software is responsible for producing the following MOVES input files during any analysis run:

- VMT by HPMS vehicle class
- VHT by speed bin
- Road type distributions
- Ramp fractions

These files are text formatted files with a *.csv extension. The files were provided as inputs to MOVES GUI through the CDM.

VMT Input File: VMT is the primary traffic input that affects emission results. The roadway segment distances and traffic volumes were used to prepare estimates of VMT. PPSUITE performed these calculations and the MOVES annual VMT input file was imported into the MOVES GUI through the CDM.

VHT by Speed Bin File: As described in the previous section, the PPSUITE software prepares the MOVES VHT by speed bin file, which summarizes the distribution of speeds across all links into each of 16 MOVES speed bins for each hour of the day by road type. This robust process ensures that MOVES emission rates were used to the fullest extent and was consistent with the methods and recommendations provided in USEPA's Technical Guidance.

Road Type Distributions: In MOVES, typical drive cycles and associated operating conditions vary by the type of roadway.

MOVES define five different road types as follows:

- 1 Off-Network
- 2 Rural Restricted Access
- 3 Rural Unrestricted Access
- 4 Urban Restricted Access
- 5 Urban Unrestricted Access

For this inventory, the MOVES road type distribution file was automatically generated by PPSUITE using defined equivalencies. The off-network road type included emissions from vehicle starts, extended idle activity, and evaporative emissions. Off-network activity in MOVES is primarily determined by the Source Type Population input.

The remaining distribution among road types is determined by equating the functional class with each MOVES road type as follows:

- MOVES Road Type (2) = SHA Functional Class (1)
- MOVES Road Type (3) = SHA Functional Class (2,6,7,8,9)
- MOVES Road Type (4) = SHA Functional Class (11,12)
- MOVES Road Type (5) = SHA Functional Class (14,16,17,19)

Ramp Fractions: Since ramps are not directly represented within the SHA's database information, it is assumed that 8% of the Freeway VHT is ramp VHT. This is consistent with national default values within MOVES and recommendations provided in USEPA's Technical Guidance.

6.8.4 MOVES RUNS

After computing speeds and aggregating VMT and VHT, PPSUITE prepared traffic-related inputs needed to run USEPA's MOVES2014a software. Additional required MOVES inputs were prepared external to the processing software, which included temperatures, I/M program parameters, fuel characteristics, vehicle fleet age distributions and source type population.

The MOVES county importer was run in batch mode. This program converted all data files into the MYSQL formats used by the MOVES model. At that point a MOVES run specification file (*.mrs) was created that specified options and key data locations for the run. MOVES was then executed in batch mode.

MOVES could be executed using either the *inventory* or *rate-based* approaches. For this highway emissions inventory, MOVES was applied using the *inventory-based* approach. Under this method, actual VMT and population were provided as inputs to the model, and MOVES was responsible for producing the total emissions for the area being modeled. Under the *rate-based* approach, MOVES would produce emission factors, after which PPSUITE would apply the emission factors to the link data and calculate total emissions for the area being modeled.

6.9 FUEL CONSUMPTION ESTIMATES

The MOVES output energy rates could be converted to fuel consumption values using the conversion rates for gasoline and diesel fuel (See equation 1-1 and 4-12 for the conversion of fuel from kilojoules to gallons).

The estimated 2017 fuel consumption values are shown in Table 6.9 below. The 2017 values were compared to the actual statewide fuel sales as illustrated in the last column.

TABLE 6.9: 2017 Fuel Consumption Estimates

Scenario	Fuel Type	MOVES2014A Output		Actual Statewide Fuel Sales ² (Thousand Gallons)
		Energy Consumption (Trillion BTU)	Estimated Fuel Consumption ¹ (Thousand Gallons)	
2017	Gasoline	291		

			2,417,950	2,790,991
	Diesel	79	573,989	517,250

¹Assumes the following conversion rates extracted from the EIA's website:
(120,333 BTU per gallon of gasoline) and (137,381 BTU per gallon of diesel)

²Gasoline and diesel values were obtained from Maryland Comptroller's Office for calendar year (CY) 2017.

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6.11 HIGHWAY VEHICLE INVENTORY GLOSSARY

AADT: Average Annual Daily Traffic, average of ALL days.

AWDT: Average Weekday Daily Traffic.

County Data Manager (CDM): User interface developed to simplify importing specific local data for a single county or a user-defined custom domain without requiring direct interaction with the underlying MySQL database.

Emission rate or factor: Expresses the amount of pollution emitted per unit of activity. For highway vehicles, usually in grams of pollutant emitted per mile driven

FC: Functional code, applied in data management to road segments to identify their type (freeway, local, etc.).

Growth factor: Factor used to convert volumes to future years.

HPMS: Highway Performance Monitoring System, MDOT's official source of highway information and a subset of SHA.

I/M: Vehicle emissions inspection/maintenance programs ensure that vehicle emission controls are in good working order throughout the life of the vehicle. The programs require vehicles to be tested for emissions. Most vehicles that do not pass must be repaired.

MOVES: The latest model EPA has developed with which Maryland uses to estimate emissions from highway vehicles.

Pattern data: Extrapolations of traffic patterns (such as how traffic volume on road segment types varies by time of day, or what kinds of vehicles tend to use a road segment type) from segments with observed data to similar segments.

PPSUITE: Post-Processor for Air Quality, a set of programs that estimate speeds and processes MOBILE emission rates.

Road Type: Functional code, applied in data management to road segments to identify their type (rural/urban highways, rural/urban arterials, etc.)

Source Type: vehicle types used in MOVES modeling

UR: Urban/rural code, applied in data management to identify whether a road segment is urban, small urban or rural.

VHT: Vehicle hours traveled.

VMT: Vehicle miles traveled. In modeling terms, it is the simulated traffic volumes times the link length.

7.0 BIOGENIC SOURCES

7.1 INTRODUCTION

Biogenic sources, a subset of natural sources, include only those sources that result from some sort of biological activity. Biogenic emissions represent a significant portion of the natural source emissions, and VOC, NO_x, and the greenhouse gases can be emitted from biogenic sources.

Vegetation is the predominant biogenic source of VOC and is typically the only source that is used to estimate biogenic VOC emissions. Microbial activity is responsible for the emission of NO_x and the greenhouse gases of CO₂, CH₄, and N₂O. Soil microbial activity is responsible for NO_x and N₂O emissions from agricultural lands and grasslands. CH₄ is emitted through microbial action in waterlogged soils or in other anaerobic microenvironments. CO₂ is released through the aerobic decay of biomass (EPA, 1993; EPA, 1990a).

The biogenic emissions⁷⁹ category can't be controlled directly; therefore, a majority of the resources were directed towards other categories of air pollution where direct control is feasible. For this reason, MDE used the data files created and made available by EPA (2017). These emissions were computed on an hourly basis with a specially-modified version of BEIS3.61 that utilized county land use data from EPA's land use inventory and National Weather Service first-order station data of temperature and cloud cover. However, due to the large size of the hourly data files, only the monthly data files were available when MDE gathered this information.

The data files EPA generated contained county-total estimates of 2017 biogenic emissions based on the BEIS3.61 model. The purpose of this spreadsheet is to provide default 2017 estimates to the states for the purpose of biogenic emissions submittals by county required by the Consolidated Emissions Reporting Rule (CERR). These estimates were created using the following data:

- 1) 2017 meteorology from the Weather Research and Forecasting (WRF) model version 3.8 (WRFv3.8)
- 2) Biogenic Emission Inventory System (BEIS3.61) model via the Sparse Matrix Operator Kernel Emissions (SMOKE) modeling system (version 4.7)
- 3) BELD5 land use data (1-km original data aggregated to 36-km grid).

The BEIS3.61 model creates gridded, hourly, model-species emissions from vegetation and soils at 12-kilometer horizontal resolution. The 12-kilometer gridded hourly data are summed to monthly and annual level and are mapped from 12-kilometer grid cells to counties using a standard mapping file.

Monthly emission estimates were given for each county in Maryland for the following pollutants:

- CO: Carbon monoxide
- NO_x: Nitrogen oxide
- VOC: Volatile Organic Compounds

The daily emissions were calculated by summing the monthly emissions from June, July, and August and dividing by the number of days in those three months (92).

⁷⁹ Biogenic emissions can be downloaded from an EPA website at: <https://www.epa.gov/air-emissions-inventories/2017-national-emissions-inventory-nei-data#dataq>, https://gaftp.epa.gov/air/nei/2017/data_summaries/2017v1/2017nei_beld5_biogenics_report.xlsx



Maryland
Department of
the Environment

Wes Moore, Governor
Aruna Miller, Lt. Governor

Serena McIlwain, Secretary
Suzanne E. Dorsey, Deputy Secretary

APPENDIX A-1B

Baltimore Moderate Nonattainment Area Projection Year Emission Inventory Methodologies

**Prepared for:
U.S. Environmental Protection Agency**

**Prepared by:
Maryland Department of the Environment**



Baltimore, MD Ozone Moderate Nonattainment Area Projection Year Emission Inventory Methodologies

© Maryland Department of the Environment
Air and Radiation Administration
1800 Washington Boulevard, Suite 730
Baltimore, Maryland 21230
Phone 410.537.3240 • Fax 410.631.3202

Table of Contents

1.0	Projection Year Inventory Development.....	2
1.1	ON-ROAD MOBILE SOURCES.....	2
1.2	NONROAD MOBILE SOURCES.....	3
1.2.1	Marine-Air-Rail.....	3
1.2.2	MOVES3 -NONROAD.....	4
1.3	POINT SOURCES.....	4
1.4	QUASI-POINT SOURCES.....	8
1.5	AREA SOURCES	10

1.0 PROJECTION YEAR INVENTORY DEVELOPMENT

This section describes the proposed approach to estimating future year emissions for the State of Maryland nonattainment areas for the purposes of meeting Clean Air Act plan requirements.

In preparing the projection year inventories, the approach should address two components: (1) estimate expected changes in emissions generating activity between the base year (2017) and the projection years; and (2) account for changes in emission rates by source category resulting from air pollution regulations or the replacement of equipment with new, lower emitting technologies. Additionally, the best way to estimate activity changes is to pick an indicator for each source category that has available projections data and provides as direct as possible a link to emissions generating activity.

Possible sources of projections data, in order of preference, are: (1) State of Maryland economic/population/housing projections at the State, County, or facility level, and (2) recent regional economic projections.

The methods used to project each source category are presented below.

1.1 ON-ROAD MOBILE SOURCES

On-road mobile source emission projections to 2023 were estimated using the MOVES3 model. MOVES (MOTOR Vehicle Emissions Simulator) is a computer program designed by the US Environmental Protection Agency (EPA) to estimate air pollution emissions from on-road mobile sources. EPA created MOVES3 as a state-of-the-art model for estimating emissions from all on-road vehicles including cars, trucks, motorcycles, and buses. MOVES3 can be used to estimate exhaust and evaporative emissions as well as brake and tire wear emissions from all types of on-road vehicles for any part of the country, except California.

MOVES3 is the latest version of MOVES that uses emission factors, vehicle types, time periods, vehicle operating characteristics and road types to provide estimates of bulk emissions or emission rates. The projection year emission estimates take into account any fuels strategies that were adopted or planned for the area, and any changes in fuel specifications that change by month/season in order to calculate ozone seasons period average emissions.

1.2 NONROAD MOBILE SOURCES

The Department used two methodologies approved by the EPA for developing the emissions inventory for nonroad categories. One of the methodologies used consisted of employing EPA's MOVES3-NONROAD Mobile Inventory Model. In a memorandum¹, dated June 16, 2003, EPA allowed the use of the draft NONROAD Model and associated default inputs in the development of inventories supporting State Implementation Plans (SIPs). EPA has incorporated the NONROAD Model into the MOVES3 structure. The second methodology entailed the use of surrogate economic or operational data from federal and state agencies. The MOVES3-NONROAD Model was used to generate all nonroad mobile projection emission estimates except for the marine, air and rail source categories.

1.2.1 MARINE-AIR-RAIL

The Marine-Air-Rail (M-A-R) source emissions were forecasted to the projection years using surrogate economic or operational data. Aircraft emission projections were grown using Maryland Department of Labor forecast for air transportation. Locomotives emission projections were grown using Maryland Department of Labor forecast for rail transportation. Marine Vessels emission projections were grown using Maryland Department of Labor forecast for water transportation. The growth factors for the M-A-R sources are presented in the table below.

Table 1-1: Marine-Air-Rail Growth Factors (RET Update 6/8/2022)

M-A-R Source Category	SCC	Surrogate Growth Factor	GF 2023
Aircraft – Military	2275001000	MD DLLR Air Transportation Forecast	1.03059
Aircraft – Commercial	2275020000	MD DLLR Air Transportation Forecast	1.03059
Aircraft - General Aviation	2275050000	MD DLLR Air Transportation Forecast	1.03059
Aircraft - Air Taxi	2275060000	MD DLLR Air Transportation Forecast	1.03059
Marine Vessels, Commercial /Diesel /Port emissions	2280002100	MD DLLR Water Transportation Forecast	1.17333
Marine Vessels, Commercial /Diesel /Underway emissions	2280002200	MD DLLR Water Transportation Forecast	1.17333
Marine Vessels, Commercial /Residual /Port emissions	2280003100	MD DLLR Water Transportation Forecast	1.17333
Marine Vessels, Commercial /Residual /Underway emissions	2280003200	MD DLLR Water Transportation Forecast	1.17333
Locomotives - Class I Line Haul	2285002006	MD DLLR Rail Transportation Forecast	1.10531
Locomotives - Class II / III Line Haul	2285002007	MD DLLR Rail Transportation Forecast	1.10531
Locomotives - Passenger Trains (Amtrak)	2285002008	MD DLLR Rail Transportation Forecast	1.10531
Locomotives - Commuter Lines	2285002009	MD DLLR Rail Transportation Forecast	1.03059
Locomotives - Yard Locomotives	2285002010	MD DLLR Rail Transportation Forecast	1.03059

¹ USEPA Memorandum, dated June 16, 2003, from Gene Tierney or the Air Quality and Modeling Centery and Leila H. Cook of the Transportation and Regional Programs Division; to Regional Mobile Source Program Manages and Staff.

1.2.2 MOVES3 -NONROAD

Nonroad/National Mobile Inventory Model (NMIM) has been incorporated into the MOVES3 model by EPA. The MOVES3-Nonroad component was used to forecast emissions to the projection year.

For the MOVES3-NONROAD model categories, summer day emission projections will be based on the month of July's emissions running the most current version of EPA's MOVES3 model for the projection year. This methodology is the same as was used for the 2017 base year inventory.

1.3 POINT SOURCES

For emissions inventory purposes, point sources are defined as stationary, commercial, or industrial operations that emit more than 10 tons per year (tons/year) of VOCs or 25 tons/year or more of NOx or CO. The point source inventory consists of actual emissions for the base-year 2017 and includes sources within the geographical area of the Baltimore, MD nonattainment area. Each of Maryland's major source facility is identified by standard NAICS industry codes.

Point source emissions are forecasted using data from the Maryland Department of Labor, Licensing and Regulation (DLLR), Maryland Industry Projections (<http://www.dllr.state.md.us/lmi/iandoproj/industry.shtml>). The industry projection data from the DLLR was correlated to standard NAICS industry employment codes. The calculated growth per NAICS industry employment code is used as the growth surrogate for each major source. Maryland does not allow for negative NAICS growth surrogates (less than one) for a SIP inventory. Therefore, all growth surrogates calculated to be less than one are defaulted to a growth surrogate of one indicating no growth for the facility. The point source growth factors are presented in the table below.

Table 1-3: Point Source Growth Factors (RET Update 6/8/2022)

Point Source Growth Factors					
Ozone NAA	State Facility Identifier	Facility Name	NAICS	GF-2023	GF-2023ADJ
BNA	003-0023	Valley Proteins, Inc. - Curtis Bay	311119	1.110038077	1.110038077
BNA	003-0033	Jessup Correctional Institute	92214	1.033487999	1.033487999
BNA	003-0043	Reliable Contracting - Asphalt Plant	324121	0.949591764	1
BNA	003-0056	Prince Erachem Inc	21229	0.647646814	1
BNA	003-0060	Reliable Contracting Company, Inc. - Glen Burnie	324121	0.949591764	1
BNA	003-0118	William T. Burnett and Company	3261	0.876545623	1
BNA	003-0193	Baltimore Washington Medical Center	622	1.128247103	1.128247103
BNA	003-0250	Northrop Grumman Systems Corporation - BWI	334511	0.943580376	1
BNA	003-0276	Hi Tech Color Inc	32591	0.949384594	1

Point Source Growth Factors					
Ozone NAA	State Facility Identifier	Facility Name	NAICS	GF-2023	GF-2023ADJ
BNAA	003-0309	Kinder Morgan Phoenix Holdings LLC	42471	0.986977289	1
BNAA	003-0310	US Naval Support Activity Annapolis (PWD-A EV)	61131	1.096256281	1.096256281
BNAA	003-0316	US Coast Guard Yard (USCG Yard)	92811	1.033487999	1.033487999
BNAA	003-0317	National Security Agency	92811	1.033487999	1.033487999
BNAA	003-0322	Fort George G. Meade, Dept. of the Army	92811	1.033487999	1.033487999
BNAA	003-0468	Raven Power Fort Smallwood LLC	221112	0.981232222	1
BNAA	003-0548	Bardon, Inc (d/b/a Aggregate Industries)	32732	0.95783729	1
BNAA	003-0826	Aggregate Industries - Severn Asphalt	32412	0.949591764	1
BNAA	003-0886	Millersville Landfill & Resource Recovery Facility	562212	1.036118438	1.036118438
BNAA	003-0984	National Security Agency Fanx III	92811	1.033487999	1.033487999
BNAA	003-1460	Allan Myers Materials-Jessup (RAP)	32412	0.949591764	1
BNAA	003-1471	Millersville Landfill Gas to Electric Project	562	1.036118438	1.036118438
BNAA	005-0002	University of Maryland - Baltimore County	61131	1.096256281	1.096256281
BNAA	005-0003	Bluegrass Materials - Texas Quarry	212319	0.647646814	1
BNAA	005-0039	Greater Baltimore Medical Center	62211	1.128247103	1.128247103
BNAA	005-0076	Constellation Power - Notch Cliff	221112	0.981232222	1
BNAA	005-0078	Constellation Power - Riverside Generating Station	221122	0.981232222	1
BNAA	005-0079	C P Crane Generating Station	221112	0.981232222	1
BNAA	005-0146	Diageo North America Inc (Relay Plant)	31214	1.026687598	1.026687598
BNAA	005-0148	Independent Can Company	332431	0.984291504	1
BNAA	005-0184	Noxell Corporation	32562	0.949384594	1
BNAA	005-0236	Schmidt Baking Co	311812	1.110038077	1.110038077
BNAA	005-0256	York Building Products - Cockeysville	327331	0.95783729	1
BNAA	005-0282	Social Security Administration - National Control Center	92313	1.033487999	1.033487999
BNAA	005-0332	Tradeport Atlantic Shipyard	336611	1.10984811	1.10984811
BNAA	005-0400	MedStar Franklin Square Hospital Center	62211	1.128247103	1.128247103
BNAA	005-0812	Back River WWTP	22132	0.981232222	1
BNAA	005-0979	American Yeast Corporation	311942	1.110038077	1.110038077
BNAA	005-1149	Gamse Lithographing Company	32311	0.884608428	1
BNAA	005-1484	Lafarge Building Materials, Inc.	327992	0.95783729	1
BNAA	005-1809	Maryland Paving Rosedale, LLC	324121	0.949591764	1
BNAA	005-2075	Eastern Sanitary Landfill Solid Waste Management Facility	562212	1.036118438	1.036118438
BNAA	005-2152	Synagro - Pelletech at Back River	562219	1.036118438	1.036118438
BNAA	005-2196	Roebuck Printing, Inc.	32311	0.884608428	1
BNAA	005-2262	Honeygo Run Reclamation Center Rubble Landfill	562219	1.036118438	1.036118438
BNAA	005-2305	Polystyrene Products	32614	0.876545623	1
BNAA	005-2322	Imerys Carbonates USA, Inc.	212312	0.647646814	1
BNAA	005-2407	Middle River Aircraft Systems	336413	1.10984811	1.10984811
BNAA	005-2436	Maryland Paving - Texas Quarry	324121	0.949591764	1

Point Source Growth Factors					
Ozone NAA	State Facility Identifier	Facility Name	NAICS	GF-2023	GF-2023ADJ
BNA	005-2581	Eastern Landfill Gas, LLC	221119	0.981232222	1
BNA	005-2684	MANN-PAK, Inc.	32311	0.884608428	1
BNA	005-2824	Vac Pac, Inc	326111	0.876545623	1
BNA	005-2843	Benjer, Inc. - Middle River	562111	1.036118438	1.036118438
BNA	013-0012	Lehigh Cement Company LLC	32731	0.95783729	1
BNA	013-0013	Congoleum Corporation	32211	0.93323217	1
BNA	013-0046	C.J. Miller, LLC - Westminster	324121	0.949591764	1
BNA	013-0056	Colonial Pipeline Company-Dorsey Junction	48691	1.094613899	1.094613899
BNA	013-0098	Maryland Paving - Woodbine	324121	0.949591764	1
BNA	013-0102	C.J. Miller, LLC - Finksburg	324	0.949591764	1
BNA	013-0110	Maryland Paving - Finksburg	324121	0.949591764	1
BNA	013-0242	Northern Municipal Landfill	562219	1.036118438	1.036118438
BNA	013-0394	Harvest Mid-Atlantic, LLC	325314	0.949384594	1
BNA	025-0005	Evonik Corporation	325131	0.949384594	1
BNA	025-0006	Cytec Aerospace Materials, Inc	32552	0.949384594	1
BNA	025-0024	Constellation Power - Perryman Generating Station	221112	0.981232222	1
BNA	025-0031	Maryland Paving, Inc. - Aberdeen	324121	0.949591764	1
BNA	025-0056	Allan Myers MD, Inc. - Aberdeen Asphalt Plant	324121	0.949591764	1
BNA	025-0076	Colonial Pipeline Co - Aberdeen Junction	48691	1.094613899	1.094613899
BNA	025-0286	Frito- Lay Inc.- Aberdeen	311919	1.110038077	1.110038077
BNA	025-0333	Crouse Construction Co., Inc.	237310	0.981808271	1
BNA	025-0360	Harford Waste Disposal Center	22221	1.036118438	1.036118438
BNA	025-0423	Alcore, Inc	332999	0.984291504	1
BNA	025-0434	Upper Chesapeake Medical Center	81321	1.006837915	1.006837915
BNA	025-0525	WAVE - Worthington Armstrong Venture	332323	0.984291504	1
BNA	025-0558	Lifoam Industries, LLC	32614	0.876545623	1
BNA	025-0630	Bizerba Label Solutions, Inc	424120	0.986977289	1
BNA	027-0050	Johns Hopkins University - Applied Physics Laboratory	541715	1.074430413	1.074430413
BNA	027-0052	MD & VA Milk Producers Coop	311514	1.110038077	1.110038077
BNA	027-0080	Precoat Metals	332812	0.984291504	1
BNA	027-0127	Tate Access Floors	33232	0.984291504	1
BNA	027-0223	Transcontinental Gas Pipe Line Co., LLC Compressor Stn 190	48621	1.094613899	1.094613899
BNA	027-0260	Honeyland 108, LLC	33411	0.943580376	1
BNA	027-0364	Alpha Ridge Municipal Landfill	562212	1.036118438	1.036118438
BNA	027-0535	Allan Myers Materials-Jessup Asphalt	324121	0.949591764	1
BNA	027-0612	Laurel Sand and Gravel, Inc. - Elkridge	212321	0.647646814	1
BNA	510-0001	Johns Hopkins Hospital	62211	1.128247103	1.128247103
BNA	510-0006	Constellation Power – Westport	221112	0.981232222	1
BNA	510-0007	Constellation Power - Gould Street Station	221112	0.981232222	1

Point Source Growth Factors					
Ozone NAA	State Facility Identifier	Facility Name	NAICS	GF-2023	GF-2023ADJ
BNAA	510-0069	P. Flanigan and Sons, Inc - N. Monroe St.	32412	0.949591764	1
BNAA	510-0071	GAF	324122	0.949591764	1
BNAA	510-0076	W. R. Grace & Co. - Davison Chemical	325188	0.949384594	1
BNAA	510-0077	Johns Hopkins University - Charles Street	61131	1.096256281	1.096256281
BNAA	510-0078	St. Agnes Hospital	621111	1.203801856	1.203801856
BNAA	510-0088	University of MD Medical Center Midtown Campus	621112	1.203801856	1.203801856
BNAA	510-0106	United States Gypsum Company	32742	0.95783729	1
BNAA	510-0119	Citgo Motiva Baltimore Terminal	42471	0.986977289	1
BNAA	510-0171	P. Flanigan and Sons, Inc - Annapolis Rd	324121	0.949591764	1
BNAA	510-0233	National Gypsum Company	32742	0.95783729	1
BNAA	510-0265	Constellation Energy Group - Philadelphia Road	221112	0.981232222	1
BNAA	510-0283	Mid Atlantic Baking Co	311812	1.110038077	1.110038077
BNAA	510-0286	The Sherwin-Williams Company - Baltimore	32551	0.949384594	1
BNAA	510-0301	H & S Bakery	31181	1.110038077	1.110038077
BNAA	510-0314	American Sugar Refining, Inc.	311312	1.110038077	1.110038077
BNAA	510-0337	Kaydon Ring & Seal, Inc	336311	1.10984811	1.10984811
BNAA	510-0376	USALCO, LLC	22133	0.981232222	1
BNAA	510-0651	Veolia Energy Baltimore Heating, LLP-Central Ave	42471	0.986977289	1
BNAA	510-0660	Veolia Energy Baltimore Heating, LLP-Cherry Hill	22133	0.981232222	1
BNAA	510-0677	Petroleum Fuel and Terminal Co - Erdman Ave	42471	0.986977289	1
BNAA	510-0703	Sunoco Partners Baltimore Terminal	42471	0.986977289	1
BNAA	510-0728	Motiva Enterprises LLC	42471	0.986977289	1
BNAA	510-0730	Center Point Terminal Baltimore LLC	311941	1.110038077	1.110038077
BNAA	510-0754	Fleischmann's Vinegar Company, Inc.	322223	0.93323217	1
BNAA	510-0918	Buckeye Terminals, LLC - Baltimore Terminal	62211	1.128247103	1.128247103
BNAA	510-1045	Morgan State University	32551	0.949384594	1
BNAA	510-1158	Johns Hopkins Bayview Medical Center	61131	1.096256281	1.096256281
BNAA	510-1322	Crispy Bagel Company	31181	1.110038077	1.110038077
BNAA	510-1400	Automatic Rolls of Baltimore	325188	0.949384594	1
BNAA	510-1665	Philadelphia Quartz Corp	562213	1.036118438	1.036118438
BNAA	510-1886	Wheelabrator Baltimore, LP	42471	0.986977289	1
BNAA	510-1923	Petroleum Fuel and Terminal Company - S Clinton St	32551	0.949384594	1
BNAA	510-1986	Tnemec Company, Inc.	323117	0.884608428	1
BNAA	510-2091	NuStar Terminals Operations Partnership L.P.	49319	1.159789319	1.159789319
BNAA	510-2244	MPI Labels of Baltimore, Inc	562219	1.036118438	1.036118438
BNAA	510-2260	Clean Harbors of Baltimore	562212	1.036118438	1.036118438
BNAA	510-2293	Quarantine Road Municipal Landfill	56292	1.036118438	1.036118438
BNAA	510-2781	Baltimore City Composting/Veolia Water N.A.-Central, LLC	22133	0.981232222	1
BNAA	510-2796	Veolia Energy Baltimore Heating, LLP-Spring Gardens Plant	324121	0.949591764	1

Point Source Growth Factors					
Ozone NAA	State Facility Identifier	Facility Name	NAICS	GF-2023	GF-2023ADJ
BNA	510-2857	U.S. Concrete Products	311119	1.110038077	1.110038077
BNA	510-2871	Reconserve of MD dba Dext Company	562213	1.036118438	1.036118438
BNA	510-2975	Curtis Bay Energy, LP	61131	1.096256281	1.096256281
BNA	510-3032	University of Maryland at Baltimore	51111	0.984729124	1
BNA	510-3065	The Baltimore Sun	22133	0.981232222	1
BNA	510-3078	Veolia Energy Baltimore Heating, LLP-Saratoga Plant	562219	1.036118438	1.036118438
BNA	510-3157	Synagro-Patapsco Pelletizer	32311	0.884608428	1
BNA	510-3237	Trigen Energy - Inner Harbor East	22133	0.981232222	1
BNA	510-3253	P & J Contracting Company, Inc.	238990	1.033239492	1.033239492
BNA	510-3258	CCL Label, Inc.	54171	1.074430413	1.074430413
BNA	510-3406	NIH Bayview Acquisition, LLC	531120	1.082700759	1.082700759
BNA	510-3465	Origin Baltimore Recycling, LLC	562111	1.036118438	1.036118438
BNA	510-3488	University of Maryland Medical Center	62211	1.128247103	1.128247103
BNA	510-3600	Key Recycling, LLC	562111	1.036118438	1.036118438
BNA	510-3601	Cintas Corporation - Baltimore	561990	1.091921745	1.091921745
BNA	510-3645	Targa Baltimore Terminal	42471	0.986977289	1

1.4 QUASI-POINT SOURCES

The Maryland Department of the Environment Air and Radiation Administration 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. These emissions are actual emissions estimated for the facilities. The actual emissions were forecasted to the projection years using surrogates specific to each quasi-point source. The surrogate growth factor indicators and their sources are presented in the table below.

Table 1-4: Quasi-Point Source Growth Factors (RET Update 6/8/2022)

Quasi-Point Source	Surrogate Growth Indicator	GF 2023
Baltimore Washington International (BWI) Airport	MAA BWI Aircraft Forecasted Total Operations	1.0334
Port of Baltimore	Port of Baltimore Strategic Plan (2019)	1.1941
Aberdeen Proving Grounds	BRAC Report	1.9405

1.5 AREA SOURCES

Nonpoint/area source projections are typically made using growth surrogates gathered from local information.

Nonpoint/area growth surrogate indicators data were gather from the following data sources:

- County-level population (POP) projections from Maryland Department of Planning/Baltimore Metropolitan Council of Government's Cooperative Forecasting Committee (BMC Round 9A).
- County-level housing (HSE) projections from Maryland Department of Planning/Baltimore Metropolitan Council of Government's Cooperative Forecasting Committee (BMC Round 9A).
- County-level employment (EMP) projections from Maryland Department of Planning/Baltimore Metropolitan Council of Government's Cooperative Forecasting Committee (BMC Round 9A).
- County-level vehicle miles traveled (VMT) projections from Maryland Department of Planning/Baltimore Metropolitan Council of Government's Cooperative Forecasting Committee (BMC Round 9A).

The surrogate activity indicators for each nonpoint/area source category are shown in the Table 1-5 below.

Table 1-5: Nonpoint/Area Source Growth Factor Surrogates

Source Category	Surrogate Growth Indicator
Petroleum Distribution Losses	
Aircraft Refueling	EMP
Petroleum Vessel Unloading	EMP
Stage II Refueling	VMT
Tank Breathing	VMT
Tank Transit	VMT
Tank Unloading	VMT
Portable Fuel Containers Residential	POP
Portable Fuel Containers Commercial	EMP
Catastrophic/Accidental Releases	
Oil Spills	No Growth
Soil Remediation	No Growth
Fire Sources	
Automobile Fires	POP
Wild (Forest) Fires	No Growth
Slash Burning	No Growth
Prescribed Burning	No Growth
Structure Fires	POP
Stationary Area	
Dry Cleaners	POP

Source Category	Surrogate Growth Indicator
Architectural Surface Coatings - Water Based Architectural Surface Coatings - Solvent Based Cold Cleaning/Degreasing Auto Refinishing Commercial Cooking - Total Commercial - Consumer Solvents Asphalt Paving – All Processes Asphalt Roofing Cutback Asphalt Emulsified Asphalt Graphic Arts Industrial Surface Coatings Industrial Adhesives Industrial Refrigeration Pesticides Traffic Paints - Total	POP POP EMP EMP EMP POP POP No Growth POP POP POP EMP POP No Growth No Growth POP
Small Stationary Source Fuel Combustion Commercial/Institutional Coal Combustion Commercial/Institutional Kerosene Combustion Commercial/Institutional Distillate Oil Combustion Commercial/Institutional Residual Oil Combustion Commercial/Institutional LPG Combustion Commercial/Institutional Natural Gas Combustion Residential Coal Combustion Residential Kerosene Combustion Residential Distillate Oil Combustion Residential Natural Gas Combustion Residential LPG Combustion Residential Wood Combustion Industrial Distillate Oil Combustion Industrial Residual Oil Combustion	EMP EMP EMP EMP EMP EMP HSE HSE HSE HSE HSE HSE HSE EMP EMP
Bioprocess Emission Sources Bakeries Brewpubs Wineries	EMP EMP EMP
Miscellaneous Area Sources Agricultural Land Preparation Construction – Residential Construction – Heavy Construction – Road Hospital Sterilizer Mercury - Total Mining and Quarrying Paved Roads Unpaved Roads	No Growth EMP EMP EMP No Growth No Growth No Growth VMT No Growth

Source Category	Surrogate Growth Indicator
Solid Waste Treatment, Disposal, and Recovery	
Incinerators	No Growth
Open Burning – Land Clearing Debris	No Growth
Open Burning – Residential Municipal Solid Waste	HSE
Open Burning – Residential Brush Debris	HSE
Open Burning – Residential Leaf Debris	HSE
Landfills	POP
POTWs	HSE

Base-year area source surrogate growth factors for 2017 were calculated using 2017 population, household, and employment data. Linearly interpolating between surrogate activity data from 2017 and 2035 produced the 2017 growth factor data.

Dividing Round 9A population, household, and employment forecasts for the analysis year (2023) by the derived 2017 values for the region produced the growth factors for the periods of 2017 to 2023. Surrogate activity indicators for each area source category along with the 2023 growth factors are shown in Tables 1-5 and 1-6 below.

An example of linear interpolation and growth factor development is presented below.

Equation:

$$POP_{co-I-yr} = \left\{ \left[\frac{POP_{co-I-yr(A)} - POP_{co-I-yr(B)}}{[yr(A) - yr(B)]} \right] * [yr(A) - yr] \right\} + POP_{co-I-yr(B)}$$

The equation simplifies to the following when linearly interpolated for 2018 using 2020 and 2015 as data points.

$$POP_{co-I-2018} = \left\{ \left[\frac{POP_{co-I-2020} - POP_{co-I-2015}}{(2020 - 2015)} \right] * [2020 - 2018] \right\} + POP_{co-I-2015}$$

Where:

POP_{co-i-yr} = Population of County I for the year in question
POP_{co-i-yr(A)} = Population of County I for the given year A
POP_{co-i-yr(B)} = Population of County I for the given year B
Yr(A) = Surrogate Indicator data for year A
Yr(B) = Surrogate Indicator data for year B

2023 Projection Growth Factor Example Population - Anne Arundel County

$$GF-POP_{Anne\ Arundel\ 2023} = \frac{[(595,010 - 582,880) / 5] * 2 + 582,880}{582,880}$$

571,339

GF- POP_{Anne Arundel 2017} = 1.03294 growth factor population

The growth factors for the surrogates population, households, vehicle miles traveled (VMT) and employment are presented in the tables below.

Table 1-6: 2017-2023 Growth Factors(RET Update 6/8/2022)

Jurisdiction	Population ³	Household ³	VMT ²	Employment
Anne Arundel County	1.03294	1.05287	1.04918	1.06063
Baltimore City	0.97958	1.02651	1.04918	1.05197
Baltimore County	1.00798	1.03818	1.04918	1.05701
Carroll County	1.01834	1.05287	1.04918	1.04948
Harford County	1.04024	1.05638	1.04918	1.12525
Howard County	1.05774	1.09382	1.04918	1.10000

² Growth factors based on BMC Round 8.2 Cooperative Population Forecast

⁴ Growth factors based on Maryland Department of Planning Housing Forecast

⁵ Growth factors based on VMT estimates provided by the MDE Mobile Source Division



Maryland
Department of
the Environment

Wes Moore, Governor
Aruna Miller, Lt. Governor

Serena McIlwain, Secretary
Suzanne E. Dorsey, Deputy Secretary

APPENDIX A-2

Baltimore Moderate Nonattainment Area Point Source Emission Inventory

**Prepared for:
U.S. Environmental Protection Agency**

**Prepared by:
Maryland Department of the Environment**



**Baltimore, MD Ozone Moderate Nonattainment Area
Point Source Emission Inventory**

© Maryland Department of the Environment
Air and Radiation Administration
1800 Washington Boulevard, Suite 730
Baltimore, Maryland 21230
Phone 410.537.3240 • Fax 410.631.3202

State County FIPS	State Facility Identifier	Facility Name	NAICS -2 Digits	Emission Unit ID	Process ID	2017 BY CO	2917 BY NOX	2917 BY VOC	GF-2023	GF-2023ADJ	2023_CO	2023_NOX	2023_VOC
24003	003-0023	Valley Proteins, Inc. - Curtis Bay	311	003-0023-4- 0654	10200602	0.008	0.009		1.110038077	1.110038077	0.00875265	0.010417707	
24003	003-0023	Valley Proteins, Inc. - Curtis Bay	311	003-0023-4- 0654	10201302	0.003	0.035		1.110038077	1.110038077	0.002775095	0.038851333	
24003	003-0023	Valley Proteins, Inc. - Curtis Bay	311	003-0023-5- 0830	10300602	0.008	0.010	0.001	1.110038077	1.110038077	0.009252167	0.010983827	0.00057722
24003	003-0023	Valley Proteins, Inc. - Curtis Bay	311	003-0023-5- 0712	10300603		0.001		1.110038077	1.110038077		0.000738175	
24003	003-0023	Valley Proteins, Inc. - Curtis Bay	311	003-0023-8- 0188	30201999			0.011	1.110038077	1.110038077			0.012277021
	003-0023 Total					0.01872	0.054945	0.012			0.020779913	0.060991042	0.012854241
24003	003-0033	Jessup Correctional Institute	9991	003-0033-5- 0494	10300602	0.014	0.016	0.001	1.033487999	1.033487999	0.014076107	0.016758008	0.000919804
24003	003-0033	Jessup Correctional Institute	9991	003-0033-5- 0493	10300602	0.020	0.024	0.001	1.033487999	1.033487999	0.0207111	0.024659024	0.001353869
24003	003-0033	Jessup Correctional Institute	9991	003-0033-5- 0492	10300602	0.028	0.033	0.002	1.033487999	1.033487999	0.029030678	0.034559839	0.001901618
24003	003-0033	Jessup Correctional Institute	9991	003-0033-5- 0404	10300602	0.025	0.030	0.002	1.033487999	1.033487999	0.0260594	0.031020142	0.001705255
24003	003-0033	Jessup Correctional Institute	9991	003-0033-9- 1144	20100102	0.000	0.000	0.000	1.033487999	1.033487999	8.88758E-05	0.000334592	8.56348E-06
	003-0033 Total					0.087	0.104	0.006			0.08996616	0.107331604	0.00588911
24003	003-0043	Reliable Contracting - Asphalt Plant	324	003-0043-6- 0866	30500205	0.133	0.027	0.033	0.949591764	1	0.133355	0.02667096	0.032825799
	003-0043 Total					0.133	0.027	0.033			0.133355	0.02667096	0.032825799
24003	003-0056	Prince Erachem Inc	212	003-0056-5- 0378	10200602	0.002	0.003	0.000	0.647646814	1	0.00221	0.00265	0.0001
24003	003-0056	Prince Erachem Inc	212	003-0056-5- 0412	10200602	0.041	0.049	0.002	0.647646814	1	0.0412	0.049	0.00155
24003	003-0056	Prince Erachem Inc	212	003-0056-7- 0408	30199998	0.059	0.003	0.000	0.647646814	1	0.059	0.002706	0.000066
24003	003-0056	Prince Erachem Inc	212	003-0056-7- 0410	30199998	0.002	0.002	0.000	0.647646814	1	0.0018	0.00215	0.000068
24003	003-0056	Prince Erachem Inc	212	003-0056-7- 0407	30199998	0.000	0.000	0.000	0.647646814	1	0.00038	0.00045	0.000015
24003	003-0056	Prince Erachem Inc	212	003-0056-6- 0288	30199998	1.059	0.011	0.000	0.647646814	1	1.059	0.011	0.00035
24003	003-0056	Prince Erachem Inc	212	003-0056-7- 0404	30199998	0.000	0.000	0.000	0.647646814	1	0.000057	0.00005	0.000025
	003-0056 Total					1.164	0.068	0.002			1.163647	0.068006	0.002174
24003	003-0060	Reliable Contracting Company, Inc. - Glen	324	003-0060-6- 1093	30500205	0.073	0.015	0.018	0.949591764	1	0.07295	0.0146	0.01795

State County FIPS	State Facility Identifier	Facility Name	NAICS -2 Digits	Emission Unit ID	Process ID	2017 BY CO	2917 BY NOX	2917 BY VOC	GF-2023	GF-2023ADJ	2023_CO	2023_NOX	2023_VOC
		Burnie											
24003	003-0060	Reliable Contracting Company, Inc. - Glen Burnie	324	003-0060-6- 1228	39000699	0.003	0.003	0.000	0.949591764	1	0.00259	0.003085	0.00017
	003-0060 Total					0.076	0.018	0.018			0.07554	0.017685	0.01812
24003	003-0118	William T. Burnett and Company	326	003-0118-5- 0287	10200603	0.001	0.001	0.000	0.876545623	1	0.0006535	0.000778	0.000043
24003	003-0118	William T. Burnett and Company	326	003-0118-5- 0459	10200603	0.000	0.000	0.000	0.876545623	1	0.0002805	0.000334	0.0000185
24003	003-0118	William T. Burnett and Company	326	003-0118-5- 0460	10200603	0.000	0.000	0.000	0.876545623	1	0.000197	0.000235	0.000013
24003	003-0118	William T. Burnett and Company	326	003-0118-5- 0465	10200603	0.000	0.000	0.000	0.876545623	1	0.000197	0.000235	0.000013
24003	003-0118	William T. Burnett and Company	326	003-0118-5- 0464	10200603	0.000	0.000	0.000	0.876545623	1	0.0002995	0.0003565	0.0000195
24003	003-0118	William T. Burnett and Company	326	003-0118-5- 0463	10200603	0.000	0.000	0.000	0.876545623	1	0.0003745	0.000446	0.0000245
24003	003-0118	William T. Burnett and Company	326	003-0118-5- 0462	10200603	0.001	0.001	0.000	0.876545623	1	0.000591	0.000704	0.0000385
24003	003-0118	William T. Burnett and Company	326	003-0118-5- 0461	10200603	0.000	0.001	0.000	0.876545623	1	0.0004925	0.0005865	0.0000325
24003	003-0118	William T. Burnett and Company	326	003-0118-5- 0458	10200603	0.001	0.001	0.000	0.876545623	1	0.000788	0.000938	0.0000515
24003	003-0118	William T. Burnett and Company	326	003-0118-5- 0697	10300603	0.001	0.001	0.000	0.876545623	1	0.0006595	0.0007855	0.000043
24003	003-0118	William T. Burnett and Company	326	003-0118-6- 0395	30101817			0.006	0.876545623	1			0.0063
24003	003-0118	William T. Burnett and Company	326	003-0118-6- 0018	30101817			0.021	0.876545623	1			0.021125
	003-0118 Total					0.004533	0.0053985	0.028			0.004533	0.0053985	0.027722
24003	003-0193	Baltimore Washington Medical Center	622	003-0193-5- 0657	10300501	0.000	0.001	0.000	1.128247103	1.128247103	0.000253856	0.001015422	1.27943E-05
24003	003-0193	Baltimore Washington Medical Center	622	003-0193-5- 0658	10300501	0.000	0.001	0.000	1.128247103	1.128247103	0.000253856	0.001015422	1.27943E-05
24003	003-0193	Baltimore Washington Medical Center	622	003-0193-5- 0657	10300601	0.011	0.014	0.001	1.128247103	1.128247103	0.012814704	0.015255599	0.00083906
24003	003-0193	Baltimore Washington Medical Center	622	003-0193-5- 0658	10300601	0.011	0.014	0.001	1.128247103	1.128247103	0.012814704	0.015255599	0.00083906
24003	003-0193	Baltimore Washington Medical Center	622	003-0193-9- 0877	20300101	0.001	0.002	0.000	1.128247103	1.128247103	0.000614895	0.002685228	7.89773E-05
24003	003-0193	Baltimore Washington Medical Center	622	003-0193-9- 0875	20300101	0.001	0.008	0.000	1.128247103	1.128247103	0.001201583	0.008834175	0.000214367
24003	003-0193	Baltimore Washington	622	003-0193-9-	20300101	0.001	0.006	0.000	1.128247103	1.128247103	0.000987216	0.007232064	0.000174878

State County FIPS	State Facility Identifier	Facility Name	NAICS -2 Digits	Emission Unit ID	Process ID	2017 BY CO	2917 BY NOX	2917 BY VOC	GF-2023	GF-2023ADJ	2023_CO	2023_NOX	2023_VOC
		Medical Center		0876									
24003	003-0193	Baltimore Washington Medical Center	622	003-0193-9- 0878	20300101	0.001	0.003	0.000	1.128247103	1.128247103	0.000733361	0.003192939	9.5901E-05
24003	003-0193	Baltimore Washington Medical Center	622	003-0193-9- 0879	20300101	0.001	0.003	0.000	1.128247103	1.128247103	0.000880033	0.00383604	0.000112825
	003-0193 Total					0.027	0.052	0.002			0.030554206	0.058322489	0.002380658
24003	003-0250	Northrop Grumman Systems Corporation - BWI	334	003-0250-5- 0444	10200602	0.022	0.026	0.001	0.943580376	1	0.02175	0.02585	0.00142
24003	003-0250	Northrop Grumman Systems Corporation - BWI	334	003-0250-5- 0438	10200602	0.017	0.020	0.001	0.943580376	1	0.0167	0.0199	0.00109
24003	003-0250	Northrop Grumman Systems Corporation - BWI	334	003-0250-5- 0439	10200602	0.018	0.021	0.001	0.943580376	1	0.01775	0.0211	0.00116
24003	003-0250	Northrop Grumman Systems Corporation - BWI	334	003-0250-9- 0812	20100102	0.016	0.069	0.002	0.943580376	1	0.0158	0.069	0.002025
24003	003-0250	Northrop Grumman Systems Corporation - BWI	334	003-0250-9- 0871	20100102	0.002	0.009	0.001	0.943580376	1	0.001835	0.0085	0.000805
24003	003-0250	Northrop Grumman Systems Corporation - BWI	334	003-0250-9- 0778	20100102	0.001	0.007	0.001	0.943580376	1	0.001495	0.00695	0.000655
24003	003-0250	Northrop Grumman Systems Corporation - BWI	334	003-0250-6- 1125	31306500			0.017	0.943580376	1			0.01725
24003	003-0250	Northrop Grumman Systems Corporation - BWI	334	003-0250-6- 0822	31399999	0.000		0.011	0.943580376	1	0.000422		0.0107
24003	003-0250	Northrop Grumman Systems Corporation - BWI	334	003-0250-6- 0949	40100310			0.010	0.943580376	1			0.01005
24003	003-0250	Northrop Grumman Systems Corporation - BWI	334	003-0250-6- 0810	40100399			0.010	0.943580376	1			0.0103
24003	003-0250	Northrop Grumman Systems Corporation - BWI	334	003-0250-6- 0811	40200101			0.000	0.943580376	1			0.0004935
24003	003-0250	Northrop Grumman Systems Corporation - BWI	334	003-0250-6- 0813	40200201			0.003	0.943580376	1			0.003025
24003	003-0250	Northrop Grumman Systems Corporation - BWI	334	003-0250-6- 0812	40200701			0.001	0.943580376	1			0.001405

State County FIPS	State Facility Identifier	Facility Name	NAICS -2 Digits	Emission Unit ID	Process ID	2017 BY CO	2917 BY NOX	2917 BY VOC	GF-2023	GF-2023ADJ	2023_CO	2023_NOX	2023_VOC
24003	003-0250	Northrop Grumman Systems Corporation - BWI	334	003-0250-6- 0818	49099998			0.000	0.943580376	1			0.0000855
	003-0250 Total					0.075752	0.1513	0.060			0.075752	0.1513	0.060464
24003	003-0276	Hi Tech Color Inc	325	003-0276-5- 0820	10300603	0.001	0.001		0.949384594	1	0.00105	0.001275	
24003	003-0276	Hi Tech Color Inc	325	003-0276-5- 0819	10300603	0.001	0.001		0.949384594	1	0.00105	0.001275	
24003	003-0276	Hi Tech Color Inc	325	003-0276-6- 0844	49099998			0.007	0.949384594	1			0.00715
24003	003-0276	Hi Tech Color Inc	325	003-0276-6- 0175	49099998			0.012	0.949384594	1			0.01185
	003-0276 Total					0.0021	0.00255	0.019			0.0021	0.00255	0.019
24003	003-0309	Kinder Morgan Phoenix Holdings LLC	424	003-0309-9- 0029	40400178	0.019	0.007	0.139	0.986977289	1	0.01852	0.007425	0.138875
	003-0309 Total					0.019	0.007	0.139			0.01852	0.007425	0.138875
24003	003-0310	US Naval Support Activity Annapolis (PWD-A EV)	61	003-0310-5- 0312	10300402	0.001	0.003	0.000	1.096256281	1.096256281	0.000844117	0.003376469	5.48128E-05
24003	003-0310	US Naval Support Activity Annapolis (PWD-A EV)	61	003-0310-5- 0631	10300502	0.000	0.001	0.000	1.096256281	1.096256281	0.000542647	0.000701604	3.8369E-05
24003	003-0310	US Naval Support Activity Annapolis (PWD-A EV)	61	003-0310-5- 0313	10300602	0.009	0.008	0.001	1.096256281	1.096256281	0.010282884	0.008320585	0.000674198
24003	003-0310	US Naval Support Activity Annapolis (PWD-A EV)	61	003-0310-5- 0312	10300602	0.020	0.024	0.001	1.096256281	1.096256281	0.022177265	0.026403333	0.001447058
24003	003-0310	US Naval Support Activity Annapolis (PWD-A EV)	61	003-0310-5- 0631	10300602	0.019	0.007	0.001	1.096256281	1.096256281	0.021135821	0.008052002	0.001386764
24003	003-0310	US Naval Support Activity Annapolis (PWD-A EV)	61	003-0310-5- 0736	10300603	0.000	0.000	0.000	1.096256281	1.096256281	9.31818E-05	0.000109626	5.48128E-07
24003	003-0310	US Naval Support Activity Annapolis (PWD-A EV)	61	003-0310-5- 0737	10300603	0.000	0.000	0.000	1.096256281	1.096256281	9.31818E-05	0.000109626	5.48128E-07
24003	003-0310	US Naval Support Activity Annapolis (PWD-A EV)	61	003-0310-9- 0984	20100102	0.001	0.004	0.000	1.096256281	1.096256281	0.000992112	0.004593314	0.000367246
24003	003-0310	US Naval Support Activity Annapolis (PWD-A EV)	61	003-0310-9- 0986	20100102	0.006	0.023	0.001	1.096256281	1.096256281	0.006561094	0.024698654	0.000630347

State County FIPS	State Facility Identifier	Facility Name	NAICS -2 Digits	Emission Unit ID	Process ID	2017 BY CO	2917 BY NOX	2917 BY VOC	GF-2023	GF-2023ADJ	2023_CO	2023_NOX	2023_VOC
24003	003-0310	US Naval Support Activity Annapolis (PWD-A EV)	61	003-0310-9-0985	20100102	0.006	0.023	0.001	1.096256281	1.096256281	0.006561094	0.024693173	0.000630347
24003	003-0310	US Naval Support Activity Annapolis (PWD-A EV)	61	003-0310-9-1112	20300101	0.002	0.009	0.000	1.096256281	1.096256281	0.002625534	0.009877269	0.000252139
24003	003-0310	US Naval Support Activity Annapolis (PWD-A EV)	61	003-0310-9-1143	20300101	0.002	0.007	0.000	1.096256281	1.096256281	0.001956817	0.007377805	0.000186364
24003	003-0310	US Naval Support Activity Annapolis (PWD-A EV)	61	003-0310-9-1005	20300101	0.057	0.034	0.000	1.096256281	1.096256281	0.062524977	0.037146644	0.000498797
	003-0310 Total					0.124	0.142	0.006			0.136390725	0.155460103	0.006167538
24003	003-0316	US Coast Guard Yard (USCG Yard)	9991	003-0316-4-0825	10300502	0.000			1.033487999	1.033487999	5.16744E-07		
24003	003-0316	US Coast Guard Yard (USCG Yard)	9991	003-0316-5-0497	10300502	0.000		0.000	1.033487999	1.033487999	1.60191E-05		1.8086E-05
24003	003-0316	US Coast Guard Yard (USCG Yard)	9991	003-0316-4-0824	10300602			0.000	1.033487999	1.033487999			1.8086E-05
24003	003-0316	US Coast Guard Yard (USCG Yard)	9991	003-0316-5-0497	10300602	0.001	0.001		1.033487999	1.033487999	0.001252587	0.001491323	
24003	003-0316	US Coast Guard Yard (USCG Yard)	9991	003-0316-4-0825	10300602	0.000		0.000	1.033487999	1.033487999	3.10046E-06		1.60191E-05
24003	003-0316	US Coast Guard Yard (USCG Yard)	9991	003-0316-5-0277	10300603			0.000	1.033487999	1.033487999			7.75116E-06
24003	003-0316	US Coast Guard Yard (USCG Yard)	9991	003-0316-9-0892	20100202	0.032	0.009	0.003	1.033487999	1.033487999	0.032620498	0.009549429	0.003017268
24003	003-0316	US Coast Guard Yard (USCG Yard)	9991	003-0316-9-0890	20100202	0.011	0.004	0.001	1.033487999	1.033487999	0.01149497	0.004417644	0.001130636
24003	003-0316	US Coast Guard Yard (USCG Yard)	9991	003-0316-9-0891	20100202	0.015	0.004	0.002	1.033487999	1.033487999	0.015007279	0.003883331	0.001684069
24003	003-0316	US Coast Guard Yard (USCG Yard)	9991	003-0316-9-0889	20100202	0.025	0.010	0.002	1.033487999	1.033487999	0.02596897	0.01022223	0.001618959
24003	003-0316	US Coast Guard Yard (USCG Yard)	9991	003-0316-9-0889	20100802	0.031	0.011	0.002	1.033487999	1.033487999	0.032286165	0.011335813	0.002340334
24003	003-0316	US Coast Guard Yard (USCG Yard)	9991	003-0316-9-0892	20100802	0.023	0.007	0.002	1.033487999	1.033487999	0.023735085	0.007449381	0.002185827
24003	003-0316	US Coast Guard Yard (USCG Yard)	9991	003-0316-9-0890	20100802	0.018	0.007	0.002	1.033487999	1.033487999	0.01811136	0.00683549	0.001791035
24003	003-0316	US Coast Guard Yard (USCG Yard)	9991	003-0316-9-0891	20100802	0.019	0.004	0.002	1.033487999	1.033487999	0.019121595	0.003761896	0.001816355
24003	003-0316	US Coast Guard Yard (USCG Yard)	9991	003-0316-6-0902	40200501			0.040	1.033487999	1.033487999			0.041072363
	003-0316 Total					0.173798	0.0570365	0.055			0.179618147	0.058946538	0.056716788

State County FIPS	State Facility Identifier	Facility Name	NAICS -2 Digits	Emission Unit ID	Process ID	2017 BY CO	2917 BY NOX	2917 BY VOC	GF-2023	GF-2023ADJ	2023_CO	2023_NOX	2023_VOC
24003	003-0317	National Security Agency	9991	003-0317-5-0502	10200502	0.001	0.004	0.000	1.033487999	1.033487999	0.000857795	0.004009933	5.68418E-05
24003	003-0317	National Security Agency	9991	003-0317-5-0505	10200502	0.000	0.011	0.000	1.033487999	1.033487999	0.000325549	0.011487219	0.000160191
24003	003-0317	National Security Agency	9991	003-0317-5-0504	10200502		0.009	0.000	1.033487999	1.033487999		0.008794983	0.000124019
24003	003-0317	National Security Agency	9991	003-0317-5-0503	10200502		0.008	0.000	1.033487999	1.033487999		0.008014699	0.000113684
24003	003-0317	National Security Agency	9991	003-0317-5-0504	10300602	0.000	0.051	0.003	1.033487999	1.033487999	0.000248037	0.052387507	0.00298678
24003	003-0317	National Security Agency	9991	003-0317-5-0505	10300602	0.001	0.058	0.002	1.033487999	1.033487999	0.001477888	0.059570248	0.002294343
24003	003-0317	National Security Agency	9991	003-0317-5-0502	10300602	0.000	0.028	0.001	1.033487999	1.033487999	0.000113684	0.02906685	0.001508892
24003	003-0317	National Security Agency	9991	003-0317-5-0503	10300602	0.000	0.032	0.001	1.033487999	1.033487999	0.000227367	0.032859751	0.000950809
24003	003-0317	National Security Agency	9991	003-0317-5-0674	10300603	0.009	0.003	0.001	1.033487999	1.033487999	0.009373736	0.003570701	0.000614925
24003	003-0317	National Security Agency	9991	003-0317-5-0725	10300603	0.003	0.001	0.000	1.033487999	1.033487999	0.002831757	0.001079995	0.000186028
24003	003-0317	National Security Agency	9991	003-0317-5-0726	10300603	0.002	0.001	0.000	1.033487999	1.033487999	0.002320181	0.000883632	0.000149856
24003	003-0317	National Security Agency	9991	003-0317-5-0644	10300603	0.000	0.000	0.000	1.033487999	1.033487999	0.000191195	0.000227367	1.03349E-05
24003	003-0317	National Security Agency	9991	003-0317-5-0645	10300603	0.001	0.001	0.000	1.033487999	1.033487999	0.001028321	0.001224683	6.71767E-05
24003	003-0317	National Security Agency	9991	003-0317-5-0727	10300603	0.003	0.001	0.000	1.033487999	1.033487999	0.003389841	0.00129186	0.0002222
24003	003-0317	National Security Agency	9991	003-0317-5-0728	10300603	0.003	0.001	0.000	1.033487999	1.033487999	0.003307162	0.001260855	0.000217032
24003	003-0317	National Security Agency	9991	003-0317-9-0804	20100102	0.003	0.011	0.000	1.033487999	1.033487999	0.003146971	0.011859275	0.000335884
24003	003-0317	National Security Agency	9991	003-0317-9-0807	20100102	0.009	0.036	0.001	1.033487999	1.033487999	0.009797466	0.036885187	0.001038655
24003	003-0317	National Security Agency	9991	003-0317-9-0806	20100102	0.001	0.005	0.000	1.033487999	1.033487999	0.001131669	0.005322463	0.000428898
24003	003-0317	National Security Agency	9991	003-0317-9-0805	20100102		0.007	0.001	1.033487999	1.033487999		0.007523793	0.00060459
24003	003-0317	National Security Agency	9991	003-0317-9-1092	20300101		0.004	0.004	1.033487999	1.033487999		0.003751561	0.003751561
24003	003-0317	National Security Agency	9991	003-0317-9-1035	20300101	0.067	0.219	0.047	1.033487999	1.033487999	0.069553742	0.226804109	0.048579103
24003	003-0317	National Security Agency	9991	003-0317-9-0968	20300101		0.032		1.033487999	1.033487999		0.032632384	
24003	003-0317	National Security Agency	9991	003-0317-9-1055	20300101	0.080	0.073	0.022	1.033487999	1.033487999	0.08267904	0.075103573	0.023196638

State County FIPS	State Facility Identifier	Facility Name	NAICS -2 Digits	Emission Unit ID	Process ID	2017 BY CO	2917 BY NOX	2917 BY VOC	GF-2023	GF-2023ADJ	2023_CO	2023_NOX	2023_VOC
24003	003-0317	National Security Agency	9991	003-0317-9-1090	20300101	0.036	0.059	0.004	1.033487999	1.033487999	0.037520782	0.061125648	0.004583519
24003	003-0317	National Security Agency	9991	003-0317-9-1091	20300101		0.008	0.003	1.033487999	1.033487999		0.008262737	0.003260655
24003	003-0317	National Security Agency	9991	003-0317-9-0967	20300101		0.004		1.033487999	1.033487999		0.004051273	
24003	003-0317	National Security Agency	9991	003-0317-9-0918	20300101	0.012	0.021	0.002	1.033487999	1.033487999	0.011895447	0.02173942	0.002278841
24003	003-0317	National Security Agency	9991	003-0317-9-0442	20300102	0.004	0.016	0.000	1.033487999	1.033487999	0.004412994	0.01661332	0.00046507
24003	003-0317	National Security Agency	9991	003-0317-9-0818	28888801	0.001	0.021	0.000	1.033487999	1.033487999	0.001095497	0.021568895	0.000480572
24003	003-0317	National Security Agency	9991	003-0317-9-0819	28888801	0.001	0.021	0.000	1.033487999	1.033487999	0.001121334	0.022101141	0.000490907
24003	003-0317	National Security Agency	9991	003-0317-9-0820	28888801	0.001	0.028	0.001	1.033487999	1.033487999	0.001467553	0.028891157	0.000640763
24003	003-0317	National Security Agency	9991	003-0317-9-0821	28888801	0.001	0.028	0.001	1.033487999	1.033487999	0.00147272	0.02902551	0.00064593
24003	003-0317	National Security Agency	9991	003-0317-9-0822	28888801	0.001	0.026	0.001	1.033487999	1.033487999	0.001348702	0.026550307	0.000589088
24003	003-0317	National Security Agency	9991	003-0317-9-0823	28888801	0.002	0.033	0.001	1.033487999	1.033487999	0.001705255	0.033614197	0.000749279
24003	003-0317	National Security Agency	9991	003-0317-8-0155	30201311			0.003	1.033487999	1.033487999			0.00322965
	003-0317 Total					0.24581	0.860345	0.102			0.254041685	0.889156233	0.105012716
24003	003-0322	Fort George G. Meade, Dept. of the Army	9991	003-0322-4-0687	10300503	0.001	0.001	0.000	1.033487999	1.033487999	0.001235018	0.001467553	8.06121E-05
24003	003-0322	Fort George G. Meade, Dept. of the Army	9991	003-0322-5-0783	10300603	0.000	0.000	0.000	1.033487999	1.033487999	9.35307E-05	0.000111617	6.14925E-06
24003	003-0322	Fort George G. Meade, Dept. of the Army	9991	003-0322-5-0733	10300603	0.000	0.000	0.000	1.033487999	1.033487999	0.000398926	0.000474888	2.60956E-05
24003	003-0322	Fort George G. Meade, Dept. of the Army	9991	003-0322-5-0735	10300603	0.000	0.000	0.000	1.033487999	1.033487999	0.000398926	0.000474888	2.60956E-05
24003	003-0322	Fort George G. Meade, Dept. of the Army	9991	003-0322-5-0724	10300603	0.000	0.000	0.000	1.033487999	1.033487999	0.000356553	0.000424764	2.33568E-05
24003	003-0322	Fort George G. Meade, Dept. of the Army	9991	003-0322-5-0721	10300603	0.000	0.000	0.000	1.033487999	1.033487999	0.000171042	0.000203597	1.12133E-05
24003	003-0322	Fort George G. Meade, Dept. of the Army	9991	003-0322-5-0723	10300603	0.000	0.000	0.000	1.033487999	1.033487999	0.000356553	0.000424764	2.33568E-05
24003	003-0322	Fort George G. Meade, Dept. of the Army	9991	003-0322-5-0720	10300603	0.000	0.000	0.000	1.033487999	1.033487999	0.000171042	0.000203597	1.12133E-05
24003	003-0322	Fort George G. Meade, Dept. of the Army	9991	003-0322-5-0716	10300603	0.001	0.001	0.000	1.033487999	1.033487999	0.000971479	0.001152339	6.35595E-05
24003	003-0322	Fort George G. Meade, Dept. of the Army	9991	003-0322-5-0715	10300603	0.001	0.001	0.000	1.033487999	1.033487999	0.000971479	0.001152339	6.35595E-05

State County FIPS	State Facility Identifier	Facility Name	NAICS -2 Digits	Emission Unit ID	Process ID	2017 BY CO	2917 BY NOX	2917 BY VOC	GF-2023	GF-2023ADJ	2023_CO	2023_NOX	2023_VOC
24003	003-0322	Fort George G. Meade, Dept. of the Army	9991	003-0322-5- 0714	10300603	0.001	0.001	0.000	1.033487999	1.033487999	0.000971479	0.001152339	6.35595E-05
24003	003-0322	Fort George G. Meade, Dept. of the Army	9991	003-0322-5- 0713	10300603	0.001	0.001	0.000	1.033487999	1.033487999	0.000971479	0.001152339	6.35595E-05
24003	003-0322	Fort George G. Meade, Dept. of the Army	9991	003-0322-5- 0487	10300603	0.006	0.007	0.000	1.033487999	1.033487999	0.006149254	0.007337765	0.000403577
24003	003-0322	Fort George G. Meade, Dept. of the Army	9991	003-0322-5- 0722	10300603	0.000	0.000	0.000	1.033487999	1.033487999	0.000356553	0.000424764	2.33568E-05
24003	003-0322	Fort George G. Meade, Dept. of the Army	9991	003-0322-5- 0734	10300603	0.000	0.000	0.000	1.033487999	1.033487999	0.000398926	0.000474888	2.60956E-05
24003	003-0322	Fort George G. Meade, Dept. of the Army	9991	003-0322-5- 0767	10500206	0.000	0.000	0.000	1.033487999	1.033487999	8.93967E-05	0.000106449	5.83921E-06
24003	003-0322	Fort George G. Meade, Dept. of the Army	9991	003-0322-5- 0766	10500206	0.000	0.000	0.000	1.033487999	1.033487999	0.000132286	0.000157607	8.6813E-06
24003	003-0322	Fort George G. Meade, Dept. of the Army	9991	003-0322-5- 0761	10500206	0.009	0.011	0.001	1.033487999	1.033487999	0.009146369	0.010903298	0.000599423
24003	003-0322	Fort George G. Meade, Dept. of the Army	9991	003-0322-5- 0765	10500206	0.000	0.000	0.000	1.033487999	1.033487999	0.000132286	0.000157607	8.6813E-06
24003	003-0322	Fort George G. Meade, Dept. of the Army	9991	003-0322-9- 1003	20100102	0.006	0.011	0.001	1.033487999	1.033487999	0.005839207	0.011213345	0.000682102
24003	003-0322	Fort George G. Meade, Dept. of the Army	9991	003-0322-9- 1004	20100102	0.003	0.006	0.000	1.033487999	1.033487999	0.00318831	0.006097579	0.000372056
24003	003-0322	Fort George G. Meade, Dept. of the Army	9991	003-0322-9- 1007	20100102	0.002	0.004	0.000	1.033487999	1.033487999	0.001999799	0.00383424	0.000233568
24003	003-0322	Fort George G. Meade, Dept. of the Army	9991	003-0322-9- 1002	20100102	0.006	0.011	0.001	1.033487999	1.033487999	0.005839207	0.011213345	0.000682102
24003	003-0322	Fort George G. Meade, Dept. of the Army	9991	003-0322-9- 1008	20100102	0.002	0.005	0.000	1.033487999	1.033487999	0.002475204	0.00474371	0.00028886
24003	003-0322	Fort George G. Meade, Dept. of the Army	9991	003-0322-9- 1009	20100102	0.001	0.002	0.000	1.033487999	1.033487999	0.001167841	0.002232334	0.000135904
24003	003-0322	Fort George G. Meade, Dept. of the Army	9991	003-0322-9- 0992	20100107	0.007	0.004	0.002	1.033487999	1.033487999	0.006872695	0.004139119	0.002309846
24003	003-0322	Fort George G. Meade, Dept. of the Army	9991	003-0322-9- 1066	20100107	0.000	0.001	0.000	1.033487999	1.033487999	0.000325549	0.00064593	3.79807E-05
24003	003-0322	Fort George G. Meade, Dept. of the Army	9991	003-0322-9- 1063	20100107	0.001	0.002	0.000	1.033487999	1.033487999	0.001302195	0.001555399	0.000151923
24003	003-0322	Fort George G. Meade, Dept. of the Army	9991	003-0322-9- 0965	20100107	0.000	0.000	0.000	1.033487999	1.033487999	0.000470237	0.000492457	5.47749E-05
24003	003-0322	Fort George G. Meade, Dept. of the Army	9991	003-0322-9- 1095	20300107	0.003	0.003	0.000	1.033487999	1.033487999	0.003426013	0.003586203	0.000399443
24003	003-0322	Fort George G. Meade, Dept. of the Army	9991	003-0322-9- 1096	20300107	0.000	0.001	0.000	1.033487999	1.033487999	0.000510026	0.000609758	5.94256E-05
24003	003-0322	Fort George G. Meade, Dept. of the Army	9991	003-0322-9- 0651	40600603			0.018	1.033487999	1.033487999			0.018602784
24003	003-0322	Fort George G. Meade, Dept. of the Army	9991	003-0322-9- 0787	50100410	0.001		0.014	1.033487999	1.033487999	0.001085162		0.014313809

State County FIPS	State Facility Identifier	Facility Name	NAICS -2 Digits	Emission Unit ID	Process ID	2017 BY CO	2917 BY NOX	2917 BY VOC	GF-2023	GF-2023ADJ	2023_CO	2023_NOX	2023_VOC
	003-0322 Total					0.056	0.075783	0.039			0.057974026	0.078320821	0.039862562
24003	003-0468	Raven Power Fort Smallwood LLC	22	003-0468-3- 0017	10100202	0.111	0.445	0.009	0.981232222	1	0.111	0.4445	0.009
24003	003-0468	Raven Power Fort Smallwood LLC	22	003-0468-3- 0016	10100202	0.984	4.045	0.118	0.981232222	1	0.984	4.0445	0.1175
24003	003-0468	Raven Power Fort Smallwood LLC	22	003-0468-3- 0015	10100202	0.967	3.481	0.115	0.981232222	1	0.967	3.481	0.115
24003	003-0468	Raven Power Fort Smallwood LLC	22	003-0468-3- 0003	10100215	0.393	1.447	0.047	0.981232222	1	0.393	1.4465	0.047
24003	003-0468	Raven Power Fort Smallwood LLC	22	003-0468-4- 0017	10100401	0.323	1.539	0.038	0.981232222	1	0.323	1.5385	0.0375
24003	003-0468	Raven Power Fort Smallwood LLC	22	003-0468-4- 0507	10100504	0.001	0.005	0.000	0.981232222	1	0.00122	0.004515	0.0003665
24003	003-0468	Raven Power Fort Smallwood LLC	22	003-0468-5- 0489	10100601	0.134	0.156	0.009	0.981232222	1	0.1335	0.1555	0.009
24003	003-0468	Raven Power Fort Smallwood LLC	22	003-0468-4- 0007	20100101		0.128	0.000	0.981232222	1		0.1275	0.000082
24003	003-0468	Raven Power Fort Smallwood LLC	22	003-0468-9- 0988	20200102	0.001	0.016	0.004	0.981232222	1	0.00087	0.0155	0.004
	003-0468 Total					2.914	11.258	0.339			2.91359	11.258015	0.3394485
24003	003-0548	Bardon, Inc (d/b/a Aggregate Industries)	327	003-0548-6- 0951	10300601	0.000	0.000	0.000	0.95783729	1	0.000254085	0.00030248	0.000016635
	003-0548 Total					0.000	0.000	0.000			0.000254085	0.00030248	0.000016635
24003	003-0826	Aggregate Industries - Severn Asphalt	324	003-0826-5- 0787	10300603	0.000	0.000	0.000	0.949591764	1	0.000192	0.0002285	0.0000125
24003	003-0826	Aggregate Industries - Severn Asphalt	324	003-0826-6- 0926	30500205	0.054	0.011	0.013	0.949591764	1	0.05365	0.01075	0.0132
24003	003-0826	Aggregate Industries - Severn Asphalt	324	003-0826-6- 1188	30504030	0.005	0.009		0.949591764	1	0.00472	0.008715	
	003-0826 Total					0.059	0.020	0.0132125			0.058562	0.0196935	0.0132125
24003	003-0886	Millersville Landfill & Resource Recovery Facility	562	003-0886-9- 0921	20300101	0.001	0.015	0.000	1.036118438	1.036118438	0.000818534	0.015541777	8.28895E-05
24003	003-0886	Millersville Landfill & Resource Recovery Facility	562	003-0886-9- 1038	50100410	0.007	0.002		1.036118438	1.036118438	0.007449692	0.001631887	
24003	003-0886	Millersville Landfill & Resource Recovery Facility	562	003-0886-9- 0461	50100410	0.000	0.000	0.000	1.036118438	1.036118438	2.53849E-07	1.34695E-05	0.000466253
	003-0886 Total					0.008	0.017	0.001			0.008268479	0.017187133	0.000549143

State County FIPS	State Facility Identifier	Facility Name	NAICS -2 Digits	Emission Unit ID	Process ID	2017 BY CO	2917 BY NOX	2917 BY VOC	GF-2023	GF-2023ADJ	2023_CO	2023_NOX	2023_VOC
24003	003-0984	National Security Agency Fanx III	9991	003-0984-5-0635	10300602	0.006	0.002	0.000	1.033487999	1.033487999	0.006118249	0.002330515	0.00040306
24003	003-0984	National Security Agency Fanx III	9991	003-0984-5-0636	10300602	0.007	0.003	0.000	1.033487999	1.033487999	0.00706389	0.002692236	0.000459902
24003	003-0984	National Security Agency Fanx III	9991	003-0984-5-0633	10300603	0.007	0.009	0.000	1.033487999	1.033487999	0.007430779	0.008846657	0.000485739
24003	003-0984	National Security Agency Fanx III	9991	003-0984-5-0634	10300603	0.016	0.019	0.001	1.033487999	1.033487999	0.016070738	0.019129863	0.001054158
24003	003-0984	National Security Agency Fanx III	9991	003-0984-9-0615	20300101	0.012	0.044	0.001	1.033487999	1.033487999	0.012034968	0.045308114	0.001276358
	003-0984 Total					0.047	0.076	0.004			0.048718624	0.078307386	0.003679217
24003	003-1460	Allan Myers Materials-Jessup (RAP)	324	003-1460-6-1178	30502099	0.007	0.032	0.003	0.949591764	1	0.00687	0.0319	0.002605
	003-1460 Total					0.007	0.032	0.003			0.00687	0.0319	0.002605
24003	003-1471	Millersville Landfill Gas to Electric Project	562	003-1471-9-1034	20100802	0.282	0.052	0.007	1.036118438	1.036118438	0.292029982	0.0542408	0.006993799
	003-1471 Total					0.282	0.052	0.007			0.292029982	0.0542408	0.006993799
24005	005-0002	University of Maryland - Baltimore County	61	005-0002-5-2279	10300502	0.001	0.002	0.000	1.096256281	1.096256281	0.000660494	0.002641978	3.34358E-05
24005	005-0002	University of Maryland - Baltimore County	61	005-0002-5-1711	10300502	0.003	0.010	0.000	1.096256281	1.096256281	0.002850266	0.011401065	0.000142513
24005	005-0002	University of Maryland - Baltimore County	61	005-0002-5-1712	10300602	0.005	0.006	0.000	1.096256281	1.096256281	0.005281215	0.00628703	0.000345869
24005	005-0002	University of Maryland - Baltimore County	61	005-0002-5-1537	10300602	0.018	0.022	0.001	1.096256281	1.096256281	0.019973789	0.023777799	0.001310026
24005	005-0002	University of Maryland - Baltimore County	61	005-0002-5-1711	10300602	0.005	0.007	0.000	1.096256281	1.096256281	0.005105814	0.007383286	0.000327781
24005	005-0002	University of Maryland - Baltimore County	61	005-0002-5-1637	10300602	0.022	0.027	0.001	1.096256281	1.096256281	0.024632879	0.029324856	0.001611497
24005	005-0002	University of Maryland - Baltimore County	61	005-0002-5-1743	10300603	0.001	0.001	0.000	1.096256281	1.096256281	0.001035962	0.001233288	6.57754E-05
24005	005-0002	University of Maryland - Baltimore County	61	005-0002-5-1744	10300603	0.001	0.001	0.000	1.096256281	1.096256281	0.001320989	0.001573128	8.66042E-05
24005	005-0002	University of Maryland - Baltimore County	61	005-0002-5-1745	10300603	0.001	0.001	0.000	1.096256281	1.096256281	0.000778342	0.000926337	5.09759E-05
24005	005-0002	University of Maryland - Baltimore County	61	005-0002-5-1747	10300603	0.000	0.000	0.000	1.096256281	1.096256281	0.000235695	0.000279545	1.53476E-05
24005	005-0002	University of Maryland - Baltimore County	61	005-0002-5-2279	10300603	0.020	0.024	0.001	1.096256281	1.096256281	0.022039684	0.026238894	0.001441577
24005	005-0002	University of Maryland - Baltimore County	61	005-0002-5-1746	10300603	0.001	0.002	0.000	1.096256281	1.096256281	0.00145254	0.001726604	9.31818E-05
24005	005-0002	University of Maryland - Baltimore County	61	005-0002-5-1709	10300603	0.002	0.003	0.000	1.096256281	1.096256281	0.002683087	0.003195587	0.000175401

State County FIPS	State Facility Identifier	Facility Name	NAICS -2 Digits	Emission Unit ID	Process ID	2017 BY CO	2917 BY NOX	2917 BY VOC	GF-2023	GF-2023ADJ	2023_CO	2023_NOX	2023_VOC
24005	005-0002	University of Maryland - Baltimore County	61	005-0002-9-1366	20300107	0.002	0.007	0.000	1.096256281	1.096256281	0.001732085	0.007564168	0.000202807
24005	005-0002	University of Maryland - Baltimore County	61	005-0002-9-1367	20300107	0.002	0.004	0.000	1.096256281	1.096256281	0.001808823	0.004275399	0.000211029
24005	005-0002	University of Maryland - Baltimore County	61	005-0002-9-1368	20300107	0.001	0.002	0.000	1.096256281	1.096256281	0.000909893	0.002154144	0.000106337
24005	005-0002	University of Maryland - Baltimore County	61	005-0002-9-1369	20300107	0.001	0.005	0.000	1.096256281	1.096256281	0.001129144	0.004933153	0.000131551
24005	005-0002	University of Maryland - Baltimore County	61	005-0002-9-1370	20300107	0.001	0.005	0.000	1.096256281	1.096256281	0.001359358	0.005919784	0.000158409
24005	005-0002	University of Maryland - Baltimore County	61	005-0002-9-1294	40600306				0.001	1.096256281	1.096256281		0.001096256
	005-0002 Total					0.0866495	0.12847	0.007			0.094990059	0.140836044	0.007606374
24005	005-0003	Bluegrass Materials - Texas Quarry	212	005-0003-4-2027	10300501	0.001	0.003	0.000	0.647646814	1	0.0005215	0.0025035	0.000058
24005	005-0003	Bluegrass Materials - Texas Quarry	212	005-0003-6-3082	30599999	0.003	0.014	0.001	0.647646814	1	0.00299	0.013875	0.001125
	005-0003 Total					0.004	0.016	0.001			0.0035115	0.0163785	0.001183
24005	005-0039	Greater Baltimore Medical Center	622	005-0039-5-2149	10300603	0.000	0.000	0.000	1.128247103	1.128247103	0.000146672	2.08726E-05	1.12825E-05
24005	005-0039	Greater Baltimore Medical Center	622	005-0039-5-1150	10300603	0.000	0.000	0.000	1.128247103	1.128247103	0.000174878	0.000208726	1.12825E-05
24005	005-0039	Greater Baltimore Medical Center	622	005-0039-5-1151	10300603	0.000	0.000	0.000	1.128247103	1.128247103	0.000174878	0.000208726	1.12825E-05
24005	005-0039	Greater Baltimore Medical Center	622	005-0039-5-1920	10300603	0.000	0.000	0.000	1.128247103	1.128247103	0.000203084	0.000242573	1.69237E-05
24005	005-0039	Greater Baltimore Medical Center	622	005-0039-5-2148	10300603	0.000	0.000	0.000	1.128247103	1.128247103	0.000146672	2.08726E-05	1.12825E-05
24005	005-0039	Greater Baltimore Medical Center	622	005-0039-5-2124	10500205	0.000	0.000	0.000	1.128247103	1.128247103	0.000141031	0.000558482	1.12825E-05
24005	005-0039	Greater Baltimore Medical Center	622	005-0039-5-2114	10500205	0.000	0.000	0.000	1.128247103	1.128247103	0.000141031	0.000558482	1.12825E-05
24005	005-0039	Greater Baltimore Medical Center	622	005-0039-5-2125	10500205	0.000	0.000	0.000	1.128247103	1.128247103	0.000141031	0.000558482	1.12825E-05
24005	005-0039	Greater Baltimore Medical Center	622	005-0039-5-2114	10500206	0.007	0.003	0.000	1.128247103	1.128247103	0.007587462	0.003317046	0.000496429
24005	005-0039	Greater Baltimore Medical Center	622	005-0039-5-2125	10500206	0.007	0.003	0.000	1.128247103	1.128247103	0.007474637	0.003317046	0.000496429
24005	005-0039	Greater Baltimore Medical Center	622	005-0039-5-2124	10500206	0.007	0.003	0.000	1.128247103	1.128247103	0.007587462	0.003317046	0.000496429
24005	005-0039	Greater Baltimore Medical Center	622	005-0039-9-1427	20100102	0.009	0.045	0.002	1.128247103	1.128247103	0.01031782	0.050985487	0.002075975
24005	005-0039	Greater Baltimore Medical Center	622	005-0039-9-1428	20100102	0.010	0.047	0.002	1.128247103	1.128247103	0.010814248	0.053439424	0.002171876

State County FIPS	State Facility Identifier	Facility Name	NAICS -2 Digits	Emission Unit ID	Process ID	2017 BY CO	2917 BY NOX	2917 BY VOC	GF-2023	GF-2023ADJ	2023_CO	2023_NOX	2023_VOC
24005	005-0039	Greater Baltimore Medical Center	622	005-0039-9-1393	20100102	0.002	0.027	0.001	1.128247103	1.128247103	0.00246522	0.030079068	0.000654383
24005	005-0039	Greater Baltimore Medical Center	622	005-0039-9-1359	20200102	0.002	0.007	0.000	1.128247103	1.128247103	0.001731859	0.007553614	0.000203084
24005	005-0039	Greater Baltimore Medical Center	622	005-0039-9-1380	20200102	0.002	0.007	0.000	1.128247103	1.128247103	0.001844684	0.008038761	0.000214367
	005-0039 Total					0.045	0.144	0.006			0.05109267	0.162424709	0.006904872
24005	005-0076	Constellation Power - Notch Cliff	22	005-0076-9-1098	20100201	0.031	0.175	0.001	0.981232222	1	0.0305	0.1745	0.00075
24005	005-0076	Constellation Power - Notch Cliff	22	005-0076-9-1097	20100201	0.037	0.214	0.001	0.981232222	1	0.037	0.214	0.00095
24005	005-0076	Constellation Power - Notch Cliff	22	005-0076-9-1096	20100201	0.037	0.210	0.001	0.981232222	1	0.0365	0.21	0.00095
24005	005-0076	Constellation Power - Notch Cliff	22	005-0076-9-1099	20100201	0.036	0.204	0.001	0.981232222	1	0.0355	0.2035	0.0009
24005	005-0076	Constellation Power - Notch Cliff	22	005-0076-9-1094	20100201	0.034	0.194	0.001	0.981232222	1	0.0335	0.194	0.00085
24005	005-0076	Constellation Power - Notch Cliff	22	005-0076-9-1101	20100201	0.037	0.211	0.001	0.981232222	1	0.0365	0.2105	0.00095
24005	005-0076	Constellation Power - Notch Cliff	22	005-0076-9-1100	20100201	0.034	0.194	0.001	0.981232222	1	0.0335	0.1935	0.00085
24005	005-0076	Constellation Power - Notch Cliff	22	005-0076-9-1095	20100201	0.038	0.215	0.001	0.981232222	1	0.0375	0.215	0.00095
	005-0076 Total					0.281	1.615	0.007			0.2805	1.615	0.00715
24005	005-0078	Constellation Power - Riverside Generating Station	22	005-0078-4-0658	10100504	0.002	0.397	0.000	0.981232222	1	0.00185	0.3965	0.00023
24005	005-0078	Constellation Power - Riverside Generating Station	22	005-0078-4-0659	10100504	0.001	0.259	0.000	0.981232222	1	0.0012	0.259	0.00015
	005-0078 Total					0.003	0.656	0.000			0.00305	0.6555	0.00038
24005	005-0079	C P Crane Generating Station	22	005-0079-3-0108	10100203	0.780	4.160	0.012	0.981232222	1	0.78	4.16	0.0122
24005	005-0079	C P Crane Generating Station	22	005-0079-3-0109	10100203	0.807	3.928	0.010	0.981232222	1	0.807	3.9275	0.01035
24005	005-0079	C P Crane Generating Station	22	005-0079-4-0089	10100504	0.001	0.267	0.000	0.981232222	1	0.00111	0.2665	0.00011
24005	005-0079	C P Crane Generating Station	22	005-0079-4-0091	10100504		0.001	0.000	0.981232222	1		0.001	0.0000055
24005	005-0079	C P Crane Generating Station	22	005-0079-4-1107	10100504	0.005	0.006	0.000	0.981232222	1	0.00492	0.00583	0.0003195
24005	005-0079	C P Crane Generating Station	22	005-0079-9-1509	20300101	0.005	0.010		0.981232222	1	0.005	0.01	

State County FIPS	State Facility Identifier	Facility Name	NAICS -2 Digits	Emission Unit ID	Process ID	2017 BY CO	2917 BY NOX	2917 BY VOC	GF-2023	GF-2023ADJ	2023_CO	2023_NOX	2023_VOC				
	005-0079 Total					1.598	8.371	0.022985			1.59803	8.37083	0.022985				
24005	005-0146	Diageo North America Inc (Relay Plant)	312	005-0146-5-1740	10300602	0.006	0.008	0.000	1.026687598	1.026687598	0.006622135	0.00785416	0.000410675				
24005	005-0146	Diageo North America Inc (Relay Plant)	312	005-0146-5-1739	10300602	0.006	0.007	0.000	1.026687598	1.026687598	0.006160126	0.007340816	0.000410675				
24005	005-0146	Diageo North America Inc (Relay Plant)	312	005-0146-8-0307	30201003	0.01245	0.0148	0.004	1.026687598	1.026687598	0.012782261	0.015194976	0.004055416				
24005	005-0146	Diageo North America Inc (Relay Plant)	312	005-0146-8-0308	30201003			0.042	1.026687598	1.026687598			0.043249215				
24005	005-0146	Diageo North America Inc (Relay Plant)	312	005-0146-8-0334	30201011			0.002	1.026687598	1.026687598			0.001848038				
24005	005-0146	Diageo North America Inc (Relay Plant)	312	005-0146-8-0307	30201011			0.012	1.026687598	1.026687598			0.011806907				
	005-0146 Total							0.01245	0.0148	0.060					0.012782261	0.015194976	0.061780926
24005	005-0148	Independent Can Company	332	005-0148-6-2113	30988801			0.000	0.000	0.000			0.984291504	1	0.00021	0.00025	0.000015
24005	005-0148	Independent Can Company	332	005-0148-6-2112	30988801			0.000	0.000	0.006			0.984291504	1	0.000085	0.0001	0.00627
24005	005-0148	Independent Can Company	332	005-0148-6-2110	30988801			0.006	0.984291504	1			0.00627				
24005	005-0148	Independent Can Company	332	005-0148-6-2116	30988801	0.000	0.000	0.000	0.984291504	1	0.00021	0.00025	0.000015				
24005	005-0148	Independent Can Company	332	005-0148-6-2699	40200920			0.005	0.984291504	1			0.004765				
24005	005-0148	Independent Can Company	332	005-0148-6-2120	40201725			0.008	0.984291504	1			0.0083				
24005	005-0148	Independent Can Company	332	005-0148-6-2698	40201726			0.000	0.984291504	1			0.00031				
24005	005-0148	Independent Can Company	332	005-0148-6-2086	40201726			0.000	0.984291504	1			0.00034				
24005	005-0148	Independent Can Company	332	005-0148-6-2119	40201799	0.000	0.000	0.024	0.984291504	1	0.000085	0.0001	0.02383				
24005	005-0148	Independent Can Company	332	005-0148-6-2863	40500597			0.000	0.984291504	1			0.000085				
	005-0148 Total					0.00059	0.0007	0.050			0.00059	0.0007	0.0502				
24005	005-0184	Noxell Corporation	325	005-0184-5-1478	10200602	0.004	0.006	0.000	0.949384594	1	0.0040713	0.00593195	0.00026635				
24005	005-0184	Noxell Corporation	325	005-0184-5-1633	10200602	0.004	0.004	0.000	0.949384594	1	0.004071	0.00449755	0.00026655				
24005	005-0184	Noxell Corporation	325	005-0184-6-1393	30188801			0.000	0.949384594	1			0.00028				
24005	005-0184	Noxell Corporation	325	005-0184-6-0103	30188801			0.000	0.949384594	1			0.0000208				

State County FIPS	State Facility Identifier	Facility Name	NAICS -2 Digits	Emission Unit ID	Process ID	2017 BY CO	2917 BY NOX	2917 BY VOC	GF-2023	GF-2023ADJ	2023_CO	2023_NOX	2023_VOC
24005	005-0184	Noxell Corporation	325	005-0184-6-1391	30188801			0.000	0.949384594	1			0.0000376
	005-0184 Total					0.0081423	0.0104295	0.001			0.0081423	0.0104295	0.0008713
24005	005-0236	Schmidt Baking Co	311	005-0236-5-0946	10200603	0.001	0.002	0.000	1.110038077	1.110038077	0.001648407	0.001964767	0.000105454
24005	005-0236	Schmidt Baking Co	311	005-0236-5-0945	10200603	0.001	0.002	0.000	1.110038077	1.110038077	0.001648407	0.001964767	0.000105454
24005	005-0236	Schmidt Baking Co	311	005-0236-8-0163	30203201	0.004	0.005	0.008	1.110038077	1.110038077	0.004340249	0.005167227	0.009107862
24005	005-0236	Schmidt Baking Co	311	005-0236-8-0213	30203201	0.003	0.004	0.005	1.110038077	1.110038077	0.003380066	0.004018338	0.005511339
	005-0236 Total					0.010	0.012	0.013			0.011017128	0.0131151	0.014830109
24005	005-0256	York Building Products - Cockeysville	327	005-0256-5-1232	10200602	0.001	0.001	0.000	0.95783729	1	0.000665	0.0007918	0.00004355
24005	005-0256	York Building Products - Cockeysville	327	005-0256-6-0837	30500609	0.003	0.014	0.001	0.95783729	1	0.00304608	0.014136	0.00114
	005-0256 Total					0.004	0.015	0.001			0.00371108	0.0149278	0.00118355
24005	005-0282	Social Security Administration - National Control Center	9991	005-0282-5-2302	10300602	0.005	0.006	0.000	1.033487999	1.033487999	0.004805719	0.005684184	0.000258372
24005	005-0282	Social Security Administration - National Control Center	9991	005-0282-5-0889	10300602	0.002	0.002	0.000	1.033487999	1.033487999	0.001963627	0.002377022	0.000155023
24005	005-0282	Social Security Administration - National Control Center	9991	005-0282-5-0074	10300602	0.002	0.002	0.000	1.033487999	1.033487999	0.001550232	0.001860278	0.000103349
24005	005-0282	Social Security Administration - National Control Center	9991	005-0282-5-0075	10300602	0.002	0.002	0.000	1.033487999	1.033487999	0.001550232	0.001860278	0.000103349
24005	005-0282	Social Security Administration - National Control Center	9991	005-0282-5-2378	10300603	0.001	0.001	0.001	1.033487999	1.033487999	0.000516744	0.000516744	0.000516744
24005	005-0282	Social Security Administration - National Control Center	9991	005-0282-5-1737	10300603	0.000	0.000		1.033487999	1.033487999	0.000103349	0.000103349	
24005	005-0282	Social Security Administration - National Control Center	9991	005-0282-5-2377	10300603	0.001	0.001	0.001	1.033487999	1.033487999	0.000516744	0.000516744	0.000516744
24005	005-0282	Social Security Administration - National Control Center	9991	005-0282-5-2582	10300603	0.000	0.000		1.033487999	1.033487999	0.000103349	0.000155023	
24005	005-0282	Social Security Administration -	9991	005-0282-9-1181	20300102	0.002	0.012	0.001	1.033487999	1.033487999	0.002170325	0.011988461	0.000568418

State County FIPS	State Facility Identifier	Facility Name	NAICS -2 Digits	Emission Unit ID	Process ID	2017 BY CO	2917 BY NOX	2917 BY VOC	GF-2023	GF-2023ADJ	2023_CO	2023_NOX	2023_VOC
		National Control Center											
24005	005-0282	Social Security Administration - National Control Center	9991	005-0282-9-1436	20300107	0.001	0.002		1.033487999	1.033487999	0.000516744	0.001860278	
24005	005-0282	Social Security Administration - National Control Center	9991	005-0282-9-1437	20300107	0.002	0.011	0.001	1.033487999	1.033487999	0.002221999	0.011109996	0.00082679
24005	005-0282	Social Security Administration - National Control Center	9991	005-0282-9-1180	28888801	0.003	0.016	0.001	1.033487999	1.033487999	0.003513859	0.016225762	0.000930139
24005	005-0282	Social Security Administration - National Control Center	9991	005-0282-9-1182	30113210	0.004	0.016	0.001	1.033487999	1.033487999	0.003668882	0.016380785	0.001033488
24005	005-0282	Social Security Administration - National Control Center	9991	005-0282-9-0403	40600601			0.000	1.033487999	1.033487999			0.000310046
	005-0282 Total					0.02245	0.06835	0.005			0.023201806	0.070638905	0.005322463
24005	005-0332	Tradepoint Atlantic Shipyard	336	005-0332-6-2808	40202301			0.122	1.10984811	1.10984811			0.135567947
24005	005-0332	Tradepoint Atlantic Shipyard	336	005-0332-9-1390	50410420			0.001	1.10984811	1.10984811			0.000738049
	005-0332 Total					0	0	0.123			0	0	0.136305996
24005	005-0400	MedStar Franklin Square Hospital Center	622	005-0400-5-2236	10300602	0.006	0.007	0.000	1.128247103	1.128247103	0.007147445	0.00762695	0.000468223
24005	005-0400	MedStar Franklin Square Hospital Center	622	005-0400-5-2237	10300602	0.006	0.007	0.000	1.128247103	1.128247103	0.007147445	0.00762695	0.000468223
24005	005-0400	MedStar Franklin Square Hospital Center	622	005-0400-5-2238	10300602	0.006	0.007	0.000	1.128247103	1.128247103	0.007147445	0.00762695	0.000468223
24005	005-0400	MedStar Franklin Square Hospital Center	622	005-0400-9-1378	20300101	0.003	0.040	0.001	1.128247103	1.128247103	0.003740139	0.045665801	0.000992857
24005	005-0400	MedStar Franklin Square Hospital Center	622	005-0400-9-1377	20300101	0.003	0.033	0.001	1.128247103	1.128247103	0.003080115	0.037593193	0.000817979
24005	005-0400	MedStar Franklin Square Hospital Center	622	005-0400-9-1376	20300101	0.002	0.024	0.001	1.128247103	1.128247103	0.002177517	0.026570219	0.000575406
	005-0400 Total					0.027	0.118	0.003			0.030440107	0.132710065	0.00379091
24005	005-0812	Back River WWTP	22	005-0812-5-0511	10300602	0.006	0.008	0.000	0.981232222	1	0.006423	0.0076465	0.0004205
24005	005-0812	Back River WWTP	22	005-0812-5-1432	10300799	0.001	0.004	0.000	0.981232222	1	0.00096	0.00384	0.0000655
24005	005-0812	Back River WWTP	22	005-0812-5-1426	10300799	0.000	0.000	0.000	0.981232222	1	0.0001115	0.0001325	0.0000075
24005	005-0812	Back River WWTP	22	005-0812-9-	20100702	0.068	0.020	0.015	0.981232222	1	0.06783	0.0196155	0.014535

State County FIPS	State Facility Identifier	Facility Name	NAICS -2 Digits	Emission Unit ID	Process ID	2017 BY CO	2917 BY NOX	2917 BY VOC	GF-2023	GF-2023ADJ	2023_CO	2023_NOX	2023_VOC
				1320									
24005	005-0812	Back River WWTP	22	005-0812-9-1317	20100702	0.072	0.021	0.016	0.981232222	1	0.07241	0.02094	0.0155165
24005	005-0812	Back River WWTP	22	005-0812-9-1319	20100702	0.072	0.021	0.015	0.981232222	1	0.07177	0.020755	0.0153795
24005	005-0812	Back River WWTP	22	005-0812-9-0105	50100702			0.007	0.981232222	1			0.006837
	005-0812 Total					0.2195045	0.0729295	0.053			0.2195045	0.0729295	0.0527615
24005	005-0979	American Yeast Corporation	311	005-0979-5-1513	10200503	0.004	0.002	0.000	1.110038077	1.110038077	0.004151542	0.002469835	0.000271959
24005	005-0979	American Yeast Corporation	311	005-0979-5-1853	10300503	0.002	0.008	0.000	1.110038077	1.110038077	0.002264478	0.009057911	0.000155405
24005	005-0979	American Yeast Corporation	311	005-0979-5-1853	10300603	0.003	0.002	0.000	1.110038077	1.110038077	0.003646475	0.002170124	0.000238658
24005	005-0979	American Yeast Corporation	311	005-0979-9-1465	20100702	0.004	0.000		1.110038077	1.110038077	0.004151542	6.66023E-05	
24005	005-0979	American Yeast Corporation	311	005-0979-8-0236	30203299			0.016	1.110038077	1.110038077			0.017816111
24005	005-0979	American Yeast Corporation	311	005-0979-8-0237	30203299			0.015	1.110038077	1.110038077			0.016450764
24005	005-0979	American Yeast Corporation	311	005-0979-8-0190	30203299			0.017	1.110038077	1.110038077			0.018321178
24005	005-0979	American Yeast Corporation	311	005-0979-8-0056	30203299			0.026	1.110038077	1.110038077			0.029044146
24005	005-0979	American Yeast Corporation	311	005-0979-8-0209	30203299			0.014	1.110038077	1.110038077			0.016062251
24005	005-0979	American Yeast Corporation	311	005-0979-8-0301	50382599	0.006	0.004	0.000	1.110038077	1.110038077	0.006654678	0.003962836	0.000438465
	005-0979 Total					0.019	0.016	0.089			0.020868716	0.017727308	0.098798939
24005	005-1149	Gamse Lithographing Company	323	005-1149-6-2825	40500301			0.008	0.884608428	1			0.008465
24005	005-1149	Gamse Lithographing Company	323	005-1149-6-3017	40500301			0.010	0.884608428	1			0.009725
24005	005-1149	Gamse Lithographing Company	323	005-1149-6-3123	40500301			0.009	0.884608428	1			0.009055
24005	005-1149	Gamse Lithographing Company	323	005-1149-6-2634	40500401			0.017	0.884608428	1			0.01654
24005	005-1149	Gamse Lithographing Company	323	005-1149-6-2376	40500401			0.004	0.884608428	1			0.003875
24005	005-1149	Gamse Lithographing Company	323	005-1149-6-2377	40500401			0.005	0.884608428	1			0.00507
24005	005-1149	Gamse Lithographing Company	323	005-1149-6-1983	40500401			0.015	0.884608428	1			0.014665

State County FIPS	State Facility Identifier	Facility Name	NAICS -2 Digits	Emission Unit ID	Process ID	2017 BY CO	2917 BY NOX	2917 BY VOC	GF-2023	GF-2023ADJ	2023_CO	2023_NOX	2023_VOC
24005	005-1149	Gamse Lithographing Company	323	005-1149-6-2156	40500401			0.017	0.884608428	1			0.016745
24005	005-1149	Gamse Lithographing Company	323	005-1149-6-2818	40500431			0.005	0.884608428	1			0.004745
24005	005-1149	Gamse Lithographing Company	323	005-1149-9-0159	40500511	0.000	0.001	0.015	0.884608428	1	0.000045	0.000535	0.015125
24005	005-1149	Gamse Lithographing Company	323	005-1149-6-2936	40500597			0.002	0.884608428	1			0.002195
	005-1149 Total					0.000045	0.000535	0.106			0.000045	0.000535	0.106205
24005	005-1484	Lafarge Building Materials, Inc.	327	005-1484-6-2676	30500613	0.021	0.025	0.002	0.95783729	1	0.0209835	0.02498	0.001545
	005-1484 Total					0.021	0.025	0.002			0.0209835	0.02498	0.001545
24005	005-1809	Maryland Paving Rosedale, LLC	324	005-1809-6-3069	10200603	0.002	0.002	0.000	0.949591764	1	0.00192	0.0022855	0.0001255
24005	005-1809	Maryland Paving Rosedale, LLC	324	005-1809-6-3024	30500205	0.086	0.017	0.021	0.949591764	1	0.086	0.0172	0.02115
24005	005-1809	Maryland Paving Rosedale, LLC	324	005-1809-6-3025	30502006	0.006	0.009	0.002	0.949591764	1	0.00623	0.009335	0.002155
	005-1809 Total					0.094	0.029	0.023			0.09415	0.0288205	0.0234305
24005	005-2075	Eastern Sanitary Landfill Solid Waste Management Facility	562	005-2075-6-1438	20200102	0.001	0.007	0.000	1.036118438	1.036118438	0.001129369	0.007755347	0.000165779
24005	005-2075	Eastern Sanitary Landfill Solid Waste Management Facility	562	005-2075-9-1394	40600401			0.002	1.036118438	1.036118438			0.001808027
24005	005-2075	Eastern Sanitary Landfill Solid Waste Management Facility	562	005-2075-9-1035	50100402			0.017	1.036118438	1.036118438			0.017784973
24005	005-2075	Eastern Sanitary Landfill Solid Waste Management Facility	562	005-2075-9-1020	50100410	0.026	0.008	0.001	1.036118438	1.036118438	0.027058233	0.008117988	0.000689019
	005-2075 Total					0.027	0.015	0.020			0.028187602	0.015873334	0.020447797
24005	005-2152	Synagro - Pelletech at Back River	562	005-2152-6-1849	39990003	0.018	0.011	0.001	1.036118438	1.036118438	0.01828749	0.010884424	0.001196717
	005-2152 Total					0.018	0.011	0.001			0.01828749	0.010884424	0.001196717
24005	005-2196	Roebuck Printing, Inc.	323	005-2196-6-2934	40500401	0.000	0.001	0.009	0.884608428	1	0.0004359	0.000519	0.00858
24005	005-2196	Roebuck Printing, Inc.	323	005-2196-6-2780	40500421	0.000	0.001	0.008	0.884608428	1	0.0004306	0.0005125	0.00848
	005-2196 Total					0.001	0.001	0.017			0.0008665	0.0010315	0.01706

State County FIPS	State Facility Identifier	Facility Name	NAICS -2 Digits	Emission Unit ID	Process ID	2017 BY CO	2917 BY NOX	2917 BY VOC	GF-2023	GF-2023ADJ	2023_CO	2023_NOX	2023_VOC
24005	005-2262	Honeygo Run Reclamation Center Rubble Landfill	562	005-2262-6- 2717	30502001	0.004	0.022	0.002	1.036118438	1.036118438	0.004097848	0.023136525	0.001554178
24005	005-2262	Honeygo Run Reclamation Center Rubble Landfill	562	005-2262-9- 1420	50100410	0.000			1.036118438	1.036118438	8.02992E-05		
	005-2262 Total					0.004	0.02233	0.0015			0.004178148	0.023136525	0.001554178
24005	005-2305	Polystyrene Products	326	005-2305-5- 1610	10200603	0.001	0.001	0.000	0.876545623	1	0.0008	0.00095	0.00005
24005	005-2305	Polystyrene Products	326	005-2305-5- 1644	10200603	0.001	0.001	0.000	0.876545623	1	0.0008	0.00095	0.00005
24005	005-2305	Polystyrene Products	326	005-2305-6- 2166	30800799			0.105	0.876545623	1			0.105435
	005-2305 Total					0.0016	0.0019	0.106			0.0016	0.0019	0.105535
24005	005-2322	Imerys Carbonates USA, Inc.	212	005-2322-5- 1533	10200602	0.013	0.015	0.001	0.647646814	1	0.012995	0.01547	0.00085
24005	005-2322	Imerys Carbonates USA, Inc.	212	005-2322-6- 2189	30504021	0.003	0.004	0.000	0.647646814	1	0.002965	0.00353	0.000194
24005	005-2322	Imerys Carbonates USA, Inc.	212	005-2322-6- 2185	30504031	0.005	0.011	0.001	0.647646814	1	0.00495	0.011225	0.00081
24005	005-2322	Imerys Carbonates USA, Inc.	212	005-2322-6- 2188	30504099	0.021	0.025	0.001	0.647646814	1	0.020755	0.024705	0.00136
	005-2322 Total					0.042	0.055	0.003			0.041665	0.05493	0.003214
24005	005-2407	Middle River Aircraft Systems	336	005-2407-5- 1468	10300603	0.001	0.001	0.000	1.10984811	1.10984811	0.000627064	0.000743598	4.10644E-05
24005	005-2407	Middle River Aircraft Systems	336	005-2407-5- 1579	10300603	0.000	0.000	0.000	1.10984811	1.10984811	9.98863E-05	0.000116534	6.65909E-06
24005	005-2407	Middle River Aircraft Systems	336	005-2407-5- 1469	10300603	0.001	0.001	0.000	1.10984811	1.10984811	0.000627064	0.000743598	4.10644E-05
24005	005-2407	Middle River Aircraft Systems	336	005-2407-5- 1577	10300603	0.000	0.000	0.000	1.10984811	1.10984811	9.98863E-05	0.000116534	6.65909E-06
24005	005-2407	Middle River Aircraft Systems	336	005-2407-5- 2222	10300603	0.000	0.001	0.000	1.10984811	1.10984811	0.000493882	0.00058267	3.21856E-05
24005	005-2407	Middle River Aircraft Systems	336	005-2407-5- 1466	10300603	0.001	0.001	0.000	1.10984811	1.10984811	0.000627064	0.000743598	4.10644E-05
24005	005-2407	Middle River Aircraft Systems	336	005-2407-5- 1657	10300603	0.005	0.005	0.000	1.10984811	1.10984811	0.005033161	0.005987631	0.000327405
24005	005-2407	Middle River Aircraft Systems	336	005-2407-5- 1262	10300603	0.000	0.000	0.000	1.10984811	1.10984811	9.98863E-05	0.000116534	6.65909E-06
24005	005-2407	Middle River Aircraft Systems	336	005-2407-5- 1261	10300603	0.000	0.000	0.000	1.10984811	1.10984811	9.98863E-05	0.000116534	6.65909E-06
24005	005-2407	Middle River Aircraft Systems	336	005-2407-5- 1259	10300603	0.000	0.000	0.000	1.10984811	1.10984811	0.00029411	0.000349602	1.94223E-05

State County FIPS	State Facility Identifier	Facility Name	NAICS -2 Digits	Emission Unit ID	Process ID	2017 BY CO	2917 BY NOX	2917 BY VOC	GF-2023	GF-2023ADJ	2023_CO	2023_NOX	2023_VOC
24005	005-2407	Middle River Aircraft Systems	336	005-2407-5-1467	10300603	0.001	0.001	0.000	1.10984811	1.10984811	0.000621515	0.000743598	4.10644E-05
24005	005-2407	Middle River Aircraft Systems	336	005-2407-5-2300	10300603	0.000	0.000	0.000	1.10984811	1.10984811	0.000194223	0.000233068	1.27633E-05
24005	005-2407	Middle River Aircraft Systems	336	005-2407-5-2320	10300603	0.001	0.001	0.000	1.10984811	1.10984811	0.000627064	0.000749147	4.10644E-05
24005	005-2407	Middle River Aircraft Systems	336	005-2407-5-2321	10300603	0.001	0.001	0.000	1.10984811	1.10984811	0.000787992	0.000937822	5.16079E-05
24005	005-2407	Middle River Aircraft Systems	336	005-2407-5-1263	10300603	0.000	0.000	0.000	1.10984811	1.10984811	0.00029411	0.000349602	1.94223E-05
24005	005-2407	Middle River Aircraft Systems	336	005-2407-6-2430	30499999			0.000	1.10984811	1.10984811			0.000133182
24005	005-2407	Middle River Aircraft Systems	336	005-2407-6-2441	39000699	0.000	0.000	0.000	1.10984811	1.10984811	0.000149829	0.000177576	0.000521629
24005	005-2407	Middle River Aircraft Systems	336	005-2407-6-2499	39000699	0.000	0.000	0.000	1.10984811	1.10984811	0.000349602	0.000416193	0.000538276
24005	005-2407	Middle River Aircraft Systems	336	005-2407-6-2900	40200101	0.002	0.002	0.004	1.10984811	1.10984811	0.00204767	0.002436117	0.004472688
24005	005-2407	Middle River Aircraft Systems	336	005-2407-6-2426	40200101			0.000	1.10984811	1.10984811			0.000427292
24005	005-2407	Middle River Aircraft Systems	336	005-2407-6-2448	40200701			0.021	1.10984811	1.10984811			0.023340106
24005	005-2407	Middle River Aircraft Systems	336	005-2407-6-2443	40202502			0.002	1.10984811	1.10984811			0.001714715
24005	005-2407	Middle River Aircraft Systems	336	005-2407-6-2455	40500301			0.004	1.10984811	1.10984811			0.004300661
	005-2407 Total					0.01187	0.01411	0.033			0.013173897	0.015659957	0.036143314
24005	005-2436	Maryland Paving - Texas Quarry	324	005-2436-5-2342	10300603	0.002	0.002	0.000	0.949591764	1	0.00192	0.0022855	0.0001255
24005	005-2436	Maryland Paving - Texas Quarry	324	005-2436-6-3076	30500204	0.006	0.007	0.001	0.949591764	1	0.00619	0.006605	0.000535
24005	005-2436	Maryland Paving - Texas Quarry	324	005-2436-6-3077	30500204	0.003	0.002	0.000	0.949591764	1	0.002935	0.0022	0.00018
24005	005-2436	Maryland Paving - Texas Quarry	324	005-2436-6-2595	30500205	0.087	0.017	0.021	0.949591764	1	0.08665	0.01733	0.021325
	005-2436 Total					0.098	0.028	0.022			0.097695	0.0284205	0.0221655
24005	005-2581	Eastern Landfill Gas, LLC	22	005-2581-9-1280	20100102	0.045	0.010	0.003	0.981232222	1	0.04484	0.010105	0.003275
24005	005-2581	Eastern Landfill Gas, LLC	22	005-2581-9-1278	20100102	0.039	0.009	0.003	0.981232222	1	0.03878	0.009085	0.002945
24005	005-2581	Eastern Landfill Gas, LLC	22	005-2581-9-1279	20100102	0.038	0.008	0.003	0.981232222	1	0.03757	0.00824	0.00267
	005-2581 Total					0.121	0.027	0.009			0.12119	0.02743	0.00889

State County FIPS	State Facility Identifier	Facility Name	NAICS -2 Digits	Emission Unit ID	Process ID	2017 BY CO	2917 BY NOX	2917 BY VOC	GF-2023	GF-2023ADJ	2023_CO	2023_NOX	2023_VOC
24005	005-2684	MANN-PAK, Inc.	323	005-2684-6-2178	40500301			0.031	0.884608428	1			0.03146
24005	005-2684	MANN-PAK, Inc.	323	005-2684-6-2967	40500301	0.000	0.000	0.052	0.884608428	1	0.00017	0.0002	0.05212
	005-2684 Total					0.000	0.000	0.084			0.00017	0.0002	0.08358
24005	005-2824	Vac Pac, Inc	326	005-2824-6-3124	40500301	0.000	0.000	0.002	0.876545623	1	0.000335	0.000395	0.002199
24005	005-2824	Vac Pac, Inc	326	005-2824-6-3126	40500301			0.000	0.876545623	1			0.000363
24005	005-2824	Vac Pac, Inc	326	005-2824-6-3127	40500301			0.000	0.876545623	1			0.000363
	005-2824 Total					0.000335	0.000395	0.003			0.000335	0.000395	0.002925
24005	005-2843	Benjer, Inc. - Middle River	562	005-2843-6-3138	30504030	0.009	0.042	0.003	1.036118438	1.036118438	0.009428678	0.043620586	0.003470997
	005-2843 Total					0.009	0.042	0.003			0.009428678	0.043620586	0.003470997
24013	013-0012	Lehigh Cement Company LLC	327	013-0012-6-0256	30500606	4.856	8.048	0.143	0.95783729	1	4.85595	8.04785	0.14315
24013	013-0012	Lehigh Cement Company LLC	327	013-0012-6-0331	30500717	0.005	0.003	0.001	0.95783729	1	0.00512	0.003125	0.001168
24013	013-0012	Lehigh Cement Company LLC	327	013-0012-9-0107	40600601			0.001	0.95783729	1			0.00111
	013-0012 Total					4.86107	8.050975	0.145			4.86107	8.050975	0.145428
24013	013-0013	Congoleum Corporation	322	013-0013-5-0004	10200602	0.019	0.022	0.001	0.93323217	1	0.018745	0.022315	0.001225
24013	013-0013	Congoleum Corporation	322	013-0013-5-0003	10200602	0.019	0.022	0.001	0.93323217	1	0.01869	0.02225	0.001225
24013	013-0013	Congoleum Corporation	322	013-0013-5-0005	10200602	0.025	0.030	0.002	0.93323217	1	0.0248	0.02952	0.001625
	013-0013 Total					0.062	0.074	0.004			0.062235	0.074085	0.004075
24013	013-0046	C.J. Miller, LLC - Westminster	324	013-0046-5-0218	10200603	0.001	0.001	0.000	0.949591764	1	0.00096	0.001143	0.000063
24013	013-0046	C.J. Miller, LLC - Westminster	324	013-0046-6-0283	30500201	0.052	0.010	0.013	0.949591764	1	0.052	0.01045	0.01285
24013	013-0046	C.J. Miller, LLC - Westminster	324	013-0046-6-0361	30502003	0.012	0.012	0.001	0.949591764	1	0.01225	0.0117	0.00095
	013-0046 Total					0.065	0.023	0.014			0.06521	0.023293	0.013863
24013	013-0056	Colonial Pipeline Company-Dorsey Junction	48-49	013-0056-9-0202	20100102	0.001	0.003		1.094613899	1.094613899	0.000634876	0.002933565	

State County FIPS	State Facility Identifier	Facility Name	NAICS -2 Digits	Emission Unit ID	Process ID	2017 BY CO	2917 BY NOX	2917 BY VOC	GF-2023	GF-2023ADJ	2023_CO	2023_NOX	2023_VOC
24013	013-0056	Colonial Pipeline Company-Dorsey Junction	48-49	013-0056-9- 0132	40400178				0.180	1.094613899	1.094613899		0.197330426
	013-0056 Total					0.00058	0.00268	0.180			0.000634876	0.002933565	0.197330426
24013	013-0098	Maryland Paving - Woodbine	324	013-0098-4- 0149	10200503	0.001	0.002	0.000	0.949591764	1	0.0005475	0.00219	0.000037
24013	013-0098	Maryland Paving - Woodbine	324	013-0098-4- 0148	10200503	0.000	0.001	0.000	0.949591764	1	0.0002845	0.0011385	0.0000195
24013	013-0098	Maryland Paving - Woodbine	324	013-0098-9- 0059	30500201	0.055	0.011	0.013	0.949591764	1	0.0545	0.0109	0.0134
24013	013-0098	Maryland Paving - Woodbine	324	013-0098-9- 0007	30500201	0.074	0.022	0.002	0.949591764	1	0.0735	0.02205	0.001505
24013	013-0098	Maryland Paving - Woodbine	324	013-0098-6- 0448	30504030	0.001	0.001		0.949591764	1	0.00121	0.00098	
	013-0098 Total					0.130	0.037	0.0149615			0.130042	0.0372585	0.0149615
24013	013-0102	C.J. Miller, LLC - Finksburg	324	013-0102-5- 0217	10200603	0.002	0.003	0.000	0.949591764	1	0.00211266	0.00251507	0.00013833
24013	013-0102	C.J. Miller, LLC - Finksburg	324	013-0102-5- 0216	10200603	0.001	0.001	0.000	0.949591764	1	0.001152985	0.001372605	0.000075495
24013	013-0102	C.J. Miller, LLC - Finksburg	324	013-0102-6- 0118	30500201	0.145	0.009	0.003	0.949591764	1	0.1445	0.009	0.00296
24013	013-0102	C.J. Miller, LLC - Finksburg	324	013-0102-6- 0358	30500257	0.080	0.016	0.020	0.949591764	1	0.08	0.016	0.0197
24013	013-0102	C.J. Miller, LLC - Finksburg	324	013-0102-6- 0359	30502003	0.012	0.013		0.949591764	1	0.012245	0.012685	
	013-0102 Total					0.240	0.042	0.0228738 25			0.240010645	0.041572675	0.022873825
24013	013-0110	Maryland Paving - Finksburg	324	013-0110-4- 0150	10200501	0.000	0.002	0.000	0.949591764	1	0.0004445	0.001778	0.00003
24013	013-0110	Maryland Paving - Finksburg	324	013-0110-6- 0148	30500201	0.184	0.011	0.004	0.949591764	1	0.1835	0.01145	0.00376
	013-0110 Total					0.184	0.013	0.004			0.1839445	0.013228	0.00379
24013	013-0242	Northern Municipal Landfill	562	013-0242-9- 0213	20200102	0.001	0.020	0.000	1.036118438	1.036118438	0.000802992	0.020965857	0.00017096
24013	013-0242	Northern Municipal Landfill	562	013-0242-9- 0111	50100402	0.003	0.000	0.003	1.036118438	1.036118438	0.003197461	0.000170441	0.002707896
	013-0242 Total					0.004	0.020	0.003			0.004000453	0.021136298	0.002878855
24013	013-0394	Harvest Mid-Atlantic, LLC	325	013-0394-9- 0215	20200102	0.005	0.018	0.000	0.949384594	1	0.00474194	0.017852007	0.0004569
24013	013-0394	Harvest Mid-Atlantic, LLC	325	013-0394-9- 0192	20300101	0.006	0.022	0.001	0.949384594	1	0.00571628	0.021520111	0.000550781

State County FIPS	State Facility Identifier	Facility Name	NAICS -2 Digits	Emission Unit ID	Process ID	2017 BY CO	2917 BY NOX	2917 BY VOC	GF-2023	GF-2023ADJ	2023_CO	2023_NOX	2023_VOC
24013	013-0394	Harvest Mid-Atlantic, LLC	325	013-0394-9-0193	20300101	0.005	0.018	0.000	0.949384594	1	0.004755306	0.017902328	0.000458188
24013	013-0394	Harvest Mid-Atlantic, LLC	325	013-0394-9-0194	20300101	0.006	0.021	0.001	0.949384594	1	0.005691709	0.021427608	0.000548413
	013-0394 Total					0.021	0.079	0.002			0.020905234	0.078702053	0.002014281
24025	025-0005	Evonik Corporation	325	025-0005-5-0032	10200602	0.016	0.019	0.001	0.949384594	1	0.01589	0.018715	0.0007
24025	025-0005	Evonik Corporation	325	025-0005-5-0013	10200602	0.013	0.013	0.001	0.949384594	1	0.01325	0.012955	0.00083
24025	025-0005	Evonik Corporation	325	025-0005-5-0125	10200603	0.001	0.002	0.000	0.949384594	1	0.001235	0.0015945	0.000001
24025	025-0005	Evonik Corporation	325	025-0005-7-0151	30103552	0.000	0.001	0.000	0.949384594	1	0.0000325	0.000515	0.000005
24025	025-0005	Evonik Corporation	325	025-0005-7-0105	30103553	0.004	0.003	0.000	0.949384594	1	0.003515	0.003335	0.000225
24025	025-0005	Evonik Corporation	325	025-0005-7-0069	30103553	0.011	0.006	0.001	0.949384594	1	0.011035	0.005725	0.000735
24025	025-0005	Evonik Corporation	325	025-0005-7-0102	30103553	0.013	0.007	0.001	0.949384594	1	0.012815	0.0071	0.000845
24025	025-0005	Evonik Corporation	325	025-0005-7-0132	30103554	0.000	0.000	0.000	0.949384594	1	0.000105	0.0003	0.00001
	025-0005 Total					0.058	0.050	0.003			0.0578775	0.0502395	0.003351
24025	025-0006	Cytec Aerospace Materials, Inc	325	025-0006-4-0519	10200503	0.000	0.000	0.000	0.949384594	1	0.000015	0.0000505	0.000001
24025	025-0006	Cytec Aerospace Materials, Inc	325	025-0006-5-0076	10200602	0.007	0.008	0.000	0.949384594	1	0.006505	0.007743	0.000426
24025	025-0006	Cytec Aerospace Materials, Inc	325	025-0006-5-0136	10200603	0.001	0.001	0.000	0.949384594	1	0.000555	0.000658	0.000036
24025	025-0006	Cytec Aerospace Materials, Inc	325	025-0006-5-0137	10200603	0.001	0.001	0.000	0.949384594	1	0.000555	0.0006595	0.0000365
24025	025-0006	Cytec Aerospace Materials, Inc	325	025-0006-5-0077	10200603	0.004	0.005	0.000	0.949384594	1	0.004388	0.0052235	0.0002875
24025	025-0006	Cytec Aerospace Materials, Inc	325	025-0006-9-0426	20300101	0.007	0.029	0.001	0.949384594	1	0.0065	0.029	0.001
24025	025-0006	Cytec Aerospace Materials, Inc	325	025-0006-7-0180	30105114			0.002	0.949384594	1			0.002
24025	025-0006	Cytec Aerospace Materials, Inc	325	025-0006-6-0210	40200706			0.020	0.949384594	1			0.019715
24025	025-0006	Cytec Aerospace Materials, Inc	325	025-0006-7-0172	40201101	0.002	0.002	0.006	0.949384594	1	0.00186	0.00221	0.006495
24025	025-0006	Cytec Aerospace Materials, Inc	325	025-0006-7-0174	40201101			0.007	0.949384594	1			0.007
24025	025-0006	Cytec Aerospace Materials, Inc	325	025-0006-7-0175	40201101			0.001	0.949384594	1			0.000815

State County FIPS	State Facility Identifier	Facility Name	NAICS -2 Digits	Emission Unit ID	Process ID	2017 BY CO	2917 BY NOX	2917 BY VOC	GF-2023	GF-2023ADJ	2023_CO	2023_NOX	2023_VOC
24025	025-0006	Cytec Aerospace Materials, Inc	325	025-0006-7-0173	40201101	0.002	0.002	0.010	0.949384594	1	0.001955	0.002325	0.010495
24025	025-0006	Cytec Aerospace Materials, Inc	325	025-0006-6-0263	40202501			0.001	0.949384594	1			0.0005
	025-0006 Total					0.022333	0.0478695	0.049			0.022333	0.0478695	0.048807
24025	025-0024	Constellation Power - Peryman Generating Station	22	025-0024-4-0083	10100504	0.003	0.675	0.000	0.981232222	1	0.0033	0.675	0.0004
24025	025-0024	Constellation Power - Peryman Generating Station	22	025-0024-4-0081	10100504	0.005	0.956	0.001	0.981232222	1	0.00515	0.955555	0.00065
24025	025-0024	Constellation Power - Peryman Generating Station	22	025-0024-4-0084	10100504	0.003	0.700	0.000	0.981232222	1	0.0034	0.7	0.0004
24025	025-0024	Constellation Power - Peryman Generating Station	22	025-0024-5-0088	10100601	0.018	0.410	0.000	0.981232222	1	0.01755	0.40964	0.0004
24025	025-0024	Constellation Power - Peryman Generating Station	22	025-0024-5-0354	20100201	0.024	0.021	0.006	0.981232222	1	0.0235	0.02127	0.006
24025	025-0024	Constellation Power - Peryman Generating Station	22	025-0024-5-0353	20100201	0.024	0.022	0.006	0.981232222	1	0.02435	0.022135	0.0062
	025-0024 Total					0.077	2.784	0.014			0.07725	2.7836	0.01405
24025	025-0031	Maryland Paving, Inc. - Aberdeen	324	025-0031-4-0712	10200503	0.000	0.001	0.000	0.949591764	1	0.000265	0.001065	0.00002
24025	025-0031	Maryland Paving, Inc. - Aberdeen	324	025-0031-6-0055	30500205	0.062	0.012	0.015	0.949591764	1	0.0619	0.0124	0.01525
24025	025-0031	Maryland Paving, Inc. - Aberdeen	324	025-0031-6-0499	30500298	0.008	0.014	0.006	0.949591764	1	0.007695	0.0135	0.00559
	025-0031 Total					0.070	0.027	0.021			0.06986	0.026965	0.02086
24025	025-0056	Allan Myers MD, Inc. - Aberdeen Asphalt Plant	324	025-0056-6-0364	30500205	0.082	0.016	0.022	0.949591764	1	0.082	0.0164	0.022015
24025	025-0056	Allan Myers MD, Inc. - Aberdeen Asphalt Plant	324	025-0056-6-0479	30503201	0.019	0.036	0.007	0.949591764	1	0.01945	0.036	0.007375
	025-0056 Total					0.101	0.052	0.029			0.10145	0.0524	0.02939
24025	025-0076	Colonial Pipeline Co - Aberdeen Junction	48-49	025-0076-9-0007	40400178	0.000	0.000	0.033	1.094613899	1.094613899	8.2096E-05	0.000394061	0.036286451
	025-0076 Total					0.000	0.000	0.033			8.2096E-05	0.000394061	0.036286451
24025	025-0286	Frito- Lay Inc.- Aberdeen	311	025-0286-5-0280	10300602	0.007	0.008	0.000	1.110038077	1.110038077	0.007237448	0.008608345	0.000527268

State County FIPS	State Facility Identifier	Facility Name	NAICS -2 Digits	Emission Unit ID	Process ID	2017 BY CO	2917 BY NOX	2917 BY VOC	GF-2023	GF-2023ADJ	2023_CO	2023_NOX	2023_VOC
24025	025-0286	Frito- Lay Inc.- Aberdeen	311	025-0286-8-0049	30290003	0.015	0.018	0.001	1.110038077	1.110038077	0.016950281	0.020224894	0.001110038
24025	025-0286	Frito- Lay Inc.- Aberdeen	311	025-0286-8-0049	30290005	0.000	0.000	0.000	1.110038077	1.110038077	8.49179E-05	0.000149855	8.8803E-05
	025-0286 Total					0.022	0.026	0.002			0.024272648	0.028983094	0.001726109
24025	025-0333	Crouse Construction Co., Inc.	237	025-0333-9-0445	20200102	0.006	0.024	0.001	0.981808271	1	0.00633	0.023835	0.00061
	025-0333 Total					0.006	0.024	0.001			0.00633	0.023835	0.00061
24025	025-0360	Harford Waste Disposal Center	562	025-0360-9-0447	20200102	0.002	0.008		1.036118438	1.036118438	0.001844291	0.008553158	
24025	025-0360	Harford Waste Disposal Center	562	025-0360-9-0422	20200102	0.003	0.010		1.036118438	1.036118438	0.002668005	0.010039988	
24025	025-0360	Harford Waste Disposal Center	562	025-0360-9-0417	50100410	0.001		0.003	1.036118438	1.036118438	0.00052324		0.002880409
24025	025-0360	Harford Waste Disposal Center	562	025-0360-9-0498	50300601	0.016	0.006	0.000	1.036118438	1.036118438	0.017090774	0.006714047	0.000150237
	025-0360 Total					0.021	0.024	0.003			0.022126309	0.025307193	0.003030646
24025	025-0423	Alcore, Inc	332	025-0423-5-0286	10300603	0.003	0.003	0.000	0.984291504	1	0.002515	0.002995	0.000165
24025	025-0423	Alcore, Inc	332	025-0423-6-0299	40200701			0.011	0.984291504	1			0.01119
24025	025-0423	Alcore, Inc	332	025-0423-6-0301	40200701			0.036	0.984291504	1			0.035625
24025	025-0423	Alcore, Inc	332	025-0423-6-0300	40200701			0.048	0.984291504	1			0.048045
24025	025-0423	Alcore, Inc	332	025-0423-6-0493	40201806	0.003	0.003	0.003	0.984291504	1	0.002515	0.002995	0.0032
24025	025-0423	Alcore, Inc	332	025-0423-6-0367	40201806	0.003	0.003	0.007	0.984291504	1	0.002515	0.002995	0.006635
	025-0423 Total					0.008	0.009	0.105			0.007545	0.008985	0.10486
24025	025-0434	Upper Chesapeake Medical Center	813	025-0434-5-0139	10300602	0.000	0.000		1.006837915	1.006837915	0.000120821	0.000176197	
24025	025-0434	Upper Chesapeake Medical Center	813	025-0434-5-0141	10300602	0.000	0.000		1.006837915	1.006837915	0.000181231	0.000176197	
24025	025-0434	Upper Chesapeake Medical Center	813	025-0434-5-0140	10300602	0.000	0.000		1.006837915	1.006837915	0.000151026	0.000176197	
24025	025-0434	Upper Chesapeake Medical Center	813	025-0434-9-0271	20300102	0.006	0.009	0.001	1.006837915	1.006837915	0.005567814	0.009373661	0.000714855
24025	025-0434	Upper Chesapeake Medical Center	813	025-0434-9-0483	20300201	0.012	0.035	0.024	1.006837915	1.006837915	0.012323696	0.035279601	0.02416411
	025-0434 Total					0.018	0.045	0.025			0.018344587	0.045181851	0.024878965

State County FIPS	State Facility Identifier	Facility Name	NAICS -2 Digits	Emission Unit ID	Process ID	2017 BY CO	2917 BY NOX	2917 BY VOC	GF-2023	GF-2023ADJ	2023_CO	2023_NOX	2023_VOC
24025	025-0525	WAVE - Worthington Armstrong Venture	332	025-0525-6- 0405	30900198			0.049	0.984291504	1			0.04905
	025-0525 Total					0	0	0.049			0	0	0.04905
24025	025-0558	Lifoam Industries, LLC	326	025-0558-5- 0284	10300601	0.002	0.002	0.000	0.876545623	1	0.00175	0.0021	0.000116
24025	025-0558	Lifoam Industries, LLC	326	025-0558-6- 0424	30800801	0.016	0.019	0.109	0.876545623	1	0.01565	0.018615	0.108957
24025	025-0558	Lifoam Industries, LLC	326	025-0558-6- 0482	30800801			0.001	0.876545623	1			0.0005005
24025	025-0558	Lifoam Industries, LLC	326	025-0558-6- 0425	40500101			0.002	0.876545623	1			0.001935
	025-0558 Total					0.0174	0.020715	0.112			0.0174	0.020715	0.1115085
24025	025-0630	Bizerba Label Solutions, Inc	424	025-0630-6- 0466	40500301			0.002	0.986977289	1			0.00235
24025	025-0630	Bizerba Label Solutions, Inc	424	025-0630-6- 0222	40500301			0.001	0.986977289	1			0.00135
24025	025-0630	Bizerba Label Solutions, Inc	424	025-0630-6- 0221	40500301			0.001	0.986977289	1			0.00135
24025	025-0630	Bizerba Label Solutions, Inc	424	025-0630-6- 0488	40500301			0.002	0.986977289	1			0.00235
24025	025-0630	Bizerba Label Solutions, Inc	424	025-0630-6- 0380	40500301			0.002	0.986977289	1			0.0018
24025	025-0630	Bizerba Label Solutions, Inc	424	025-0630-6- 0507	40500301			0.002	0.986977289	1			0.00235
24025	025-0630	Bizerba Label Solutions, Inc	424	025-0630-6- 0238	40500301			0.001	0.986977289	1			0.00135
24025	025-0630	Bizerba Label Solutions, Inc	424	025-0630-6- 0223	40500301			0.001	0.986977289	1			0.00135
24025	025-0630	Bizerba Label Solutions, Inc	424	025-0630-6- 0515	40500301			0.002	0.986977289	1			0.00235
24025	025-0630	Bizerba Label Solutions, Inc	424	025-0630-6- 0220	40500301			0.004	0.986977289	1			0.00445
24025	025-0630	Bizerba Label Solutions, Inc	424	025-0630-6- 0503	40500597			0.002	0.986977289	1			0.00165
24025	025-0630	Bizerba Label Solutions, Inc	424	025-0630-6- 0502	40500597			0.002	0.986977289	1			0.00155
24025	025-0630	Bizerba Label Solutions, Inc	424	025-0630-6- 0504	40500597			0.002	0.986977289	1			0.0018
	025-0630 Total					0	0	0.026			0	0	0.02605
24027	027-0050	Johns Hopkins University - Applied Physics Laboratory	541	027-0050-5- 0260	10300601	0.002	0.001	0.000	1.074430413	1.074430413	0.002653413	0.001579413	0.000173735

State County FIPS	State Facility Identifier	Facility Name	NAICS -2 Digits	Emission Unit ID	Process ID	2017 BY CO	2917 BY NOX	2917 BY VOC	GF-2023	GF-2023ADJ	2023_CO	2023_NOX	2023_VOC
24027	027-0050	Johns Hopkins University - Applied Physics Laboratory	541	027-0050-5-0339	10300602	0.003	0.002	0.000	1.074430413	1.074430413	0.003537165	0.002105454	0.000231599
24027	027-0050	Johns Hopkins University - Applied Physics Laboratory	541	027-0050-5-0341	10300602	0.004	0.002	0.000	1.074430413	1.074430413	0.003889701	0.002315301	0.000254683
24027	027-0050	Johns Hopkins University - Applied Physics Laboratory	541	027-0050-5-0340	10300602	0.003	0.002	0.000	1.074430413	1.074430413	0.003537165	0.002105454	0.000231599
24027	027-0050	Johns Hopkins University - Applied Physics Laboratory	541	027-0050-5-0359	10300603	0.000	0.000	0.000	1.074430413	1.074430413	0.000284294	0.000169223	1.86145E-05
24027	027-0050	Johns Hopkins University - Applied Physics Laboratory	541	027-0050-5-0184	10300603	0.001	0.001	0.000	1.074430413	1.074430413	0.001548458	0.0009217	0.000101389
24027	027-0050	Johns Hopkins University - Applied Physics Laboratory	541	027-0050-6-0392	10300603	0.000	0.000	0.000	1.074430413	1.074430413	0.000296478	0.000176475	1.94096E-05
24027	027-0050	Johns Hopkins University - Applied Physics Laboratory	541	027-0050-5-0103	10300603	0.000	0.000	0.000	1.074430413	1.074430413	0.000317462	0.000188965	2.07849E-05
24027	027-0050	Johns Hopkins University - Applied Physics Laboratory	541	027-0050-5-0346	10300603	0.000	0.000	0.000	1.074430413	1.074430413	0.000473824	0.000282038	3.10242E-05
24027	027-0050	Johns Hopkins University - Applied Physics Laboratory	541	027-0050-5-0393	10300603	0.000	0.000	0.000	1.074430413	1.074430413	0.000487362	0.000290096	3.19106E-05
24027	027-0050	Johns Hopkins University - Applied Physics Laboratory	541	027-0050-5-0102	10300603	0.000	0.000	0.000	1.074430413	1.074430413	0.000317462	0.000188965	2.07849E-05
24027	027-0050	Johns Hopkins University - Applied Physics Laboratory	541	027-0050-5-0344	10300603	0.000	0.000	0.000	1.074430413	1.074430413	0.000238808	0.000142147	1.56383E-05
24027	027-0050	Johns Hopkins University - Applied Physics Laboratory	541	027-0050-5-0228	10300603	0.000	0.000	0.000	1.074430413	1.074430413	0.000473824	0.000282038	3.10242E-05
24027	027-0050	Johns Hopkins University - Applied Physics Laboratory	541	027-0050-5-0343	10300603	0.000	0.000	0.000	1.074430413	1.074430413	0.000238808	0.000142147	1.56383E-05
24027	027-0050	Johns Hopkins University - Applied Physics Laboratory	541	027-0050-5-0302	10300603	0.000	0.000	0.000	1.074430413	1.074430413	0.000296478	0.000176475	1.94096E-05
24027	027-0050	Johns Hopkins University - Applied Physics Laboratory	541	027-0050-5-0394	10300603	0.001	0.000	0.000	1.074430413	1.074430413	0.000568589	0.000338446	3.7229E-05
24027	027-0050	Johns Hopkins	541	027-0050-5-	10300603	0.001	0.001	0.000	1.074430413	1.074430413	0.001548458	0.0009217	0.000101389

State County FIPS	State Facility Identifier	Facility Name	NAICS -2 Digits	Emission Unit ID	Process ID	2017 BY CO	2917 BY NOX	2917 BY VOC	GF-2023	GF-2023ADJ	2023_CO	2023_NOX	2023_VOC
		University - Applied Physics Laboratory		0185									
24027	027-0050	Johns Hopkins University - Applied Physics Laboratory	541	027-0050-5- 0345	10300603	0.000	0.000	0.000	1.074430413	1.074430413	0.000451755	0.000268903	2.95791E-05
24027	027-0050	Johns Hopkins University - Applied Physics Laboratory	541	027-0050-5- 0092	10300603	0.001	0.001	0.000	1.074430413	1.074430413	0.001189486	0.000708028	7.78855E-05
24027	027-0050	Johns Hopkins University - Applied Physics Laboratory	541	027-0050-5- 0360	10300603	0.000	0.000	0.000	1.074430413	1.074430413	0.000284294	0.000169223	1.86145E-05
24027	027-0050	Johns Hopkins University - Applied Physics Laboratory	541	027-0050-9- 0320	20100102	0.000	0.001	0.000	1.074430413	1.074430413	0.000384371	0.001447043	3.65306E-05
24027	027-0050	Johns Hopkins University - Applied Physics Laboratory	541	027-0050-9- 0287	20100102	0.003	0.010	0.000	1.074430413	1.074430413	0.002712771	0.010207089	0.000261384
24027	027-0050	Johns Hopkins University - Applied Physics Laboratory	541	027-0050-9- 0360	20100102	0.001	0.002	0.000	1.074430413	1.074430413	0.000703012	0.002646591	6.77321E-05
24027	027-0050	Johns Hopkins University - Applied Physics Laboratory	541	027-0050-9- 0284	20100102	0.001	0.005	0.000	1.074430413	1.074430413	0.001441555	0.005427029	0.000138898
24027	027-0050	Johns Hopkins University - Applied Physics Laboratory	541	027-0050-9- 0367	20100102	0.000	0.001	0.000	1.074430413	1.074430413	0.000356079	0.001340534	3.42743E-05
24027	027-0050	Johns Hopkins University - Applied Physics Laboratory	541	027-0050-9- 0359	20100102	0.000	0.001	0.000	1.074430413	1.074430413	0.000231627	0.000871954	2.23159E-05
24027	027-0050	Johns Hopkins University - Applied Physics Laboratory	541	027-0050-9- 0339	20100102	0.000	0.001	0.000	1.074430413	1.074430413	0.000390507	0.001470145	3.76266E-05
24027	027-0050	Johns Hopkins University - Applied Physics Laboratory	541	027-0050-9- 0376	20100102	0.000	0.001	0.000	1.074430413	1.074430413	0.000229713	0.000864755	2.21333E-05
24027	027-0050	Johns Hopkins University - Applied Physics Laboratory	541	027-0050-9- 0283	20200102	0.000	0.001	0.000	1.074430413	1.074430413	0.000255057	0.000956243	2.45754E-05
24027	027-0050	Johns Hopkins University - Applied Physics Laboratory	541	027-0050-9- 0264	20200401	0.000	0.001	0.000	1.074430413	1.074430413	0.000286031	0.001076823	2.75602E-05
24027	027-0050	Johns Hopkins University - Applied Physics Laboratory	541	027-0050-9- 0263	20200401	0.000	0.001	0.000	1.074430413	1.074430413	0.000341795	0.001286755	3.29329E-05
24027	027-0050	Johns Hopkins University - Applied	541	027-0050-9- 0327	20300101	0.000	0.001	0.000	1.074430413	1.074430413	0.00022994	0.000865657	2.21333E-05

State County FIPS	State Facility Identifier	Facility Name	NAICS -2 Digits	Emission Unit ID	Process ID	2017 BY CO	2917 BY NOX	2917 BY VOC	GF-2023	GF-2023ADJ	2023_CO	2023_NOX	2023_VOC
		Physics Laboratory											
24027	027-0050	Johns Hopkins University - Applied Physics Laboratory	541	027-0050-9-0415	20300101	0.001	0.004	0.000	1.074430413	1.074430413	0.001149587	0.004327972	0.000110768
24027	027-0050	Johns Hopkins University - Applied Physics Laboratory	541	027-0050-9-0328	20300101	0.000	0.001	0.000	1.074430413	1.074430413	0.000234489	0.000882782	2.25937E-05
24027	027-0050	Johns Hopkins University - Applied Physics Laboratory	541	027-0050-9-0273	28888801	0.000	0.001	0.000	1.074430413	1.074430413	0.000214744	0.000808448	2.06914E-05
24027	027-0050	Johns Hopkins University - Applied Physics Laboratory	541	027-0050-9-0321	40600401			0.000	1.074430413	1.074430413			0.000328776
	027-0050 Total					0.0295920 15	0.0446301 69	0.003			0.031794561	0.047952011	0.002692866
24027	027-0052	MD & VA Milk Producers Coop	311	027-0052-5-0065	10200602	0.011	0.013	0.001	1.110038077	1.110038077	0.011733102	0.013964279	0.000765926
24027	027-0052	MD & VA Milk Producers Coop	311	027-0052-5-0209	10300602	0.011	0.004	0.001	1.110038077	1.110038077	0.011730882	0.004469013	0.000768146
24027	027-0052	MD & VA Milk Producers Coop	311	027-0052-8-0052	30203001	0.000	0.000	0.001	1.110038077	1.110038077	2.7751E-05	2.22008E-05	0.001581804
	027-0052 Total					0.021	0.017	0.003			0.023491736	0.018455493	0.003115877
24027	027-0080	Precoat Metals	332	027-0080-5-0306	10300602	0.001	0.000	0.000	0.984291504	1	0.000709	0.000422	0.0000465
24027	027-0080	Precoat Metals	332	027-0080-7-0058	40201806	0.013	0.008	0.014	0.984291504	1	0.0129805	0.0077265	0.013685
	027-0080 Total					0.014	0.008	0.014			0.0136895	0.0081485	0.0137315
24027	027-0127	Tate Access Floors	332	027-0127-6-0244	40200701			0.003	0.984291504	1			0.002815
	027-0127 Total					0	0	0.003			0	0	0.002815
24027	027-0223	Transcontinental Gas Pipe Line Company, LLC Compressor Station 190	48-49	027-0223-5-0064	10300603	0.001	0.003	0.000	1.094613899	1.094613899	0.001477729	0.003721687	5.47307E-05
24027	027-0223	Transcontinental Gas Pipe Line Company, LLC Compressor Station 190	48-49	027-0223-5-0063	10300603	0.001	0.003	0.000	1.094613899	1.094613899	0.001477729	0.002955458	0.000218923
24027	027-0223	Transcontinental Gas Pipe Line Company, LLC Compressor Station 190	48-49	027-0223-9-0186	20100202	0.060	0.040	0.020	1.094613899	1.094613899	0.065676834	0.043784556	0.021892278
24027	027-0223	Transcontinental Gas Pipe Line Company, LLC Compressor Station 190	48-49	027-0223-5-0054	20300202	0.488	1.004	0.937	1.094613899	1.094613899	0.533624276	1.098992354	1.025653223

State County FIPS	State Facility Identifier	Facility Name	NAICS -2 Digits	Emission Unit ID	Process ID	2017 BY CO	2917 BY NOX	2917 BY VOC	GF-2023	GF-2023ADJ	2023_CO	2023_NOX	2023_VOC
	027-0223 Total					0.550	1.050	0.957			0.602256567	1.149454055	1.047819155
24027	027-0260	Honeyland 108, LLC	334	027-0260-9-0279	20100102	0.001	0.005	0.000	0.943580376	1	0.001373436	0.005170582	0.000132335
24027	027-0260	Honeyland 108, LLC	334	027-0260-9-0301	20100102	0.002	0.006	0.000	0.943580376	1	0.001538549	0.005792182	0.000148244
24027	027-0260	Honeyland 108, LLC	334	027-0260-9-0302	20100102	0.001	0.004	0.000	0.943580376	1	0.001168296	0.004398291	0.000112569
24027	027-0260	Honeyland 108, LLC	334	027-0260-9-0276	20100102	0.001	0.005	0.000	0.943580376	1	0.001268364	0.004775182	0.000122211
24027	027-0260	Honeyland 108, LLC	334	027-0260-9-0277	20100102	0.002	0.006	0.000	0.943580376	1	0.001721173	0.006479709	0.00016584
24027	027-0260	Honeyland 108, LLC	334	027-0260-9-0278	20100102	0.001	0.005	0.000	0.943580376	1	0.001345917	0.005066982	0.000129681
24027	027-0260	Honeyland 108, LLC	334	027-0260-9-0267	20200102	0.001	0.005	0.000	0.943580376	1	0.001388446	0.005227091	0.000133781
24027	027-0260	Honeyland 108, LLC	334	027-0260-9-0266	20200102	0.001	0.005	0.000	0.943580376	1	0.001390948	0.005236509	0.000132549
	027-0260 Total					0.011	0.042	0.001			0.011195129	0.042146528	0.001077208
24027	027-0364	Alpha Ridge Municipal Landfill	562	027-0364-9-0364	20100802	0.104	0.014	0.011	1.036118438	1.036118438	0.107238258	0.01460927	0.01181175
24027	027-0364	Alpha Ridge Municipal Landfill	562	027-0364-9-0369	20200102	0.006	0.024		1.036118438	1.036118438	0.006631158	0.02502226	
24027	027-0364	Alpha Ridge Municipal Landfill	562	027-0364-9-0379	40600306			0.000	1.036118438	1.036118438			0.000103612
24027	027-0364	Alpha Ridge Municipal Landfill	562	027-0364-9-0205	50100402			0.002	1.036118438	1.036118438			0.002124043
24027	027-0364	Alpha Ridge Municipal Landfill	562	027-0364-9-0193	50100410	0.016	0.005	0.000	1.036118438	1.036118438	0.016888731	0.00507698	5.18059E-05
	027-0364 Total					0.126	0.043	0.014			0.130758147	0.044708511	0.014091211
24027	027-0535	Allan Myers Materials-Jessup Asphalt	324	027-0535-6-0402	30500260	0.111	0.022	0.027	0.949591764	1	0.1112445	0.022248875	0.027383228
24027	027-0535	Allan Myers Materials-Jessup Asphalt	324	027-0535-6-0458	30502510	0.006	0.029	0.002	0.949591764	1	0.00615	0.02875	0.00228
	027-0535 Total					0.117	0.051	0.030			0.1173945	0.050998875	0.029663228
24027	027-0612	Laurel Sand and Gravel, Inc. - Elkridge	212	027-0612-6-0444	30500261	0.050	0.010	0.012	0.647646814	1	0.050271	0.01005416	0.01237435
	027-0612 Total					0.050	0.010	0.012			0.050271	0.01005416	0.01237435
24510	510-0001	Johns Hopkins Hospital	622	510-0001-5-0304	10300502	0.002	0.009	0.000	1.128247103	1.128247103	0.002312907	0.010661935	9.30804E-05
24510	510-0001	Johns Hopkins Hospital	622	510-0001-5-0734	10300502	0.002	0.007	0.000	1.128247103	1.128247103	0.001692371	0.008010554	6.82589E-05

State County FIPS	State Facility Identifier	Facility Name	NAICS -2 Digits	Emission Unit ID	Process ID	2017 BY CO	2917 BY NOX	2917 BY VOC	GF-2023	GF-2023ADJ	2023_CO	2023_NOX	2023_VOC
24510	510-0001	Johns Hopkins Hospital	622	510-0001-5-2075	10300502	0.001	0.003	0.000	1.128247103	1.128247103	0.001128247	0.003441154	5.64124E-05
24510	510-0001	Johns Hopkins Hospital	622	510-0001-5-0306	10300502	0.002	0.009	0.000	1.128247103	1.128247103	0.001692371	0.010436286	6.76948E-05
24510	510-0001	Johns Hopkins Hospital	622	510-0001-5-0305	10300502	0.003	0.011	0.000	1.128247103	1.128247103	0.003497566	0.012749192	0.000141031
24510	510-0001	Johns Hopkins Hospital	622	510-0001-5-0303	10300502	0.001	0.004	0.002	1.128247103	1.128247103	0.001128247	0.004230927	0.002030845
24510	510-0001	Johns Hopkins Hospital	622	510-0001-5-0305	10300601	0.034	0.043	0.002	1.128247103	1.128247103	0.037937309	0.04862745	0.002504709
24510	510-0001	Johns Hopkins Hospital	622	510-0001-5-0306	10300601	0.036	0.045	0.002	1.128247103	1.128247103	0.04072972	0.050206996	0.002651381
24510	510-0001	Johns Hopkins Hospital	622	510-0001-5-0304	10300601	0.031	0.032	0.002	1.128247103	1.128247103	0.035347982	0.035539784	0.002312907
24510	510-0001	Johns Hopkins Hospital	622	510-0001-5-0303	10300601	0.028	0.026	0.002	1.128247103	1.128247103	0.031252445	0.029334425	0.002030845
24510	510-0001	Johns Hopkins Hospital	622	510-0001-5-2075	10300602	0.025	0.013	0.002	1.128247103	1.128247103	0.027867703	0.014103089	0.001805195
24510	510-0001	Johns Hopkins Hospital	622	510-0001-5-0734	10300602	0.039	0.056	0.003	1.128247103	1.128247103	0.04442473	0.062617714	0.002910878
24510	510-0001	Johns Hopkins Hospital	622	510-0001-9-0989	20200102	0.001	0.010	0.001	1.128247103	1.128247103	0.001410309	0.010718347	0.000846185
24510	510-0001	Johns Hopkins Hospital	622	510-0001-9-1015	20200102	0.001	0.010	0.001	1.128247103	1.128247103	0.001241072	0.011406578	0.000733361
24510	510-0001	Johns Hopkins Hospital	622	510-0001-9-0988	20200102	0.001	0.012	0.001	1.128247103	1.128247103	0.001241072	0.013426141	0.000846185
24510	510-0001	Johns Hopkins Hospital	622	510-0001-9-1016	20200102	0.001	0.010	0.001	1.128247103	1.128247103	0.001241072	0.01150812	0.000699513
24510	510-0001	Johns Hopkins Hospital	622	510-0001-9-0951	20200401	0.001	0.003	0.000	1.128247103	1.128247103	0.001201583	0.003847323	0.000124107
24510	510-0001	Johns Hopkins Hospital	622	510-0001-9-0950	20200401	0.001	0.010	0.001	1.128247103	1.128247103	0.001032346	0.011564533	0.000693872
24510	510-0001	Johns Hopkins Hospital	622	510-0001-9-0949	20200401	0.001	0.010	0.001	1.128247103	1.128247103	0.000936445	0.011451708	0.000676948
24510	510-0001	Johns Hopkins Hospital	622	510-0001-5-2073	20300102	0.003	0.005	0.000	1.128247103	1.128247103	0.002944725	0.005528411	1.69237E-05
24510	510-0001	Johns Hopkins Hospital	622	510-0001-5-2074	20300102	0.010	0.011	0.000	1.128247103	1.128247103	0.011451708	0.012523543	6.20536E-05
24510	510-0001	Johns Hopkins Hospital	622	510-0001-5-2074	20300202	0.014	0.042	0.002	1.128247103	1.128247103	0.016190346	0.047555615	0.002256494
24510	510-0001	Johns Hopkins Hospital	622	510-0001-5-2073	20300202	0.014	0.048	0.002	1.128247103	1.128247103	0.016167781	0.054155861	0.002256494
	510-0001 Total					0.252	0.429	0.023			0.284070056	0.483645686	0.025885373
24510	510-0006	Constellation Power - Westport	22	510-0006-5-0005	10100601	0.260	0.997	0.007	0.981232222	1	0.2595	0.997	0.0065

State County FIPS	State Facility Identifier	Facility Name	NAICS -2 Digits	Emission Unit ID	Process ID	2017 BY CO	2917 BY NOX	2917 BY VOC	GF-2023	GF-2023ADJ	2023_CO	2023_NOX	2023_VOC
	510-0006 Total					0.260	0.997	0.007			0.2595	0.997	0.0065
24510	510-0007	Constellation Power - Gould Street Station	22	510-0007-4- 0536	10100601	0.310	0.648	0.021	0.981232222	1	0.31	0.648	0.0205
	510-0007 Total					0.310	0.648	0.021			0.31	0.648	0.0205
24510	510-0069	P. Flanigan and Sons, Inc - N. Monroe St.	324	510-0069-6- 1535	30500205	0.072	0.014	0.018	0.949591764	1	0.071935	0.014385	0.017705
24510	510-0069	P. Flanigan and Sons, Inc - N. Monroe St.	324	510-0069-6- 2038	30500208	0.003	0.000		0.949591764	1	0.002715	0.00022	
	510-0069 Total					0.075	0.015	0.017705			0.07465	0.014605	0.017705
24510	510-0071	GAF	324	510-0071-5- 1143	10200602	0.005	0.005	0.000	0.949591764	1	0.00458	0.00545	0.0003
24510	510-0071	GAF	324	510-0071-4- 3041	10200603	0.008	0.005	0.001	0.949591764	1	0.007695	0.00513	0.000505
24510	510-0071	GAF	324	510-0071-5- 1142	10200603	0.004	0.005	0.000	0.949591764	1	0.00384	0.00457	0.00025
24510	510-0071	GAF	324	510-0071-9- 1257	20100102		0.104		0.949591764	1		0.104	
24510	510-0071	GAF	324	510-0071-6- 0003	30500103	0.023	0.002	0.004	0.949591764	1	0.02313	0.002345	0.00436
24510	510-0071	GAF	324	510-0071-6- 1743	30510198	0.000	0.002	0.003	0.949591764	1	0.000375	0.0015	0.00255
24510	510-0071	GAF	324	510-0071-9- 0621	30510298			0.000	0.949591764	1			0.00021
	510-0071 Total					0.03962	0.122995	0.008			0.03962	0.122995	0.008175
24510	510-0076	W. R. Grace & Co. - Davison Chemical	325	510-0076-5- 0294	10200601	0.044	0.016	0.003	0.949384594	1	0.0443	0.0158	0.0029
24510	510-0076	W. R. Grace & Co. - Davison Chemical	325	510-0076-5- 0016	10200602	0.110	0.047	0.007	0.949384594	1	0.1096	0.0466	0.0072
24510	510-0076	W. R. Grace & Co. - Davison Chemical	325	510-0076-7- 1644	30181003	0.074	0.057	0.004	0.949384594	1	0.07435	0.05665	0.0036
24510	510-0076	W. R. Grace & Co. - Davison Chemical	325	510-0076-7- 1095	30500401	0.028	0.020	0.002	0.949384594	1	0.02845	0.0201	0.00185
24510	510-0076	W. R. Grace & Co. - Davison Chemical	325	510-0076-7- 1077	30500402	0.055	0.178	0.004	0.949384594	1	0.0546	0.178	0.00355
24510	510-0076	W. R. Grace & Co. - Davison Chemical	325	510-0076-7- 1076	30500499	0.000	0.000		0.949384594	1	0.00015	0.00015	
24510	510-0076	W. R. Grace & Co. - Davison Chemical	325	510-0076-7- 1094	30500499	0.027	0.021	0.002	0.949384594	1	0.02655	0.0212	0.0021
24510	510-0076	W. R. Grace & Co. - Davison Chemical	325	510-0076-7- 1024	30500499	0.002	0.001	0.001	0.949384594	1	0.0023	0.00145	0.0005
24510	510-0076	W. R. Grace & Co. - Davison Chemical	325	510-0076-7- 1667	30509203	0.004	0.003	0.000	0.949384594	1	0.0036	0.0026	0.00025

State County FIPS	State Facility Identifier	Facility Name	NAICS -2 Digits	Emission Unit ID	Process ID	2017 BY CO	2917 BY NOX	2917 BY VOC	GF-2023	GF-2023ADJ	2023_CO	2023_NOX	2023_VOC
24510	510-0076	W. R. Grace & Co. - Davison Chemical	325	510-0076-7- 0951	30509204	0.001	0.002	0.000	0.949384594	1	0.0012	0.0016	0.0001
	510-0076 Total					0.345	0.344	0.022			0.3451	0.34415	0.02205
24510	510-0077	Johns Hopkins University - Charles Street	61	510-0077-5- 0763	10300502	0.000	0.000		1.096256281	1.096256281	5.48128E-06	2.19251E-05	
24510	510-0077	Johns Hopkins University - Charles Street	61	510-0077-5- 0533	10300502	0.000	0.000		1.096256281	1.096256281	5.48128E-06	2.19251E-05	
24510	510-0077	Johns Hopkins University - Charles Street	61	510-0077-5- 0535	10300502	0.000	0.000		1.096256281	1.096256281	5.48128E-06	2.19251E-05	
24510	510-0077	Johns Hopkins University - Charles Street	61	510-0077-5- 0534	10300502	0.000	0.000		1.096256281	1.096256281	5.48128E-06	2.19251E-05	
24510	510-0077	Johns Hopkins University - Charles Street	61	510-0077-5- 1867	10300602	0.000	0.000	0.000	1.096256281	1.096256281	0.000328877	3.8369E-05	2.19251E-05
24510	510-0077	Johns Hopkins University - Charles Street	61	510-0077-5- 1868	10300602	0.000	0.000	0.000	1.096256281	1.096256281	0.000328877	3.8369E-05	2.19251E-05
24510	510-0077	Johns Hopkins University - Charles Street	61	510-0077-5- 0763	10300602	0.005	0.006	0.000	1.096256281	1.096256281	0.005059223	0.00602941	0.000328877
24510	510-0077	Johns Hopkins University - Charles Street	61	510-0077-5- 0534	10300602	0.005	0.006	0.000	1.096256281	1.096256281	0.005059223	0.00602941	0.000328877
24510	510-0077	Johns Hopkins University - Charles Street	61	510-0077-5- 0533	10300602	0.005	0.006	0.000	1.096256281	1.096256281	0.005059223	0.00602941	0.000328877
24510	510-0077	Johns Hopkins University - Charles Street	61	510-0077-5- 0535	10300602	0.005	0.006	0.000	1.096256281	1.096256281	0.005059223	0.00602941	0.000328877
24510	510-0077	Johns Hopkins University - Charles Street	61	510-0077-5- 1865	10300603	0.000	0.000	0.000	1.096256281	1.096256281	0.000328877	3.8369E-05	2.19251E-05
24510	510-0077	Johns Hopkins University - Charles Street	61	510-0077-5- 1866	10300603	0.000	0.000	0.000	1.096256281	1.096256281	0.000328877	3.8369E-05	2.19251E-05
24510	510-0077	Johns Hopkins University - Charles Street	61	510-0077-5- 0965	10300603	0.000	0.000	0.000	1.096256281	1.096256281	0.000137032	0.000158957	1.09626E-05
24510	510-0077	Johns Hopkins University - Charles Street	61	510-0077-5- 2024	10300603	0.000	0.000	0.000	1.096256281	1.096256281	0.000191845	0.000230214	1.09626E-05

State County FIPS	State Facility Identifier	Facility Name	NAICS -2 Digits	Emission Unit ID	Process ID	2017 BY CO	2917 BY NOX	2917 BY VOC	GF-2023	GF-2023ADJ	2023_CO	2023_NOX	2023_VOC
24510	510-0077	Johns Hopkins University - Charles Street	61	510-0077-5-2030	10300603	0.000	0.000	0.000	1.096256281	1.096256281	8.22192E-05	9.86631E-05	5.48128E-06
24510	510-0077	Johns Hopkins University - Charles Street	61	510-0077-5-0964	10300603	0.000	0.000	0.000	1.096256281	1.096256281	0.000137032	0.000158957	1.09626E-05
24510	510-0077	Johns Hopkins University - Charles Street	61	510-0077-5-2026	10300603	0.000	0.000	0.000	1.096256281	1.096256281	0.000191845	0.000230214	1.09626E-05
24510	510-0077	Johns Hopkins University - Charles Street	61	510-0077-5-2035	10300603	0.000	0.000	0.000	1.096256281	1.096256281	8.77005E-05	0.000104144	5.48128E-06
24510	510-0077	Johns Hopkins University - Charles Street	61	510-0077-5-1885	10300603		0.000	0.000	1.096256281	1.096256281		0.000394652	2.19251E-05
24510	510-0077	Johns Hopkins University - Charles Street	61	510-0077-5-1861	10300603	0.000	0.000	0.000	1.096256281	1.096256281	0.000328877	3.8369E-05	2.19251E-05
24510	510-0077	Johns Hopkins University - Charles Street	61	510-0077-5-1862	10300603	0.000	0.000	0.000	1.096256281	1.096256281	0.000328877	3.8369E-05	2.19251E-05
24510	510-0077	Johns Hopkins University - Charles Street	61	510-0077-5-1863	10300603	0.000	0.000	0.000	1.096256281	1.096256281	0.000328877	3.8369E-05	2.19251E-05
24510	510-0077	Johns Hopkins University - Charles Street	61	510-0077-5-1864	10300603	0.000	0.000	0.000	1.096256281	1.096256281	0.000328877	3.8369E-05	2.19251E-05
24510	510-0077	Johns Hopkins University - Charles Street	61	510-0077-5-2025	10300603	0.000	0.000	0.000	1.096256281	1.096256281	0.000191845	0.000230214	1.09626E-05
24510	510-0077	Johns Hopkins University - Charles Street	61	510-0077-5-2027	10300603	0.000	0.000	0.000	1.096256281	1.096256281	0.000191845	0.000230214	1.09626E-05
24510	510-0077	Johns Hopkins University - Charles Street	61	510-0077-5-2028	10300603	0.000	0.000	0.000	1.096256281	1.096256281	8.22192E-05	9.86631E-05	5.48128E-06
24510	510-0077	Johns Hopkins University - Charles Street	61	510-0077-5-2031	10300603	0.000	0.000	0.000	1.096256281	1.096256281	8.22192E-05	9.86631E-05	5.48128E-06
24510	510-0077	Johns Hopkins University - Charles Street	61	510-0077-5-2029	10300603	0.000	0.000	0.000	1.096256281	1.096256281	8.22192E-05	9.86631E-05	5.48128E-06
24510	510-0077	Johns Hopkins University - Charles Street	61	510-0077-5-2041	10300603	0.000	0.000	0.000	1.096256281	1.096256281	0.000219251	0.000241176	5.48128E-06
24510	510-0077	Johns Hopkins	61	510-0077-5-	10300603	0.000	0.000	0.000	1.096256281	1.096256281	3.28877E-05	0.000230214	5.48128E-06

State County FIPS	State Facility Identifier	Facility Name	NAICS -2 Digits	Emission Unit ID	Process ID	2017 BY CO	2917 BY NOX	2917 BY VOC	GF-2023	GF-2023ADJ	2023_CO	2023_NOX	2023_VOC
		University - Charles Street		2173									
24510	510-0077	Johns Hopkins University - Charles Street	61	510-0077-5-2032	10300603	0.000	0.000	0.000	1.096256281	1.096256281	8.22192E-05	9.86631E-05	5.48128E-06
24510	510-0077	Johns Hopkins University - Charles Street	61	510-0077-5-2034	10300603	0.000	0.000	0.000	1.096256281	1.096256281	8.77005E-05	0.000104144	5.48128E-06
24510	510-0077	Johns Hopkins University - Charles Street	61	510-0077-5-2036	10300603	0.000	0.000	0.000	1.096256281	1.096256281	8.77005E-05	0.000104144	5.48128E-06
24510	510-0077	Johns Hopkins University - Charles Street	61	510-0077-5-2040	10300603	0.000	0.000	0.000	1.096256281	1.096256281	0.000219251	0.000241176	1.09626E-05
24510	510-0077	Johns Hopkins University - Charles Street	61	510-0077-5-2033	10300603	0.000	0.000	0.000	1.096256281	1.096256281	8.77005E-05	0.000104144	5.48128E-06
24510	510-0077	Johns Hopkins University - Charles Street	61	510-0077-5-1729	10500106	0.001	0.001	0.000	1.096256281	1.096256281	0.000893449	0.001057887	5.48128E-05
24510	510-0077	Johns Hopkins University - Charles Street	61	510-0077-5-1728	10500106	0.001	0.001	0.000	1.096256281	1.096256281	0.000893449	0.001057887	5.48128E-05
24510	510-0077	Johns Hopkins University - Charles Street	61	510-0077-9-1282	20100102	0.000	0.001	0.000	1.096256281	1.096256281	0.000197326	0.000750936	2.19251E-05
24510	510-0077	Johns Hopkins University - Charles Street	61	510-0077-5-2067	20100201	0.008	0.051	0.001	1.096256281	1.096256281	0.008441173	0.05590907	0.001183957
24510	510-0077	Johns Hopkins University - Charles Street	61	510-0077-9-1179	20300101	0.000	0.001	0.000	1.096256281	1.096256281	0.000411096	0.001545721	4.38503E-05
	510-0077 Total					0.033	0.080	0.003			0.036001056	0.088089673	0.003009223
24510	510-0078	St. Agnes Hospital	621	510-0078-5-2022	10300602	0.004	0.002	0.000	1.203801856	1.203801856	0.005001797	0.0021849	0.000325027
24510	510-0078	St. Agnes Hospital	621	510-0078-5-2021	10300602	0.004	0.002	0.000	1.203801856	1.203801856	0.005001797	0.0021849	0.000325027
24510	510-0078	St. Agnes Hospital	621	510-0078-5-2020	10300602	0.004	0.002	0.000	1.203801856	1.203801856	0.005001797	0.0021849	0.000325027
24510	510-0078	St. Agnes Hospital	621	510-0078-9-1193	20300101	0.002	0.041	0.001	1.203801856	1.203801856	0.00279282	0.049319762	0.001468638
24510	510-0078	St. Agnes Hospital	621	510-0078-9-1194	20300101	0.002	0.031	0.001	1.203801856	1.203801856	0.002094615	0.036992831	0.001101479
	510-0078 Total					0.017	0.077	0.003			0.019892826	0.092867294	0.003545196

State County FIPS	State Facility Identifier	Facility Name	NAICS -2 Digits	Emission Unit ID	Process ID	2017 BY CO	2917 BY NOX	2917 BY VOC	GF-2023	GF-2023ADJ	2023_CO	2023_NOX	2023_VOC
24510	510-0088	University of MD Medical Center Midtown Campus	621	510-0088-5- 0528	10300602	0.004	0.004	0.000	1.203801856	1.203801856	0.004429991	0.005307562	0.000288912
24510	510-0088	University of MD Medical Center Midtown Campus	621	510-0088-5- 0527	10300602	0.004	0.004	0.000	1.203801856	1.203801856	0.004429991	0.005307562	0.000288912
24510	510-0088	University of MD Medical Center Midtown Campus	621	510-0088-5- 0526	10300602	0.004	0.004	0.000	1.203801856	1.203801856	0.004429991	0.005307562	0.000288912
24510	510-0088	University of MD Medical Center Midtown Campus	621	510-0088-9- 1192	20300101	0.003	0.008	0.000	1.203801856	1.203801856	0.003388702	0.00947994	0.000168532
24510	510-0088	University of MD Medical Center Midtown Campus	621	510-0088-9- 1191	20300101	0.002	0.010	0.000	1.203801856	1.203801856	0.002648364	0.011562517	0.000306969
24510	510-0088	University of MD Medical Center Midtown Campus	621	510-0088-9- 1190	20300101	0.002	0.010	0.000	1.203801856	1.203801856	0.002865048	0.01251352	0.000337065
	510-0088 Total					0.018	0.041	0.001			0.022192087	0.049478664	0.001679304
24510	510-0106	United States Gypsum Company	327	510-0106-5- 1423	10200603	0.003	0.003	0.000	0.95783729	1	0.00272	0.00324	0.00018
24510	510-0106	United States Gypsum Company	327	510-0106-5- 2174	10300603	0.003	0.004	0.000	0.95783729	1	0.003025	0.0036	0.0002
24510	510-0106	United States Gypsum Company	327	510-0106-6- 1623	30501520	0.001	0.001	0.000	0.95783729	1	0.00062	0.000735	0.00004
24510	510-0106	United States Gypsum Company	327	510-0106-6- 0879	30501520	0.062	0.073	0.047	0.95783729	1	0.06153	0.07325	0.047065
24510	510-0106	United States Gypsum Company	327	510-0106-6- 0881	30599999	0.027	0.032	0.001	0.95783729	1	0.027015	0.03216	0.00127
24510	510-0106	United States Gypsum Company	327	510-0106-9- 0814	40600601			0.000	0.95783729	1			0.000405
	510-0106 Total					0.09491	0.112985	0.049			0.09491	0.112985	0.04916
24510	510-0119	Citgo Motiva Baltimore Terminal	424	510-0119-9- 0093	40400178	0.042	0.017	0.137	0.986977289	1	0.0415	0.0165	0.1368135
	510-0119 Total					0.042	0.017	0.137			0.0415	0.0165	0.1368135
24510	510-0171	P. Flanigan and Sons, Inc - Annapolis Rd	324	510-0171-6- 0913	30500205	0.116	0.023	0.029	0.949591764	1	0.11601	0.0232	0.028555
	510-0171 Total					0.116	0.023	0.029			0.11601	0.0232	0.028555
24510	510-0233	National Gypsum Company	327	510-0233-6- 1426	30501513	0.072	0.047	0.005	0.95783729	1	0.07165	0.04747	0.00469
24510	510-0233	National Gypsum Company	327	510-0233-6- 1569	30501519	0.100	0.015	0.036	0.95783729	1	0.10031	0.01457	0.036035

State County FIPS	State Facility Identifier	Facility Name	NAICS -2 Digits	Emission Unit ID	Process ID	2017 BY CO	2917 BY NOX	2917 BY VOC	GF-2023	GF-2023ADJ	2023_CO	2023_NOX	2023_VOC
24510	510-0233	National Gypsum Company	327	510-0233-6-0646	30501520	0.065	0.048	0.015	0.95783729	1	0.065165	0.04771	0.014635
	510-0233 Total					0.237	0.110	0.055			0.237125	0.10975	0.05536
24510	510-0265	Constellation Energy Group - Philadelphia Road	22	510-0265-4-0434	10100504	0.001	0.143	0.000	0.981232222	1	0.00085	0.143	0.0001
24510	510-0265	Constellation Energy Group - Philadelphia Road	22	510-0265-4-0431	10100504	0.000	0.047	0.000	0.981232222	1	0.0003	0.0465	0.00005
24510	510-0265	Constellation Energy Group - Philadelphia Road	22	510-0265-4-0433	10100504	0.001	0.136	0.000	0.981232222	1	0.0008	0.1355	0.0001
24510	510-0265	Constellation Energy Group - Philadelphia Road	22	510-0265-4-0432	10100504	0.001	0.131	0.000	0.981232222	1	0.0008	0.1305	0.0001
	510-0265 Total					0.003	0.456	0.000			0.00275	0.4555	0.00035
24510	510-0283	Mid Atlantic Baking Co	311	510-0283-8-0326	30203201	0.010	0.012	0.030	1.110038077	1.110038077	0.011555496	0.013758922	0.032784975
	510-0283 Total					0.010	0.012	0.030			0.011555496	0.013758922	0.032784975
24510	510-0286	The Sherwin-Williams Company - Baltimore	325	510-0286-5-1328	10200602	0.001	0.001	0.000	0.949384594	1	0.000845	0.001005	0.000055
24510	510-0286	The Sherwin-Williams Company - Baltimore	325	510-0286-5-1329	10200602	0.001	0.001	0.000	0.949384594	1	0.000845	0.001005	0.000055
24510	510-0286	The Sherwin-Williams Company - Baltimore	325	510-0286-5-1368	10200603	0.000	0.000	0.000	0.949384594	1	0.00012	0.000145	0.00001
24510	510-0286	The Sherwin-Williams Company - Baltimore	325	510-0286-5-1367	10200603	0.000	0.000	0.000	0.949384594	1	0.00012	0.000145	0.00001
24510	510-0286	The Sherwin-Williams Company - Baltimore	325	510-0286-5-0074	10200603	0.001	0.002	0.000	0.949384594	1	0.001195	0.00151	0.00008
24510	510-0286	The Sherwin-Williams Company - Baltimore	325	510-0286-5-1045	10200603	0.001	0.001	0.000	0.949384594	1	0.001075	0.001405	0.00007
24510	510-0286	The Sherwin-Williams Company - Baltimore	325	510-0286-7-1424	30101401			0.001	0.949384594	1			0.0006
24510	510-0286	The Sherwin-Williams Company - Baltimore	325	510-0286-7-1070	30101401			0.020	0.949384594	1			0.0203
24510	510-0286	The Sherwin-Williams Company - Baltimore	325	510-0286-7-1487	40703697			0.001	0.949384594	1			0.00065
	510-0286 Total					0.0042	0.005215	0.022			0.0042	0.005215	0.02183
24510	510-0301	H & S Bakery	311	510-0301-5-2213	10300602	0.002	0.002	0.000	1.110038077	1.110038077	0.001959217	0.00233108	0.000127654
24510	510-0301	H & S Bakery	311	510-0301-5-2148	10300602	0.002	0.002	0.000	1.110038077	1.110038077	0.001948117	0.00231998	0.000127654

State County FIPS	State Facility Identifier	Facility Name	NAICS -2 Digits	Emission Unit ID	Process ID	2017 BY CO	2917 BY NOX	2917 BY VOC	GF-2023	GF-2023ADJ	2023_CO	2023_NOX	2023_VOC
24510	510-0301	H & S Bakery	311	510-0301-8-0278	30203202	0.008	0.010	0.244	1.110038077	1.110038077	0.009146714	0.010889474	0.270571781
	510-0301 Total					0.012	0.014	0.244			0.013054048	0.015540533	0.27082709
24510	510-0314	American Sugar Refining, Inc.	311	510-0314-5-1476	10200601	0.135	0.066	0.009	1.110038077	1.110038077	0.14985514	0.072707494	0.009823837
24510	510-0314	American Sugar Refining, Inc.	311	510-0314-5-1444	10200601	0.052	0.046	0.003	1.110038077	1.110038077	0.057333467	0.051061752	0.003774129
24510	510-0314	American Sugar Refining, Inc.	311	510-0314-5-1447	10200601	0.029	0.027	0.002	1.110038077	1.110038077	0.031636085	0.029971028	0.00205357
24510	510-0314	American Sugar Refining, Inc.	311	510-0314-5-1446	10200601	0.049	0.040	0.003	1.110038077	1.110038077	0.054003352	0.04401301	0.003552122
24510	510-0314	American Sugar Refining, Inc.	311	510-0314-5-1445	10200601	0.043	0.036	0.003	1.110038077	1.110038077	0.047176618	0.039961371	0.003052605
24510	510-0314	American Sugar Refining, Inc.	311	510-0314-9-1293	20300101	0.001	0.004	0.001	1.110038077	1.110038077	0.001110038	0.004273647	0.000555019
24510	510-0314	American Sugar Refining, Inc.	311	510-0314-8-0301	30201599	0.035	0.002	0.002	1.110038077	1.110038077	0.038435068	0.002109072	0.002497586
24510	510-0314	American Sugar Refining, Inc.	311	510-0314-6-2021	30201599			0.001	1.110038077	1.110038077			0.001110038
24510	510-0314	American Sugar Refining, Inc.	311	510-0314-8-0226	30201599			0.001	1.110038077	1.110038077			0.00117109
24510	510-0314	American Sugar Refining, Inc.	311	510-0314-9-1298	40200701			0.001	1.110038077	1.110038077			0.001221042
24510	510-0314	American Sugar Refining, Inc.	311	510-0314-6-2018	40500597			0.009	1.110038077	1.110038077			0.009851588
	510-0314 Total					0.341925	0.2199	0.035			0.37954977	0.244097373	0.038662626
24510	510-0337	Kaydon Ring & Seal, Inc	336	510-0337-4-3168	10200502	0.014	0.000	0.001	1.10984811	1.10984811	0.015077287	0.000393996	0.000910075
24510	510-0337	Kaydon Ring & Seal, Inc	336	510-0337-5-1127	10200603	0.004	0.000	0.000	1.10984811	1.10984811	0.004539279	0.000116534	0.000260814
24510	510-0337	Kaydon Ring & Seal, Inc	336	510-0337-6-1052	30300303	0.002		0.000	1.10984811	1.10984811	0.001914488		0.000432841
24510	510-0337	Kaydon Ring & Seal, Inc	336	510-0337-6-1053	30300303	0.002		0.000	1.10984811	1.10984811	0.001847897		0.000338504
24510	510-0337	Kaydon Ring & Seal, Inc	336	510-0337-6-1050	30300303	0.000		0.000	1.10984811	1.10984811	0.000527178		9.43371E-05
24510	510-0337	Kaydon Ring & Seal, Inc	336	510-0337-7-1575	40100205			0.000	1.10984811	1.10984811			0.000316307
24510	510-0337	Kaydon Ring & Seal, Inc	336	510-0337-7-1577	40100303			0.016	1.10984811	1.10984811			0.018112721
24510	510-0337	Kaydon Ring & Seal, Inc	336	510-0337-6-1749	40200501			0.004	1.10984811	1.10984811			0.004494885
	510-0337 Total					0.02154	0.00046	0.022			0.023906128	0.00051053	0.024960484

State County FIPS	State Facility Identifier	Facility Name	NAICS -2 Digits	Emission Unit ID	Process ID	2017 BY CO	2917 BY NOX	2917 BY VOC	GF-2023	GF-2023ADJ	2023_CO	2023_NOX	2023_VOC
24510	510-0376	USALCO, LLC	22	510-0376-4-3035	10200503	0.005	0.006	0.000	0.981232222	1	0.00472	0.00562	0.0002805
24510	510-0376	USALCO, LLC	22	510-0376-4-3017	10200503	0.000	0.000	0.000	0.981232222	1	0.000115	0.00046	0.000006
24510	510-0376	USALCO, LLC	22	510-0376-4-2367	10200503			0.000	0.981232222	1			0.0002805
24510	510-0376	USALCO, LLC	22	510-0376-4-3018	10200503	0.000	0.000	0.000	0.981232222	1	0.00007	0.00028	0.0000035
24510	510-0376	USALCO, LLC	22	510-0376-4-3132	10300603	0.007	0.007	0.000	0.981232222	1	0.0065	0.007493	0.000374
	510-0376 Total					0.011	0.014	0.001			0.011405	0.013853	0.0009445
24510	510-0651	Veolia Energy Baltimore Heating, LLP-Central Ave	424	510-0651-5-1281	10300601	0.055	0.074	0.004	0.986977289	1	0.0545	0.0735	0.00357
24510	510-0651	Veolia Energy Baltimore Heating, LLP-Central Ave	424	510-0651-5-1351	10300602	0.026	0.105	0.002	0.986977289	1	0.0261	0.105	0.00171
24510	510-0651	Veolia Energy Baltimore Heating, LLP-Central Ave	424	510-0651-5-1350	10300602	0.022	0.005	0.001	0.986977289	1	0.0218	0.005	0.001425
	510-0651 Total					0.102	0.184	0.007			0.1024	0.1835	0.006705
24510	510-0660	Veolia Energy Baltimore Heating, LLP-Cherry Hill	22	510-0660-5-1422	10300602	0.010	0.005	0.001	0.981232222	1	0.01035	0.00505	0.00068
24510	510-0660	Veolia Energy Baltimore Heating, LLP-Cherry Hill	22	510-0660-5-1421	10300602	0.005	0.002	0.000	0.981232222	1	0.005	0.002	0.000325
24510	510-0660	Veolia Energy Baltimore Heating, LLP-Cherry Hill	22	510-0660-5-1420	10300602	0.008	0.004	0.001	0.981232222	1	0.0077	0.00425	0.0005
	510-0660 Total					0.023	0.011	0.002			0.02305	0.0113	0.001505
24510	510-0677	Petroleum Fuel and Terminal Co - Erdman Ave	424	510-0677-4-3049	10300503	0.000	0.000	0.000	0.986977289	1	0.0000205	0.00008205	0.00000105
24510	510-0677	Petroleum Fuel and Terminal Co - Erdman Ave	424	510-0677-4-0293	10300503	0.000	0.000	0.000	0.986977289	1	0.000061	0.00024325	0.00000305
24510	510-0677	Petroleum Fuel and Terminal Co - Erdman Ave	424	510-0677-9-0784	40400178			0.127	0.986977289	1			0.1273836
	510-0677 Total					0.0000815	0.0003253	0.127			0.0000815	0.0003253	0.1273877
24510	510-0703	Sunoco Partners Baltimore Terminal	424	510-0703-4-3125	10300503	0.000	0.000		0.986977289	1	0.00004	0.000165	
24510	510-0703	Sunoco Partners Baltimore Terminal	424	510-0703-9-0999	40400101	0.002	0.001	0.063	0.986977289	1	0.001505	0.0006	0.063095
24510	510-0703	Sunoco Partners Baltimore Terminal	424	510-0703-9-1000	40400178			0.027	0.986977289	1			0.02689

State County FIPS	State Facility Identifier	Facility Name	NAICS -2 Digits	Emission Unit ID	Process ID	2017 BY CO	2917 BY NOX	2917 BY VOC	GF-2023	GF-2023ADJ	2023_CO	2023_NOX	2023_VOC
24510	510-0703	Sunoco Partners Baltimore Terminal	424	510-0703-9- 1151	40729697			0.022	0.986977289	1			0.021705
24510	510-0703	Sunoco Partners Baltimore Terminal	424	510-0703-9- 1326	40781606			0.004	0.986977289	1			0.00408
	510-0703 Total					0.001545	0.000765	0.116			0.001545	0.000765	0.11577
24510	510-0728	Motiva Enterprises LLC	424	510-0728-9- 0828	40400178	0.005	0.002	0.177	0.986977289	1	0.004535	0.001815	0.1767125
	510-0728 Total					0.005	0.002	0.177			0.004535	0.001815	0.1767125
24510	510-0730	Center Point Terminal Baltimore LLC	311	510-0730-9- 1075	40400172			0.008	1.110038077	1.110038077			0.008959672
24510	510-0730	Center Point Terminal Baltimore LLC	311	510-0730-9- 0997	40400178	0.000	0.000	0.122	1.110038077	1.110038077	1.99807E-05	0.00014708	0.134948994
	510-0730 Total					0.000	0.000	0.130			1.99807E-05	0.00014708	0.143908666
24510	510-0754	Fleischmann's Vinegar Company, Inc.	322	510-0754-8- 0331	30204201			0.032	0.93323217	1			0.032425
24510	510-0754	Fleischmann's Vinegar Company, Inc.	322	510-0754-9- 0977	42500302			0.002	0.93323217	1			0.00232
	510-0754 Total					0	0	0.035			0	0	0.034745
24510	510-0918	Buckeye Terminals, LLC - Baltimore Terminal	622	003-0283-4- 0330	10300402	0.009	0.100	0.001	1.128247103	1.128247103	0.010257459	0.1128343	0.000574278
24510	510-0918	Buckeye Terminals, LLC - Baltimore Terminal	622	510-0918-4- 1241	10300402	0.020	0.023	0.001	1.128247103	1.128247103	0.022165543	0.026387443	0.00145149
24510	510-0918	Buckeye Terminals, LLC - Baltimore Terminal	622	510-0918-4- 1242	10300402	0.023	0.027	0.002	1.128247103	1.128247103	0.026013429	0.030968126	0.001703089
24510	510-0918	Buckeye Terminals, LLC - Baltimore Terminal	622	003-0283-4- 0329	10300402	0.009	0.100	0.001	1.128247103	1.128247103	0.010281152	0.113090977	0.00057597
24510	510-0918	Buckeye Terminals, LLC - Baltimore Terminal	622	510-0918-4- 1239	10300402	0.016	0.020	0.001	1.128247103	1.128247103	0.018549511	0.022082616	0.001214558
24510	510-0918	Buckeye Terminals, LLC - Baltimore Terminal	622	510-0918-4- 3257	10300503	0.000	0.001	0.000	1.128247103	1.128247103	0.000190392	0.000761567	7.61567E-05
24510	510-0918	Buckeye Terminals, LLC - Baltimore Terminal	622	510-0918-9- 1002	20300101	0.003	0.012	0.000	1.128247103	1.128247103	0.003712723	0.013976161	0.000353705
24510	510-0918	Buckeye Terminals, LLC - Baltimore Terminal	622	510-0918-9- 0102	40400178	0.055	0.022	0.174	1.128247103	1.128247103	0.062181252	0.024902444	0.196322894
	510-0918 Total					0.136	0.306	0.179			0.153351459	0.345003635	0.202272141
24510	510-1045	Morgan State University	325	510-1045-4- 3105	10300502	0.033	0.012	0.002	0.949384594	1	0.03276	0.01248	0.002145
24510	510-1045	Morgan State University	325	510-1045-5- 1362	10300503	0.000	0.000		0.949384594	1	0.00015	0.00003	
24510	510-1045	Morgan State University	325	510-1045-4- 3268	10300503	0.000	0.000	0.000	0.949384594	1	0.00015	0.00003	0.0000645

State County FIPS	State Facility Identifier	Facility Name	NAICS -2 Digits	Emission Unit ID	Process ID	2017 BY CO	2917 BY NOX	2917 BY VOC	GF-2023	GF-2023ADJ	2023_CO	2023_NOX	2023_VOC
24510	510-1045	Morgan State University	325	510-1045-5-1364	10300503	0.000	0.000		0.949384594	1	0.0001	0.00003	
24510	510-1045	Morgan State University	325	510-1045-4-1362	10300503	0.000	0.000	0.000	0.949384594	1	0.000115	0.000045	0.000005
24510	510-1045	Morgan State University	325	510-1045-4-3269	10300503	0.000	0.000	0.000	0.949384594	1	0.00015	0.00003	0.0000645
24510	510-1045	Morgan State University	325	510-1045-4-1361	10300503	0.000	0.000	0.000	0.949384594	1	0.000115	0.000045	0.000005
24510	510-1045	Morgan State University	325	510-1045-4-3104	10300602	0.022	0.008	0.001	0.949384594	1	0.022075	0.00841	0.001445
24510	510-1045	Morgan State University	325	510-1045-4-3102	10300602	0.016	0.006	0.001	0.949384594	1	0.016	0.006095	0.00105
24510	510-1045	Morgan State University	325	510-1045-4-3103	10300602	0.008	0.003	0.001	0.949384594	1	0.008245	0.00314	0.00054
24510	510-1045	Morgan State University	325	510-1045-5-2198	10300603	0.001	0.001	0.001	0.949384594	1	0.0005	0.0005	0.0005
24510	510-1045	Morgan State University	325	510-1045-5-2233	10300603	0.001	0.001	0.001	0.949384594	1	0.0005	0.0005	0.0005
24510	510-1045	Morgan State University	325	510-1045-5-2123	10300603	0.000	0.000	0.000	0.949384594	1	0.0001	0.00003	0.00003352
24510	510-1045	Morgan State University	325	510-1045-5-2132	10300603	0.000	0.000	0.000	0.949384594	1	0.00015	0.00004	0.00002515
24510	510-1045	Morgan State University	325	510-1045-5-2124	10300603	0.000	0.000	0.000	0.949384594	1	0.00015	0.00003	0.00003352
24510	510-1045	Morgan State University	325	510-1045-5-2136	10300603	0.000	0.000	0.000	0.949384594	1	0.00015	0.000005	0.000088
24510	510-1045	Morgan State University	325	510-1045-5-2182	10300603	0.001	0.001	0.001	0.949384594	1	0.0005	0.0005	0.0005
24510	510-1045	Morgan State University	325	510-1045-5-1361	10300603	0.000	0.000		0.949384594	1	0.0001	0.00003	
24510	510-1045	Morgan State University	325	510-1045-5-2125	10300603	0.000	0.000	0.000	0.949384594	1	0.00015	0.00003	0.00006915
24510	510-1045	Morgan State University	325	510-1045-5-2134	10300603	0.000	0.000	0.000	0.949384594	1	0.0001	0.00004	0.000088
24510	510-1045	Morgan State University	325	510-1045-5-1363	10300603	0.000	0.000		0.949384594	1	0.00015	0.00003	
24510	510-1045	Morgan State University	325	510-1045-5-2127	10300603	0.000	0.000	0.000	0.949384594	1	0.0001	0.00003	0.00015
24510	510-1045	Morgan State University	325	510-1045-5-2130	10300603	0.000	0.000	0.000	0.949384594	1	0.0001	0.000005	0.0000877
24510	510-1045	Morgan State University	325	510-1045-5-2131	10300603	0.000	0.000	0.000	0.949384594	1	0.00015	0.00004	0.00002515
24510	510-1045	Morgan State University	325	510-1045-5-2133	10300603	0.000	0.000	0.000	0.949384594	1	0.0001	0.00004	0.000088
24510	510-1045	Morgan State University	325	510-1045-5-2135	10300603	0.000	0.000	0.000	0.949384594	1	0.00015	0.00004	0.000088

State County FIPS	State Facility Identifier	Facility Name	NAICS -2 Digits	Emission Unit ID	Process ID	2017 BY CO	2917 BY NOX	2917 BY VOC	GF-2023	GF-2023ADJ	2023_CO	2023_NOX	2023_VOC
24510	510-1045	Morgan State University	325	510-1045-5-1360	10300603	0.000	0.000		0.949384594	1	0.0001	0.000015	
24510	510-1045	Morgan State University	325	510-1045-5-2232	10300603	0.001	0.001	0.001	0.949384594	1	0.0005	0.0005	0.0005
24510	510-1045	Morgan State University	325	510-1045-5-2129	10300603	0.000	0.000	0.000	0.949384594	1	0.0001	0.000005	0.0000877
24510	510-1045	Morgan State University	325	510-1045-5-2234	10300603	0.001	0.001	0.001	0.949384594	1	0.0005	0.0005	0.0005
24510	510-1045	Morgan State University	325	510-1045-5-2126	10300603	0.000	0.000	0.000	0.949384594	1	0.0001	0.00003	0.0000771
24510	510-1045	Morgan State University	325	510-1045-5-2184	10300603	0.001	0.001	0.001	0.949384594	1	0.0005	0.0005	0.0005
24510	510-1045	Morgan State University	325	510-1045-5-2183	10300603	0.001	0.001	0.001	0.949384594	1	0.0005	0.0005	0.0005
24510	510-1045	Morgan State University	325	510-1045-5-2200	10300603	0.001	0.001	0.001	0.949384594	1	0.0005	0.0005	0.0005
24510	510-1045	Morgan State University	325	510-1045-5-2128	10300603	0.000	0.000	0.000	0.949384594	1	0.0001	0.00003	0.00015
24510	510-1045	Morgan State University	325	510-1045-5-2199	10300603	0.001	0.001	0.001	0.949384594	1	0.0005	0.0005	0.0005
24510	510-1045	Morgan State University	325	510-1045-9-1325	20100102	0.000	0.002	0.000	0.949384594	1	0.00017195	0.001602	0.00005465
24510	510-1045	Morgan State University	325	510-1045-9-1266	20100102	0.001	0.002	0.000	0.949384594	1	0.00103125	0.0024375	0.0001322
24510	510-1045	Morgan State University	325	510-1045-9-1107	40600601			0.000	0.949384594	1			0.00013
	510-1045 Total					0.0876132	0.0393445	0.011			0.0876132	0.0393445	0.01122684
24510	510-1158	Johns Hopkins Bayview Medical Center	61	510-1158-5-0794	10300602	0.017	0.020	0.001	1.096256281	1.096256281	0.018724057	0.022292371	0.001227807
24510	510-1158	Johns Hopkins Bayview Medical Center	61	510-1158-5-0793	10300602	0.023	0.027	0.002	1.096256281	1.096256281	0.025181007	0.029977128	0.001649866
24510	510-1158	Johns Hopkins Bayview Medical Center	61	510-1158-5-0792	10300602	0.020	0.024	0.001	1.096256281	1.096256281	0.022391035	0.026655471	0.001463502
24510	510-1158	Johns Hopkins Bayview Medical Center	61	510-1158-5-1141	10300602	0.017	0.020	0.001	1.096256281	1.096256281	0.018455474	0.021974457	0.001205882
24510	510-1158	Johns Hopkins Bayview Medical Center	61	510-1158-5-2065	10300603	0.000	0.000	0.000	1.096256281	1.096256281	4.38503E-06	5.1524E-06	2.85027E-07
24510	510-1158	Johns Hopkins Bayview Medical Center	61	510-1158-5-2066	10300603	0.000	0.000	0.000	1.096256281	1.096256281	4.38503E-06	5.1524E-06	2.85027E-07
24510	510-1158	Johns Hopkins Bayview Medical Center	61	510-1158-9-1209	20300101	0.002	0.009	0.000	1.096256281	1.096256281	0.002685828	0.010116253	0.000284479
24510	510-1158	Johns Hopkins Bayview Medical Center	61	510-1158-9-1294	20300101	0.003	0.011	0.000	1.096256281	1.096256281	0.003288769	0.0123718	0.000348061
24510	510-1158	Johns Hopkins Bayview Medical Center	61	510-1158-9-1295	20300101	0.004	0.017	0.000	1.096256281	1.096256281	0.004823528	0.018166611	0.000510855

State County FIPS	State Facility Identifier	Facility Name	NAICS -2 Digits	Emission Unit ID	Process ID	2017 BY CO	2917 BY NOX	2917 BY VOC	GF-2023	GF-2023ADJ	2023_CO	2023_NOX	2023_VOC
24510	510-1158	Johns Hopkins Bayview Medical Center	61	510-1158-9-1214	20300101	0.003	0.012	0.000	1.096256281	1.096256281	0.003376469	0.012709995	0.00035738
24510	510-1158	Johns Hopkins Bayview Medical Center	61	510-1158-9-1210	20300101	0.002	0.008	0.000	1.096256281	1.096256281	0.002324063	0.008754155	0.00024611
24510	510-1158	Johns Hopkins Bayview Medical Center	61	510-1158-9-1296	20300101	0.004	0.017	0.000	1.096256281	1.096256281	0.004839971	0.018220328	0.0005125
	510-1158 Total					0.097	0.165	0.007			0.106098972	0.181248874	0.007807011
24510	510-1322	Crispy Bagel Company	311	510-1322-5-2083	10300603	0.002	0.002	0.000	1.110038077	1.110038077	0.00232553	0.002763995	0.000149855
24510	510-1322	Crispy Bagel Company	311	510-1322-5-2084	10300603	0.001	0.001	0.000	1.110038077	1.110038077	0.001032335	0.001226592	6.66023E-05
24510	510-1322	Crispy Bagel Company	311	510-1322-8-0354	30203202	0.002	0.002	0.047	1.110038077	1.110038077	0.002114623	0.002514236	0.052504801
	510-1322 Total					0.005	0.006	0.047			0.005472488	0.006504823	0.052721258
24510	510-1400	Automatic Rolls of Baltimore	325	510-1400-8-0291	30203201	0.003	0.004	0.036	0.949384594	1	0.00349	0.004155	0.03576
	510-1400 Total					0.003	0.004	0.036			0.00349	0.004155	0.03576
24510	510-1665	Philadelphia Quartz Corp	562	510-1665-6-1734	30501402	0.010	0.264	0.010	1.036118438	1.036118438	0.009920834	0.273276238	0.009920834
	510-1665 Total					0.010	0.264	0.010			0.009920834	0.273276238	0.009920834
24510	510-1886	Wheelabrator Baltimore, LP	424	510-1886-2-0257	50100101	0.074	1.061	0.005	0.986977289	1	0.074	1.0605	0.00469
24510	510-1886	Wheelabrator Baltimore, LP	424	510-1886-2-0255	50100101	0.085	1.062	0.002	0.986977289	1	0.0845	1.0615	0.00175
24510	510-1886	Wheelabrator Baltimore, LP	424	510-1886-2-0256	50100101	0.061	1.098	0.001	0.986977289	1	0.0605	1.098	0.00146
	510-1886 Total					0.219	3.220	0.008			0.219	3.22	0.0079
24510	510-1923	Petroleum Fuel and Terminal Company - S Clinton St	325	510-1923-4-3061	10300502	0.001	0.001	0.000	0.949384594	1	0.0007735	0.0009205	0.0000505
24510	510-1923	Petroleum Fuel and Terminal Company - S Clinton St	325	510-1923-5-2111	10300602	0.004	0.005	0.000	0.949384594	1	0.0042865	0.005103	0.0002805
24510	510-1923	Petroleum Fuel and Terminal Company - S Clinton St	325	510-1923-5-1435	10300603	0.002	0.002	0.000	0.949384594	1	0.001764	0.0021005	0.0001155
24510	510-1923	Petroleum Fuel and Terminal Company - S Clinton St	325	510-1923-9-0283	10500106	0.002	0.002	0.000	0.949384594	1	0.001764	0.0021005	0.0001155
24510	510-1923	Petroleum Fuel and Terminal Company - S Clinton St	325	510-1923-9-0284	10500106	0.002	0.002	0.000	0.949384594	1	0.001764	0.0021005	0.0001155

State County FIPS	State Facility Identifier	Facility Name	NAICS -2 Digits	Emission Unit ID	Process ID	2017 BY CO	2917 BY NOX	2917 BY VOC	GF-2023	GF-2023ADJ	2023_CO	2023_NOX	2023_VOC
		Clinton St											
24510	510-1923	Petroleum Fuel and Terminal Company - S Clinton St	325	510-1923-9-0261	40400178			0.088	0.949384594	1			0.088249
	510-1923 Total					0.010352	0.012325	0.089			0.010352	0.012325	0.0889265
24510	510-1986	Tnemec Company, Inc.	323	510-1986-7-0910	30101401			0.000	0.884608428	1			0.000255
24510	510-1986	Tnemec Company, Inc.	323	510-1986-7-0909	30101401			0.024	0.884608428	1			0.02383
	510-1986 Total					0	0	0.024			0	0	0.024085
24510	510-2091	NuStar Terminals Operations Partnership L.P.	493	510-2091-5-0967	10300502	0.000	0.000	0.000	1.159789319	1.159789319	9.27831E-05	0.000365334	5.79895E-06
24510	510-2091	NuStar Terminals Operations Partnership L.P.	493	510-2091-6-1738	10300502	0.000	0.001	0.000	1.159789319	1.159789319	0.00022036	0.000887239	1.73968E-05
24510	510-2091	NuStar Terminals Operations Partnership L.P.	493	510-2091-6-1756	10300502	0.000	0.000	0.000	1.159789319	1.159789319	9.85821E-05	0.000388529	5.79895E-06
24510	510-2091	NuStar Terminals Operations Partnership L.P.	493	510-2091-6-1755	10300502	0.000	0.000	0.000	1.159789319	1.159789319	0.000104381	0.000411725	5.79895E-06
24510	510-2091	NuStar Terminals Operations Partnership L.P.	493	510-2091-5-0968	10300503	0.000	0.000	0.000	1.159789319	1.159789319	9.27831E-05	0.000365334	5.79895E-06
24510	510-2091	NuStar Terminals Operations Partnership L.P.	493	510-2091-5-0967	10300602	0.002	0.003	0.000	1.159789319	1.159789319	0.002870479	0.00341558	0.000376932
24510	510-2091	NuStar Terminals Operations Partnership L.P.	493	510-2091-6-1756	10300602	0.005	0.006	0.001	1.159789319	1.159789319	0.006320852	0.007527033	0.00082345
24510	510-2091	NuStar Terminals Operations Partnership L.P.	493	510-2091-5-0968	10300603	0.002	0.003	0.000	1.159789319	1.159789319	0.002870479	0.00341558	0.000376932
24510	510-2091	NuStar Terminals Operations Partnership L.P.	493	510-2091-6-1738	10500105	0.007	0.008	0.001	1.159789319	1.159789319	0.0082577	0.009817617	0.001078604
24510	510-2091	NuStar Terminals Operations Partnership L.P.	493	510-2091-9-0344	40301097			0.030	1.159789319	1.159789319			0.03479368
24510	510-2091	NuStar Terminals Operations Partnership L.P.	493	510-2091-6-2619	40799999			0.000	1.159789319	1.159789319			0.000284148

State County FIPS	State Facility Identifier	Facility Name	NAICS -2 Digits	Emission Unit ID	Process ID	2017 BY CO	2917 BY NOX	2917 BY VOC	GF-2023	GF-2023ADJ	2023_CO	2023_NOX	2023_VOC
	510-2091 Total					0.018045	0.02293	0.033			0.020928398	0.026593969	0.037774338
24510	510-2244	MPI Labels of Baltimore, Inc	562	510-2244-6-2029	40500301			0.018	1.036118438	1.036118438			0.018660493
24510	510-2244	MPI Labels of Baltimore, Inc	562	510-2244-6-2048	40500301			0.002	1.036118438	1.036118438			0.002051515
24510	510-2244	MPI Labels of Baltimore, Inc	562	510-2244-6-2034	40500301			0.008	1.036118438	1.036118438			0.008620505
24510	510-2244	MPI Labels of Baltimore, Inc	562	510-2244-6-2033	40500301			0.027	1.036118438	1.036118438			0.028436271
24510	510-2244	MPI Labels of Baltimore, Inc	562	510-2244-6-2049	40500301			0.004	1.036118438	1.036118438			0.004476032
	510-2244 Total					0	0	0.060			0	0	0.062244815
24510	510-2260	Clean Harbors of Baltimore	562	510-2260-5-2197	10300603	0.001	0.001	0.000	1.036118438	1.036118438	0.000989493	0.001175994	6.47574E-05
24510	510-2260	Clean Harbors of Baltimore	562	510-2260-9-0670	50300501			0.001	1.036118438	1.036118438			0.000537745
24510	510-2260	Clean Harbors of Baltimore	562	510-2260-9-0684	50300501			0.000	1.036118438	1.036118438			0.000216549
24510	510-2260	Clean Harbors of Baltimore	562	510-2260-9-0740	50300501			0.014	1.036118438	1.036118438			0.014764688
	510-2260 Total					0.000955	0.001135	0.015			0.000989493	0.001175994	0.015583739
24510	510-2293	Quarantine Road Municipal Landfill	562	510-2293-9-1150	50100403			0.004	1.036118438	1.036118438			0.00410821
24510	510-2293	Quarantine Road Municipal Landfill	562	510-2293-9-1164	50100410	0.023	0.004	0.000	1.036118438	1.036118438	0.023898072	0.004393142	4.14447E-05
	510-2293 Total					0.023	0.004	0.004			0.023898072	0.004393142	0.004149654
24510	510-2781	Baltimore City Composting/Veolia Water North America-Central, LLC	22	510-2781-9-0539	39999999			0.016	0.981232222	1			0.015715
	510-2781 Total					0	0	0.016			0	0	0.015715
24510	510-2796	Veolia Energy Baltimore Heating, LLP-Spring Gardens Plant	324	510-2796-5-1483	10300501	0.000	0.001	0.000	0.949591764	1	0.00016	0.0007	0.00005
24510	510-2796	Veolia Energy Baltimore Heating, LLP-Spring Gardens Plant	324	510-2796-5-1485	10300501	0.025	0.095	0.001	0.949591764	1	0.025	0.095	0.001
24510	510-2796	Veolia Energy Baltimore Heating, LLP-Spring Gardens Plant	324	510-2796-5-1488	10300502	0.001	0.002	0.000	0.949591764	1	0.0006	0.002	0.00005

State County FIPS	State Facility Identifier	Facility Name	NAICS -2 Digits	Emission Unit ID	Process ID	2017 BY CO	2917 BY NOX	2917 BY VOC	GF-2023	GF-2023ADJ	2023_CO	2023_NOX	2023_VOC
24510	510-2796	Veolia Energy Baltimore Heating, LLP-Spring Gardens Plant	324	510-2796-5-1486	10300601	0.052	0.172	0.003	0.949591764	1	0.0515	0.1715	0.00337
24510	510-2796	Veolia Energy Baltimore Heating, LLP-Spring Gardens Plant	324	510-2796-5-1487	10300601	0.070	0.234	0.005	0.949591764	1	0.07	0.2335	0.0046
24510	510-2796	Veolia Energy Baltimore Heating, LLP-Spring Gardens Plant	324	510-2796-5-1483	10300601	0.071	0.236	0.005	0.949591764	1	0.0705	0.2355	0.00465
24510	510-2796	Veolia Energy Baltimore Heating, LLP-Spring Gardens Plant	324	510-2796-5-1488	10300602	0.053	0.063	0.003	0.949591764	1	0.053	0.063	0.00345
	510-2796 Total					0.271	0.801	0.017			0.27076	0.8012	0.01717
24510	510-2857	U.S. Concrete Products	311	510-2857-6-1783	30500201	0.030	0.002	0.001	1.110038077	1.110038077	0.033689656	0.002608589	0.000688224
	510-2857 Total					0.030	0.002	0.001			0.033689656	0.002608589	0.000688224
24510	510-2871	Reconserve of MD dba Dext Company	562	510-2871-8-0259	30200504	0.011	0.013	0.053	1.036118438	1.036118438	0.011587949	0.013794881	0.054867652
	510-2871 Total					0.011	0.013	0.053			0.011587949	0.013794881	0.054867652
24510	510-2975	Curtis Bay Energy, LP	61	510-2975-2-0279	50200504	0.004	0.112	0.000	1.096256281	1.096256281	0.004209624	0.122232575	0.000115107
	510-2975 Total					0.004	0.112	0.000			0.004209624	0.122232575	0.000115107
24510	510-3032	University of Maryland at Baltimore	511	510-3032-9-1140	20100102	0.005	0.024	0.002	0.984729124	1	0.0052	0.02415	0.001925
24510	510-3032	University of Maryland at Baltimore	511	510-3032-9-1137	20100102	0.004	0.017	0.001	0.984729124	1	0.0037175	0.01725	0.001375
24510	510-3032	University of Maryland at Baltimore	511	510-3032-9-1141	20100102	0.004	0.018	0.001	0.984729124	1	0.003885	0.01805	0.00145
24510	510-3032	University of Maryland at Baltimore	511	510-3032-9-1138	20100102	0.030	0.139	0.011	0.984729124	1	0.03	0.139	0.0111
24510	510-3032	University of Maryland at Baltimore	511	510-3032-9-1139	20100102	0.013	0.062	0.005	0.984729124	1	0.01338	0.062	0.00495
24510	510-3032	University of Maryland at Baltimore	511	510-3032-2-0283	50200504			0.004	0.984729124	1		0.004	0.0000355
	510-3032 Total					0.0561825	0.264	0.021			0.0561825	0.26445	0.0208355
24510	510-3065	The Baltimore Sun	22	510-3065-5-1248	10200603	0.001	0.002	0.000	0.981232222	1	0.0013385	0.0015935	0.0000875
24510	510-3065	The Baltimore Sun	22	510-3065-5-1247	10200603	0.001	0.002	0.000	0.981232222	1	0.0013385	0.0015935	0.0000875
24510	510-3065	The Baltimore Sun	22	510-3065-9-0961	20100102	0.005	0.020		0.981232222	1	0.0045	0.0195	

State County FIPS	State Facility Identifier	Facility Name	NAICS -2 Digits	Emission Unit ID	Process ID	2017 BY CO	2917 BY NOX	2917 BY VOC	GF-2023	GF-2023ADJ	2023_CO	2023_NOX	2023_VOC
24510	510-3065	The Baltimore Sun	22	510-3065-9-0962	20100102	0.004	0.016		0.981232222	1	0.0035	0.0155	
24510	510-3065	The Baltimore Sun	22	510-3065-6-1365	40500401			0.008	0.981232222	1			0.0078
	510-3065 Total					0.010677	0.038187	0.008			0.010677	0.038187	0.007975
24510	510-3078	Veolia Energy Baltimore Heating, LLP-Saratoga Plant	562	510-3078-5-1264	10300502	0.020	0.070	0.001	1.036118438	1.036118438	0.020722369	0.072528291	0.000725283
24510	510-3078	Veolia Energy Baltimore Heating, LLP-Saratoga Plant	562	510-3078-5-1260	10300502	0.005	0.020	0.000	1.036118438	1.036118438	0.005180592	0.020722369	0.000207224
24510	510-3078	Veolia Energy Baltimore Heating, LLP-Saratoga Plant	562	510-3078-5-1263	10300502	0.020	0.070	0.001	1.036118438	1.036118438	0.020722369	0.072528291	0.000725283
24510	510-3078	Veolia Energy Baltimore Heating, LLP-Saratoga Plant	562	510-3078-5-1261	10300602	0.021	0.041	0.001	1.036118438	1.036118438	0.021240428	0.042092312	0.00139876
24510	510-3078	Veolia Energy Baltimore Heating, LLP-Saratoga Plant	562	510-3078-5-1264	10300602	0.021	0.041	0.001	1.036118438	1.036118438	0.021240428	0.042480856	0.001346954
24510	510-3078	Veolia Energy Baltimore Heating, LLP-Saratoga Plant	562	510-3078-5-1263	10300602	0.021	0.041	0.001	1.036118438	1.036118438	0.021240428	0.041962797	0.001378038
24510	510-3078	Veolia Energy Baltimore Heating, LLP-Saratoga Plant	562	510-3078-5-1260	10300602	0.019	0.036	0.001	1.036118438	1.036118438	0.019168191	0.037559293	0.001243342
	510-3078 Total					0.125	0.318	0.007			0.129514805	0.329874208	0.007024883
24510	510-3157	Synagro-Patapsco Pelletizer	323	510-3157-6-1386	50400201	0.017	0.010	0.001	0.884608428	1	0.01705	0.010145	0.001115
	510-3157 Total					0.017	0.010	0.001			0.01705	0.010145	0.001115
24510	510-3237	Trigen Energy - Inner Harbor East	22	510-3237-5-1424	10300602	0.011	0.003	0.001	0.981232222	1	0.0105	0.0031	0.0007
24510	510-3237	Trigen Energy - Inner Harbor East	22	510-3237-5-1425	10300602	0.014	0.004	0.001	0.981232222	1	0.0142	0.00425	0.000965
24510	510-3237	Trigen Energy - Inner Harbor East	22	510-3237-5-1426	10300602	0.006	0.002	0.000	0.981232222	1	0.00625	0.0021	0.000445
24510	510-3237	Trigen Energy - Inner Harbor East	22	510-3237-9-0909	20100102	0.008	0.060	0.002	0.981232222	1	0.008	0.06	0.002
24510	510-3237	Trigen Energy - Inner Harbor East	22	510-3237-9-0908	20100102	0.000	0.010	0.000	0.981232222	1	0.0004	0.01	0.0004
	510-3237 Total					0.039	0.079	0.005			0.03935	0.07945	0.00451

State County FIPS	State Facility Identifier	Facility Name	NAICS -2 Digits	Emission Unit ID	Process ID	2017 BY CO	2917 BY NOX	2917 BY VOC	GF-2023	GF-2023ADJ	2023_CO	2023_NOX	2023_VOC
24510	510-3253	P & J Contracting Company, Inc.	238	510-3253-6- 1952	30599999	0.007	0.033	0.003	1.033239492	1.033239492	0.007248175	0.033631945	0.002634761
	510-3253 Total					0.007	0.033	0.003			0.007248175	0.033631945	0.002634761
24510	510-3258	CCL Label, Inc.	54	510-3258-6- 1948	40500401			0.009	1.074430413	1.074430413			0.00926159
24510	510-3258	CCL Label, Inc.	54	510-3258-6- 1732	40500431			0.016	1.074430413	1.074430413			0.017088816
24510	510-3258	CCL Label, Inc.	54	510-3258-6- 1964	40500431			0.014	1.074430413	1.074430413			0.014859373
	510-3258 Total					0	0	0.038			0	0	0.041209778
24510	510-3406	NIH Bayview Acquisition, LLC	531	510-3406-5- 2081	10200602	0.010	0.012	0.001	1.082700759	1.082700759	0.011346704	0.013506692	0.00074165
24510	510-3406	NIH Bayview Acquisition, LLC	531	510-3406-5- 2080	10200602	0.003	0.003	0.000	1.082700759	1.082700759	0.002804195	0.003334718	0.000184059
24510	510-3406	NIH Bayview Acquisition, LLC	531	510-3406-5- 1827	10300602	0.011	0.013	0.001	1.082700759	1.082700759	0.012207451	0.014535258	0.000801199
24510	510-3406	NIH Bayview Acquisition, LLC	531	510-3406-5- 1829	10300602	0.010	0.011	0.001	1.082700759	1.082700759	0.010420995	0.012402337	0.000682101
24510	510-3406	NIH Bayview Acquisition, LLC	531	510-3406-5- 1828	10300602	0.009	0.010	0.001	1.082700759	1.082700759	0.00951694	0.011330463	0.000622553
24510	510-3406	NIH Bayview Acquisition, LLC	531	510-3406-9- 1040	20200102	0.015	0.064	0.002	1.082700759	1.082700759	0.015926528	0.069487735	0.001856832
24510	510-3406	NIH Bayview Acquisition, LLC	531	510-3406-9- 1042	20200102	0.014	0.062	0.002	1.082700759	1.082700759	0.015347283	0.066970455	0.00179187
24510	510-3406	NIH Bayview Acquisition, LLC	531	510-3406-9- 1041	20200102	0.005	0.021	0.001	1.082700759	1.082700759	0.005332301	0.023267239	0.000622553
	510-3406 Total					0.077	0.198	0.007			0.082902397	0.214834898	0.007302817
24510	510-3465	Origin Baltimore Recycling, LLC	562	510-3465-9- 1120	30630007	0.001	0.001	0.000	1.036118438	1.036118438	0.000518059	0.000932507	7.25283E-05
	510-3465 Total					0.001	0.001	0.000			0.000518059	0.000932507	7.25283E-05
24510	510-3488	University of Maryland Medical Center	622	510-3488-9- 1147	20300101	0.014	0.060	0.002	1.128247103	1.128247103	0.015383649	0.067130703	0.001805195
24510	510-3488	University of Maryland Medical Center	622	510-3488-9- 1144	20300101	0.001	0.053	0.001	1.128247103	1.128247103	0.001128247	0.059458622	0.001128247
24510	510-3488	University of Maryland Medical Center	622	510-3488-9- 1149	20300101	0.014	0.060	0.002	1.128247103	1.128247103	0.015383649	0.067130703	0.001805195
24510	510-3488	University of Maryland Medical Center	622	510-3488-9- 1148	20300101	0.014	0.060	0.002	1.128247103	1.128247103	0.015383649	0.067130703	0.001805195
24510	510-3488	University of Maryland Medical Center	622	510-3488-9- 1145	20300101	0.001	0.053	0.001	1.128247103	1.128247103	0.0010944	0.059458622	0.0010944
24510	510-3488	University of Maryland Medical Center	622	510-3488-9- 1146	20300101	0.001	0.053	0.001	1.128247103	1.128247103	0.0010944	0.059458622	0.0010944

State County FIPS	State Facility Identifier	Facility Name	NAICS -2 Digits	Emission Unit ID	Process ID	2017 BY CO	2917 BY NOX	2917 BY VOC	GF-2023	GF-2023ADJ	2023_CO	2023_NOX	2023_VOC
24510	510-3488	University of Maryland Medical Center	622	510-3488-8- 0351	30201311			0.000	1.128247103	1.128247103			1.12825E-05
24510	510-3488	University of Maryland Medical Center	622	510-3488-8- 0352	30201311			0.000	1.128247103	1.128247103			1.12825E-05
	510-3488 Total					0.043845	0.3366	0.008			0.049467994	0.379767975	0.008755198
24510	510-3600	Key Recycling, LLC	562	510-3600-6- 1995	30502001	0.004	0.004		1.036118438	1.036118438	0.003900986	0.00411339	
	510-3600 Total					0.004	0.004	0			0.003900986	0.00411339	0
24510	510-3601	Cintas Corporation – Baltimore	561	510-3601-5- 2228	10200603		0.000		1.091921745	1.091921745		0.000251142	
24510	510-3601	Cintas Corporation – Baltimore	561	510-3601-5- 2096	10300603	0.001	0.001		1.091921745	1.091921745	0.001190195	0.001419498	
24510	510-3601	Cintas Corporation – Baltimore	561	510-3601-6- 2052	33000106	0.001	0.002	0.004	1.091921745	1.091921745	0.001588746	0.001889025	0.004012812
24510	510-3601	Cintas Corporation – Baltimore	561	510-3601-9- 1351	33000199			0.000	1.091921745	1.091921745			0.000360334
24510	510-3601	Cintas Corporation – Baltimore	561	510-3601-9- 1358	50382599			0.001	1.091921745	1.091921745			0.001517771
	510-3601 Total					0.002545	0.00326	0.005			0.002778941	0.003559665	0.005890918
24510	510-3645	Targa Baltimore Terminal	424	510-3645-5- 2157	10200602		0.002	0.000	0.986977289	1		0.00165	0.00009
24510	510-3645	Targa Baltimore Terminal	424	510-3645-5- 2158	10200602		0.001	0.000	0.986977289	1		0.001195	0.000065
24510	510-3645	Targa Baltimore Terminal	424	510-3645-5- 2159	10200603		0.004	0.000	0.986977289	1		0.004055	0.000225
24510	510-3645	Targa Baltimore Terminal	424	510-3645-9- 1292	40600251			0.037	0.986977289	1			0.03673
	510-3645 Total					0	0.0069	0.037			0	0.0069	0.03711
	Grand Total					18.902	47.531	5.729			19.178	48.033	5.982
ERC	025-0212	Harford County RRF ERC					0	0.0000	0			0	0.4575
	Total						0	0	0			0	0.4575
	ERC TOTAL	ALL ERCs					0	0	0			0	0.4575



Maryland
Department of
the Environment

Wes Moore, Governor
Aruna Miller, Lt. Governor

Serena McIlwain, Secretary
Suzanne E. Dorsey, Deputy Secretary

APPENDIX A-3

Baltimore Moderate Nonattainment Area Quasi-Point Source Emission Inventory

**Prepared for:
U.S. Environmental Protection Agency**

**Prepared by:
Maryland Department of the Environment**



**Baltimore, MD Ozone Moderate Nonattainment Area
Quasi-Point Source Emission Inventory**

© Maryland Department of the Environment
Air and Radiation Administration
1800 Washington Boulevard, Suite 730
Baltimore, Maryland 21230
Phone 410.537.3240 • Fax 410.631.3202

State County FIPs	State Facility Identifier	Facility Name	2017			2017-2023 GF	2023		
			CO	NOX	VOC		CO	NOX	VOC
24003	003-0208	BWI	0.00258	0.00071	0.00005	1.03342	0.00267	0.00073	0.00005
24003	003-0208	BWI	0.95824	0.11037	0.03408	1.03342	0.99026	0.11405	0.03522
24003	003-0208	BWI	0.01381	0.01459	0.00305	1.03342	0.01428	0.01508	0.00315
24003	003-0208	BWI	2.72003	2.87258	0.60020	1.03342	2.81093	2.96858	0.62026
24003	003-0208	BWI	0.16659	0.17593	0.03676	1.03342	0.17216	0.18181	0.03799
24003	003-0208	BWI	0.38615	0.40781	0.08521	1.03342	0.39905	0.42143	0.08805
24003	003-0208	BWI	0.09523	0.10431	0.00662	1.03342	0.09841	0.10780	0.00684
24003	003-0208	BWI	0.00459	0.00016	0.00907	1.03342	0.00475	0.00016	0.00937
24003	003-0208	BWI	0.00135	0.00535	0.00010	1.03342	0.00140	0.00553	0.00010
24003	003-0208	BWI	0.00700	0.02805	0.00050	1.03342	0.00723	0.02899	0.00052
24003	003-0208	BWI	0.05315	0.03165	0.00350	1.03342	0.05493	0.03271	0.00362
24003	003-0208	BWI	0.00700	0.02805	0.00050	1.03342	0.00723	0.02899	0.00052
24003	003-0208	BWI	0.05315	0.03165	0.00350	1.03342	0.05493	0.03271	0.00362
24003	003-0208	BWI	0.00320	0.01275	0.00020	1.03342	0.00331	0.01318	0.00021
24003	003-0208	BWI	0.02415	0.01440	0.00160	1.03342	0.02496	0.01488	0.00165
24003	003-0208	BWI	0.00001	0.00005		1.03342	0.00001	0.00005	0.00000
24003	003-0208	BWI	0.00001	0.00005		1.03342	0.00001	0.00005	0.00000
24003	003-0208	BWI	0.00295	0.00175	0.00020	1.03342	0.00305	0.00181	0.00021
24003	003-0208	BWI	0.00295	0.00175	0.00020	1.03342	0.00305	0.00181	0.00021
24003	003-0208	BWI	0.00295	0.00175	0.00020	1.03342	0.00305	0.00181	0.00021
24003	003-0208	BWI	0.00295	0.00175	0.00020	1.03342	0.00305	0.00181	0.00021
24003	003-0208	BWI	0.00100	0.00060	0.00005	1.03342	0.00103	0.00062	0.00005
24003	003-0208	BWI	0.00190	0.00115	0.00015	1.03342	0.00196	0.00119	0.00016
24003	003-0208	BWI	0.00060	0.00060	0.00005	1.03342	0.00062	0.00062	0.00005
24003	003-0208	BWI			0.00275	1.03342	0.00000	0.00000	0.00284
24003	003-0208	BWI	0.00250	0.00950	0.00015	1.03342	0.00258	0.00982	0.00016
24003	003-0208	BWI	0.00185	0.00695	0.00020	1.03342	0.00191	0.00718	0.00021

State County FIPs	State Facility Identifier	Facility Name	2017			2017-2023	2023		
			CO	NOX	VOC	GF	CO	NOX	VOC
24003	003-0208	BWI	0.00135	0.00510	0.00010	1.03342	0.00140	0.00527	0.00010
24003	003-0208	BWI	0.00455	0.01715	0.00045	1.03342	0.00470	0.01772	0.00047
24003	003-0208	BWI	0.00115	0.00530	0.00040	1.03342	0.00119	0.00548	0.00041
24003	003-0208	BWI	0.00210	0.00790	0.00020	1.03342	0.00217	0.00816	0.00021
24003	003-0208	BWI	0.00090	0.00340	0.00010	1.03342	0.00093	0.00351	0.00010
24003	003-0208	BWI	0.00155	0.00585	0.00015	1.03342	0.00160	0.00605	0.00016
24003	003-0208	BWI	0.00260	0.00970	0.00025	1.03342	0.00269	0.01002	0.00026
24003	003-0208	BWI	0.00570	0.02140	0.00055	1.03342	0.00589	0.02212	0.00057
24003	003-0208	BWI	0.00995	0.03745	0.00095	1.03342	0.01028	0.03870	0.00098
24003	003-0208	BWI	0.00375	0.01420	0.00035	1.03342	0.00388	0.01467	0.00036
24003	003-0208	BWI	0.00445	0.01685	0.00045	1.03342	0.00460	0.01741	0.00047
24003 Total		BWI	4.55394	4.00855	0.79304	1.03342	4.70612	4.14250	0.81954
24025	025-0081	APG	0.00522	0.00033	0.00001	1.19405	0.00624	0.00039	0.00001
24025	025-0081	APG			0.00001	1.19405	0.00000	0.00000	0.00002
24025	025-0081	APG	0.10443	0.00949	0.01032	1.19405	0.12470	0.01133	0.01232
24025	025-0081	APG	0.10048	0.01067	0.00866	1.19405	0.11998	0.01274	0.01035
24025	025-0081	APG	0.02236	0.00175	0.00110	1.19405	0.02670	0.00210	0.00131
24025	025-0081	APG	0.00309	0.00032	0.00021	1.19405	0.00369	0.00039	0.00025
24025	025-0081	APG	0.00021	0.00064	0.00006	1.19405	0.00025	0.00076	0.00007
24025	025-0081	APG	0.00178	0.00281	0.00036	1.19405	0.00213	0.00335	0.00043
24025	025-0081	APG	0.00023	0.00093	0.00006	1.19405	0.00027	0.00112	0.00007
24025	025-0081	APG	0.00126	0.00295	0.00025	1.19405	0.00150	0.00352	0.00029
24025	025-0081	APG	0.00038	0.00116	0.00010	1.19405	0.00046	0.00138	0.00012
24025	025-0081	APG	0.00033	0.00099	0.00009	1.19405	0.00039	0.00119	0.00011
24025	025-0081	APG	0.00001	0.00005	0.00000	1.19405	0.00001	0.00007	0.00000
24025	025-0081	APG	0.00374	0.00039	0.00026	1.19405	0.00447	0.00047	0.00031
24025	025-0081	APG	0.00044	0.00090	0.00009	1.19405	0.00052	0.00107	0.00011
24025	025-0081	APG	0.00000	0.00000		1.19405	0.00000	0.00000	0.00000

State County FIPs	State Facility Identifier	Facility Name	2017			2017-2023	2023		
			CO	NOX	VOC	GF	CO	NOX	VOC
24025	025-0081	APG	0.00015	0.00031	0.00003	1.19405	0.00018	0.00036	0.00004
24025	025-0081	APG	0.00001	0.00001	0.00000	1.19405	0.00001	0.00001	0.00000
24025	025-0081	APG	0.40455	0.13564	0.10981	1.19405	0.48305	0.16197	0.13112
24025	025-0081	APG	0.00288	0.01521	0.00085	1.19405	0.00343	0.01816	0.00101
24025	025-0081	APG	0.12674	0.00360	0.02884	1.19405	0.15134	0.00430	0.03444
24025	025-0081	APG			0.00732	1.19405	0.00000	0.00000	0.00874
24025	025-0081	APG			0.00559	1.19405	0.00000	0.00000	0.00667
24025	025-0081	APG			0.00055	1.19405	0.00000	0.00000	0.00065
24025	025-0081	APG			0.00653	1.19405	0.00000	0.00000	0.00780
24025	025-0081	APG			0.00222	1.19405	0.00000	0.00000	0.00265
24025	025-0081	APG			0.00383	1.19405	0.00000	0.00000	0.00457
24025	025-0081	APG			0.00204	1.19405	0.00000	0.00000	0.00244
24025	025-0081	APG			0.00020	1.19405	0.00000	0.00000	0.00024
24025	025-0081	APG	0.02345	0.00704	0.00186	1.19405	0.02800	0.00841	0.00222
24025	025-0081	APG			0.00049	1.19405	0.00000	0.00000	0.00059
24025	025-0081	APG	0.00005	0.00005	0.00000	1.19405	0.00007	0.00006	0.00000
24025	025-0081	APG			0.00745	1.19405	0.00000	0.00000	0.00890
24025	025-0081	APG	0.00044	0.00025	0.00002	1.19405	0.00052	0.00030	0.00002
24025	025-0081	APG	0.00584	0.02050	0.00040	1.19405	0.00697	0.02447	0.00047
24025	025-0081	APG	0.00013	0.00058	0.00001	1.19405	0.00015	0.00069	0.00001
24025	025-0081	APG	0.00007	0.00024	0.00001	1.19405	0.00008	0.00028	0.00001
24025	025-0081	APG			0.00001	1.19405	0.00000	0.00000	0.00001
24025	025-0081	APG		0.00017		1.19405	0.00000	0.00020	0.00000
24025	025-0081	APG	0.00547	0.00570	0.00036	1.19405	0.00653	0.00680	0.00043
24025	025-0081	APG	0.00547	0.00570	0.00036	1.19405	0.00653	0.00680	0.00043
24025	025-0081	APG	0.00547	0.00570	0.00036	1.19405	0.00653	0.00680	0.00043
24025	025-0081	APG	0.00270	0.00256	0.00018	1.19405	0.00322	0.00306	0.00021
24025	025-0081	APG	0.00270	0.00256	0.00018	1.19405	0.00322	0.00306	0.00021

State County FIPs	State Facility Identifier	Facility Name	2017			2017-2023		2023		
			CO	NOX	VOC	GF	CO	NOX	VOC	
24025	025-0081	APG	0.00068		0.00005	1.19405	0.00081	0.00000	0.00005	
24025	025-0081	APG	0.01514	0.01341	0.00099	1.19405	0.01807	0.01601	0.00118	
24025	025-0081	APG			0.00033	1.19405	0.00000	0.00000	0.00039	
24025	025-0081	APG	0.00087	0.00065	0.00016	1.19405	0.00104	0.00077	0.00019	
24025	025-0081	APG	0.00553	0.00204	0.00036	1.19405	0.00660	0.00244	0.00043	
24025	025-0081	APG	0.00198	0.00085	0.00013	1.19405	0.00236	0.00101	0.00016	
24025	025-0081	APG	0.00566	0.00220	0.00037	1.19405	0.00675	0.00262	0.00044	
24025	025-0081	APG	0.00234	0.00105	0.00016	1.19405	0.00279	0.00125	0.00019	
24025	025-0081	APG	0.00027	0.00213	0.00002	1.19405	0.00032	0.00254	0.00002	
24025	025-0081	APG	0.00077	0.00138	0.00005	1.19405	0.00091	0.00164	0.00006	
24025	025-0081	APG	0.00077	0.00138	0.00005	1.19405	0.00091	0.00164	0.00006	
24025	025-0081	APG	0.00081	0.00096	0.00006	1.19405	0.00097	0.00115	0.00007	
24025	025-0081	APG	0.00096	0.00062		1.19405	0.00114	0.00074	0.00000	
24025	025-0081	APG	0.00081	0.00096	0.00006	1.19405	0.00097	0.00115	0.00007	
24025	025-0081	APG	0.00081	0.00060	0.00006	1.19405	0.00097	0.00072	0.00007	
24025	025-0081	APG	0.00060	0.00114	0.00004	1.19405	0.00072	0.00136	0.00005	
24025	025-0081	APG	0.00001			1.19405	0.00001	0.00000	0.00000	
24025	025-0081	APG			0.00027	1.19405	0.00000	0.00000	0.00032	
24025	025-0081	APG			0.00073	1.19405	0.00000	0.00000	0.00087	
24025	025-0081	APG			0.00115	1.19405	0.00000	0.00000	0.00137	
24025	025-0081	APG	0.00149	0.00559	0.00050	1.19405	0.00177	0.00667	0.00059	
24025	025-0081	APG	0.00513	0.00773	0.00050	1.19405	0.00613	0.00922	0.00059	
24025	025-0081	APG	0.00287	0.00824	0.00028	1.19405	0.00343	0.00983	0.00033	
24025	025-0081	APG	0.00244	0.00415	0.00024	1.19405	0.00291	0.00495	0.00028	
24025	025-0081	APG	0.00149	0.00559	0.00015	1.19405	0.00177	0.00667	0.00017	
24025	025-0081	APG	0.00325	0.01224	0.00019	1.19405	0.00388	0.01462	0.00022	
24025	025-0081	APG	0.00211	0.00792	0.00021	1.19405	0.00251	0.00946	0.00024	
24025	025-0081	APG	0.00192	0.00720	0.00019	1.19405	0.00229	0.00860	0.00022	

State County FIPs	State Facility Identifier	Facility Name	2017			2017-2023	2023		
			CO	NOX	VOC	GF	CO	NOX	VOC
24025	025-0081	APG	0.00230	0.00864	0.00022	1.19405	0.00274	0.01032	0.00026
24025	025-0081	APG	0.00287	0.01080	0.00028	1.19405	0.00343	0.01290	0.00033
24025	025-0081	APG	0.00636	0.02394	0.00062	1.19405	0.00759	0.02858	0.00073
24025	025-0081	APG	0.00219	0.00824	0.00021	1.19405	0.00261	0.00983	0.00025
24025	025-0081	APG	0.01700	0.06400	0.00164	1.19405	0.02030	0.07641	0.00196
24025	025-0081	APG	0.03040	0.11445	0.00293	1.19405	0.03630	0.13666	0.00350
24025	025-0081	APG	0.00447	0.01683	0.00043	1.19405	0.00534	0.02010	0.00051
24025	025-0081	APG	0.03585	0.12319	0.00346	1.19405	0.04281	0.14709	0.00413
24025	025-0081	APG	0.00517	0.04780	0.00050	1.19405	0.00617	0.05708	0.00060
24025	025-0081	APG	0.00127	0.00476		1.19405	0.00151	0.00568	0.00000
24025	025-0081	APG	0.00192	0.00721	0.00019	1.19405	0.00229	0.00861	0.00022
24025	025-0081	APG	0.00636	0.02395	0.00062	1.19405	0.00759	0.02859	0.00073
24025	025-0081	APG	0.00462	0.01739		1.19405	0.00552	0.02076	0.00000
24025	025-0081	APG		0.01403	0.00427	1.19405	0.00000	0.01675	0.00509
24025	025-0081	APG	0.04530	0.17055		1.19405	0.05409	0.20364	0.00000
24025	025-0081	APG	0.00227	0.00856	0.00022	1.19405	0.00271	0.01022	0.00026
24025	025-0081	APG	0.00376	0.01414	0.00036	1.19405	0.00448	0.01688	0.00043
24025	025-0081	APG	0.00225	0.00846	0.00022	1.19405	0.00268	0.01010	0.00026
24025	025-0082	APG	0.00178	0.00281	0.00036	1.19405	0.00213	0.00335	0.00043
24025	025-0082	APG	0.00126	0.00295	0.00025	1.19405	0.00150	0.00352	0.00029
24025	025-0082	APG	0.07745	0.01121	0.17260	1.19405	0.09248	0.01338	0.20610
24025	025-0082	APG	0.05627	0.00160	0.01280	1.19405	0.06719	0.00191	0.01529
24025	025-0082	APG			0.00030	1.19405	0.00000	0.00000	0.00035
24025	025-0082	APG			0.00055	1.19405	0.00000	0.00000	0.00065
24025	025-0082	APG			0.00038	1.19405	0.00000	0.00000	0.00045
24025	025-0082	APG			0.00013	1.19405	0.00000	0.00000	0.00015
24025	025-0082	APG			0.00022	1.19405	0.00000	0.00000	0.00026
24025	025-0082	APG			0.00009	1.19405	0.00000	0.00000	0.00011

State County FIPs	State Facility Identifier	Facility Name	2017			2017-2023	2023		
			CO	NOX	VOC	GF	CO	NOX	VOC
24025	025-0082	APG			0.00001	1.19405	0.00000	0.00000	0.00001
24025	025-0082	APG	0.00025	0.00007	0.00003	1.19405	0.00029	0.00009	0.00003
24025	025-0082	APG	0.00004	0.00017		1.19405	0.00005	0.00020	0.00000
24025	025-0082	APG	0.00025	0.00066	0.00001	1.19405	0.00029	0.00078	0.00001
24025	025-0082	APG	0.00004			1.19405	0.00005	0.00000	0.00000
24025	025-0082	APG	0.00004			1.19405	0.00005	0.00000	0.00000
24025	025-0082	APG	0.06950	0.03039	0.00118	1.19405	0.08299	0.03629	0.00141
24025	025-0082	APG	0.01161	0.03235		1.19405	0.01386	0.03863	0.00000
24025	025-0082	APG	0.00580	0.02310		1.19405	0.00693	0.02758	0.00000
24025	025-0082	APG	0.06600	0.02775	0.00115	1.19405	0.07881	0.03313	0.00137
24025	025-0082	APG	0.00010	0.00025		1.19405	0.00012	0.00030	0.00000
24025	025-0082	APG	0.00006			1.19405	0.00007	0.00000	0.00000
24025	025-0082	APG	0.00005			1.19405	0.00006	0.00000	0.00000
24025	025-0082	APG	0.00006			1.19405	0.00007	0.00000	0.00000
24025	025-0082	APG	0.00007	0.00026	0.00026	1.19405	0.00008	0.00030	0.00031
24025	025-0082	APG	0.00022	0.00075	0.00002	1.19405	0.00026	0.00090	0.00002
24025	025-0082	APG	0.00013	0.00036	0.00001	1.19405	0.00015	0.00043	0.00001
24025	025-0082	APG	0.00013	0.00036		1.19405	0.00015	0.00043	0.00000
24025	025-0082	APG	0.00030	0.00040		1.19405	0.00036	0.00048	0.00000
24025	025-0082	APG	0.00014	0.00033		1.19405	0.00016	0.00039	0.00000
24025	025-0082	APG	0.00016	0.00056	0.00045	1.19405	0.00019	0.00067	0.00053
24025	025-0082	APG	0.00025	0.00090		1.19405	0.00030	0.00107	0.00000
24025	025-0082	APG	0.00024	0.00092	0.00002	1.19405	0.00028	0.00109	0.00002
24025	025-0082	APG	0.00015	0.00055		1.19405	0.00018	0.00066	0.00000
24025	025-0082	APG	0.00030	0.00140		1.19405	0.00036	0.00167	0.00000
24025	025-0082	APG	0.00044	0.00106		1.19405	0.00052	0.00126	0.00000
24025	025-0082	APG	0.00045	0.00175	0.00005	1.19405	0.00054	0.00209	0.00006
24025	025-0082	APG	0.00032	0.00120		1.19405	0.00038	0.00143	0.00000

State County FIPs	State Facility Identifier	Facility Name	2017			2017-2023		2023		
			CO	NOX	VOC	GF	CO	NOX	VOC	
24025	025-0082	APG		0.00040		1.19405	0.00000	0.00048	0.00000	
24025	025-0082	APG		0.00039		1.19405	0.00000	0.00047	0.00000	
24025	025-0082	APG	0.00030			1.19405	0.00036	0.00000	0.00000	
24025	025-0082	APG	0.00022		0.00000	1.19405	0.00026	0.00000	0.00000	
24025	025-0082	APG	0.02750	0.01281	0.00003	1.19405	0.03284	0.01530	0.00003	
24025	025-0082	APG	0.00105	0.00075	0.00006	1.19405	0.00125	0.00089	0.00007	
24025	025-0082	APG	0.00105	0.00075	0.00006	1.19405	0.00125	0.00089	0.00007	
24025	025-0082	APG	0.00105	0.00075	0.00005	1.19405	0.00125	0.00089	0.00006	
24025	025-0082	APG	0.00105	0.00035	0.00005	1.19405	0.00125	0.00042	0.00006	
24025	025-0082	APG	0.00103	0.00036	0.00004	1.19405	0.00123	0.00042	0.00004	
24025	025-0082	APG	0.00105	0.00036	0.00005	1.19405	0.00125	0.00042	0.00006	
24025	025-0082	APG	0.00103	0.00036	0.00004	1.19405	0.00123	0.00042	0.00004	
24025	025-0082	APG	0.00105	0.00035	0.00005	1.19405	0.00125	0.00042	0.00006	
24025	025-0082	APG	0.02032	0.03587	0.00273	1.19405	0.02426	0.04283	0.00325	
24025	025-0082	APG			0.00003	1.19405	0.00000	0.00000	0.00003	
24025	025-0082	APG	0.00416	0.02382	0.00224	1.19405	0.00497	0.02844	0.00267	
24025	025-0082	APG		0.03566		1.19405	0.00000	0.04258	0.00000	
24025	025-0082	APG	0.00641	0.15290	0.00418	1.19405	0.00765	0.18257	0.00499	
24025	025-0082	APG	0.00245	0.00609	0.00015	1.19405	0.00292	0.00727	0.00018	
24025	025-0082	APG	0.00310	0.02761	0.00047	1.19405	0.00370	0.03296	0.00056	
24025	025-0082	APG	0.00165	0.00614	0.00013	1.19405	0.00197	0.00733	0.00016	
24025	025-0082	APG	0.00708		0.00104	1.19405	0.00845	0.00000	0.00124	
24025	025-0082	APG	0.04633	0.08045	0.00066	1.19405	0.05531	0.09606	0.00079	
24025	025-0082	APG	0.00862	0.03940	0.00134	1.19405	0.01029	0.04705	0.00160	
24025	025-0082	APG	0.00206	0.06215		1.19405	0.00245	0.07421	0.00000	
24025	025-0082	APG	0.04191	0.15608	0.00418	1.19405	0.05004	0.18637	0.00499	
24025	025-0082	APG	0.05541	0.20860	0.00245	1.19405	0.06616	0.24908	0.00293	
24025	025-0082	APG	0.00681	0.01944	0.00054	1.19405	0.00813	0.02321	0.00064	

State County FIPs	State Facility Identifier	Facility Name	2017			2017-2023		2023		
			CO	NOX	VOC	GF	CO	NOX	VOC	
24025	025-0082	APG	0.01433	0.12082	0.01460	1.19405	0.01711	0.14426	0.01743	
24025	025-0082	APG		0.02382		1.19405	0.00000	0.02844	0.00000	
24025	025-0082	APG	0.00494	0.10817		1.19405	0.00590	0.12915	0.00000	
24025	025-0082	APG	0.00530	0.03442		1.19405	0.00632	0.04109	0.00000	
24025	025-0082	APG	0.00075	0.00561		1.19405	0.00089	0.00670	0.00000	
24025	025-0082	APG	0.00415	0.08245		1.19405	0.00495	0.09845	0.00000	
24025	025-0082	APG	0.00476	0.01684	0.00046	1.19405	0.00568	0.02010	0.00055	
24025	025-0082	APG		0.02852		1.19405	0.00000	0.03405	0.00000	
24025 Total		APG	1.63373	2.45055	0.45086	1.19405	1.95076	2.92608	0.53835	
24510	510-3396	MPA			0.00112	1.19405	0.00000	0.00000	0.00134	
24510	510-3396	MPA	0.00027	0.00003	0.00001	1.19405	0.00033	0.00003	0.00001	
24510	510-3396	MPA	0.00082	0.00005	0.00003	1.19405	0.00098	0.00007	0.00003	
24510	510-3396	MPA	0.00011	0.00082	0.00003	1.19405	0.00013	0.00098	0.00003	
24510	510-3396	MPA	0.01452	0.00055	0.00329	1.19405	0.01734	0.00065	0.00393	
24510	510-3396	MPA	0.00008	0.00027	0.00001	1.19405	0.00010	0.00033	0.00001	
24510	510-3396	MPA	0.05644	0.10603	0.00822	1.19405	0.06739	0.12660	0.00981	
24510	510-3396	MPA	0.09726	0.01808	0.00411	1.19405	0.11613	0.02159	0.00491	
24510	510-3396	MPA	0.00005	0.00001	0.00000	1.19405	0.00007	0.00002	0.00000	
24510	510-3396	MPA	0.00003	0.00001	0.00000	1.19405	0.00003	0.00001	0.00000	
24510	510-3396	MPA	0.01205	0.03019	0.00301	1.19405	0.01439	0.03605	0.00360	
24510	510-3396	MPA	0.03205	0.16329	0.00630	1.19405	0.03828	0.19497	0.00752	
24510	510-3396	MPA	0.00000	0.00001	0.00000	1.19405	0.00000	0.00001	0.00000	
24510	510-3396	MPA	0.00082	0.00904	0.00110	1.19405	0.00098	0.01080	0.00131	
24510	510-3396	MPA	0.00712	0.01589	0.00167	1.19405	0.00851	0.01897	0.00200	
24510	510-3396	MPA	0.00329	0.00132	0.00030	1.19405	0.00393	0.00157	0.00036	
24510	510-3396	MPA	0.00001	0.00001	0.00000	1.19405	0.00001	0.00001	0.00000	
24510	510-3396	MPA	0.03945	0.09808	0.00825	1.19405	0.04711	0.11712	0.00985	
24510	510-3396	MPA	0.00008	0.00027	0.00003	1.19405	0.00010	0.00033	0.00003	

State County FIPs	State Facility Identifier	Facility Name	2017			2017-2023	2023		
			CO	NOX	VOC	GF	CO	NOX	VOC
24510	510-3396	MPA	0.01096	0.04521	0.00384	1.19405	0.01309	0.05398	0.00458
24510	510-3396	MPA	0.00164	0.00110	0.00027	1.19405	0.00196	0.00131	0.00033
24510	510-3396	MPA	0.04836	0.14959	0.01427	1.19405	0.05774	0.17862	0.01704
24510	510-3396	MPA	0.00014	0.00027	0.00003	1.19405	0.00016	0.00033	0.00003
24510	510-3396	MPA	0.00712	0.01589	0.00167	1.19405	0.00851	0.01897	0.00200
24510	510-3396	MPA	0.02877	0.15890	0.00822	1.19405	0.03435	0.18974	0.00981
24510 Total		MPA	0.36146	0.81491	0.06578	1.19405	0.43161	0.97305	0.07854
Grand Total			6.54913	7.27401	1.30967		7.08848	8.04163	1.43642



Maryland
Department of
the Environment

Wes Moore, Governor
Aruna Miller, Lt. Governor

Serena McIlwain, Secretary
Suzanne E. Dorsey, Deputy Secretary

APPENDIX A-4

Baltimore Moderate Nonattainment Area Area/Nonpoint Source Emission Inventory

**Prepared for:
U.S. Environmental Protection Agency**

**Prepared by:
Maryland Department of the Environment**



**Baltimore, MD Ozone Moderate Nonattainment Area
Area-Nonpoint Source Emission Inventory**

© Maryland Department of the Environment
Air and Radiation Administration
1800 Washington Boulevard, Suite 730
Baltimore, Maryland 21230
Phone 410.537.3240 • Fax 410.631.3202

State County FIPs Code	SCC (AMS)	Emission Process Description	CO	NOX	VOC	GF 2023	Basis	2023 CO	2023 NOX	2023 VOC	Pollutant Controlled	Control Factor (CF)	Control Program	Reductions	2023 Controlled CO Inv	2023 Controlled NOx Inv	2023 Controlled VOC Inv
24003	2102004001	ICI_Oil	0.00171	0.00683	0.00007	1.05197	EMP	0.00180	0.00719	0.00007					0.00180	0.00719	0.00007
24003	2102004002	ICI_Oil	0.02961	0.13758	0.00957	1.05197	EMP	0.03115	0.14473	0.01006					0.03115	0.14473	0.01006
24003	2102005000	ICI_Oil	0.00015	0.00166	0.00001	1.05197	EMP	0.00016	0.00175	0.00001					0.00016	0.00175	0.00001
24003	2102006000	ICI_NG	0.21602	0.25717	0.01414	1.05197	EMP	0.22725	0.27053	0.01488					0.22725	0.27053	0.01488
24003	2102007000	ICI_Other	0.00031	0.00056	0.00002	1.05197	EMP	0.00033	0.00059	0.00002					0.00033	0.00059	0.00002
24003	2102008000	ICI_Biomass	0.86549	0.31735	0.02452	1.05197	EMP	0.91047	0.33384	0.02580					0.91047	0.33384	0.02580
24003	2102011000	ICI_Oil	0.00008	0.00031	0.00000	1.05197	EMP	0.00008	0.00032	0.00000					0.00008	0.00032	0.00000
24003	2103004001	Emissions from commercial and institutional distillate oil combustion.	0.00039	0.00154	0.00003	1.05197	EMP	0.00041	0.00162	0.00003					0.00041	0.00162	0.00003
24003	2103004002	Emissions from commercial and institutional distillate oil combustion.	0.00053	0.00245	0.00017	1.05197	EMP	0.00055	0.00258	0.00018					0.00055	0.00258	0.00018
24003	2103005000	Emissions from commercial and institutional residual oil combustion.	0.00001	0.00006	0.00000	1.05197	EMP	0.00001	0.00007	0.00000					0.00001	0.00007	0.00000
24003	2103006000	Emissions from commercial & institutional natural gas combustion.	0.62921	0.74906	0.04120	1.05197	EMP	0.66191	0.78799	0.04334					0.66191	0.78799	0.04334
24003	2103007000	Emissions from commercial and institutional LPG combustion.	0.02115	0.03777	0.00138	1.05197	EMP	0.02225	0.03973	0.00145					0.02225	0.03973	0.00145
24003	2103008000	ICI_Biomass	0.00691	0.00253	0.00020	1.05197	EMP	0.00727	0.00267	0.00021					0.00727	0.00267	0.00021
24003	2103011000	Emissions from commercial/institutional kerosene combustion.	0.00001	0.00005	0.00000	1.05197	EMP	0.00001	0.00006	0.00000					0.00001	0.00006	0.00000
24003	2104004000	Emissions from residential distillate oil combustion.	0.00210	0.00755	0.00030	1.05287	HSE	0.00221	0.00795	0.00031					0.00221	0.00795	0.00031
24003	2104006000	Emissions from residential natural gas combustion.	0.20197	0.47462	0.02777	1.05287	HSE	0.21264	0.49971	0.02924					0.21264	0.49971	0.02924

State County FIPs Code	SCC (AMS)	Emission Process Description	CO	NOX	VOC	GF 2023	Basis	2023 CO	2023 NOX	2023 VOC	Pollutant Controlled	Control Factor (CF)	Control Program	Reductions	2023 Controlled CO Inv	2023 Controlled NOx Inv	2023 Controlled VOC Inv
24003	2104007000	Emissions from residential LPG combustion.	0.02402	0.08469	0.00330	1.05287	HSE	0.02529	0.08916	0.00347					0.02529	0.08916	0.00347
24003	2104008100	Fireplace: general	0.01628	0.00028	0.00207	1.05287	HSE	0.01714	0.00030	0.00217					0.01714	0.00030	0.00217
24003	2104008210	Woodstove: fireplace inserts; non EPA-certified	0.01009	0.00012	0.00232	1.05287	HSE	0.01062	0.00013	0.00244					0.01062	0.00013	0.00244
24003	2104008220	Woodstove: fireplace inserts; EPA-certified; non-catalytic	0.00404	0.00007	0.00034	1.05287	HSE	0.00425	0.00007	0.00036					0.00425	0.00007	0.00036
24003	2104008230	Woodstove: fireplace inserts; EPA-certified; catalytic	0.00087	0.00002	0.00013	1.05287	HSE	0.00092	0.00002	0.00013					0.00092	0.00002	0.00013
24003	2104008310	Woodstove: freestanding, non-EPA certified	0.02696	0.00033	0.00619	1.05287	HSE	0.02839	0.00034	0.00652					0.02839	0.00034	0.00652
24003	2104008320	Woodstove: freestanding, EPA certified, non-catalytic	0.02040	0.00033	0.00174	1.05287	HSE	0.02148	0.00035	0.00183					0.02148	0.00035	0.00183
24003	2104008330	Woodstove: freestanding, EPA certified, catalytic	0.01008	0.00019	0.00145	1.05287	HSE	0.01062	0.00020	0.00153					0.01062	0.00020	0.00153
24003	2104008400	Woodstove: pellet-fired, general	0.00079	0.00019	0.00011	1.05287	HSE	0.00083	0.00020	0.00011					0.00083	0.00020	0.00011
24003	2104008510	Furnace: Indoor, cordwood-fired, non-EPA certified	0.00065	0.00001	0.00004	1.05287	HSE	0.00068	0.00001	0.00004					0.00068	0.00001	0.00004
24003	2104008610	Hydronic heater: outdoor	0.00666	0.00004	0.00125	1.05287	HSE	0.00701	0.00004	0.00131					0.00701	0.00004	0.00131
24003	2104008700	Outdoor wood burning device, NEC	0.00001	0.00000	0.00000	1.05287	HSE	0.00001	0.00000	0.00000					0.00001	0.00000	0.00000
24003	2104009000	Total: All Combustor Types	0.00240	0.00015	0.00076	1.05287	HSE	0.00252	0.00015	0.00080					0.00252	0.00015	0.00080
24003	2104011000	Emissions from residential kerosene combustion.	0.00005	0.00018	0.00001	1.05287	HSE	0.00005	0.00019	0.00001					0.00005	0.00019	0.00001
24003	2201000062	Emissions from gasoline marketing refueling.			0.60736	1.04918	VMT			0.63723					0.00000	0.00000	0.63723
24003	2302002100	Conveyorized Charbroiling	0.11685		0.03499	1.03696	POP	0.12117		0.03628					0.12117	0.00000	0.03628

State County FIPs Code	SCC (AMS)	Emission Process Description	CO	NOX	VOC	GF 2023	Basis	2023 CO	2023 NOX	2023 VOC	Pollutant Controlled	Control Factor (CF)	Control Program	Reductions	2023 Controlled CO Inv	2023 Controlled NOx Inv	2023 Controlled VOC Inv
24003	2302002200	Under-fired Charbroiling	0.35754		0.10930	1.03696	POP	0.37075		0.11334					0.37075	0.00000	0.11334
24003	2302003000	Deep Fat Frying			0.01916	1.03696	POP			0.01987					0.00000	0.00000	0.01987
24003	2302003100	Flat Griddle Frying	0.02852		0.01381	1.03696	POP	0.02958		0.01432					0.02958	0.00000	0.01432
24003	2302003200	Clamshell Griddle Frying			0.00065	1.03696	POP			0.00067					0.00000	0.00000	0.00067
24003	2302050000	Emissions from bakeries.			0.04146	1.03696	POP			0.04299					0.00000	0.00000	0.04299
24003	2302070001	Emissions from small breweries			0.00009	1.03696	POP			0.00009					0.00000	0.00000	0.00009
24003	2302070005	Emissions from small wineries			0.00008	1.03696	POP			0.00008					0.00000	0.00000	0.00008
24003	2401001000	Emissions from ALL SOLVENT TYPES architectural surface coatings.			1.74652	1.03696	POP			1.81108					0.00000	0.00000	1.81108
24003	2401005000	Emissions from automobile refinishing.			0.64271	1.05197	EMP			0.67611					0.00000	0.00000	0.67611
24003	2401008000	Emissions from traffic paints.			0.09096	1.03696	POP			0.09433					0.00000	0.00000	0.09433
24003	2401020000	Emissions from surface coatings of wood furniture and fixtures.			0.04215	1.05197	EMP			0.04434					0.00000	0.00000	0.04434
24003	2401025000	Emissions from surface coatings of metal furniture & fixtures.			0.35482	1.05197	EMP			0.37326					0.00000	0.00000	0.37326
24003	2401065000	Emissions from Electronic and Other Electrical Coatings.			0.00570	1.05197	EMP			0.00600					0.00000	0.00000	0.00600
24003	2401070000	Emissions from surface coatings of Motor Vehicle.			0.01507	1.05197	EMP			0.01586					0.00000	0.00000	0.01586
24003	2401080000	Emissions from surface coatings of marine.			0.04379	1.05197	EMP			0.04606					0.00000	0.00000	0.04606
24003	2401090000	Emissions from surface coatings - misc. manufacturing.			0.14515	1.05197	EMP			0.15270					0.00000	0.00000	0.15270
24003	2401100000	Emissions from surface coatings for industrial maintenance.			0.63711	1.05197	EMP			0.67022					0.00000	0.00000	0.67022
24003	2401200000	Emissions from surface			0.63711	1.05197	EMP			0.67022					0.00000	0.00000	0.67022

State County FIPs Code	SCC (AMS)	Emission Process Description	CO	NOX	VOC	GF 2023	Basis	2023 CO	2023 NOX	2023 VOC	Pollutant Controlled	Control Factor (CF)	Control Program	Reductions	2023 Controlled CO Inv	2023 Controlled NOx Inv	2023 Controlled VOC Inv
		coatings - other categories.															
24003	2415000000	Emissions from Cleaning Products: Industrial and Institutional Cleaning.			1.41519	1.05197	EMP			1.48874					0.00000	0.00000	1.48874
24003	2420000000	Dry Cleaners			0.38704	1.03696	POP			0.40134					0.00000	0.00000	0.40134
24003	2425000000	Emissions from Screen & Plateless printing			0.06138	1.03696	POP			0.06365					0.00000	0.00000	0.06365
24003	2425010000	Emissions from Offset Lithography printing			0.26712	1.03696	POP			0.27700					0.00000	0.00000	0.27700
24003	2425020000	Emissions from Letterpress printing			0.11367	1.03696	POP			0.11787					0.00000	0.00000	0.11787
24003	2425030000	Emissions from Rotogravure printing			0.12685	1.03696	POP			0.13154					0.00000	0.00000	0.13154
24003	2425040000	Emissions from Flexography printing			0.14527	1.03696	POP			0.15064					0.00000	0.00000	0.15064
24003	2440000000	Emissions from industrial adhesives.			0.34147	1.03696	POP			0.35409					0.00000	0.00000	0.35409
24003	2460100000	Commercial & Consumer Products - Personal Care Products			1.18626	1.03696	POP			1.23011	VOC	15.00%	C&C Products PH III & IV	0.18452	0.00000	0.00000	1.04559
24003	2460200000	Commercial & Consumer Products - Household Products			0.35650	1.03696	POP			0.36967	VOC	15.00%	C&C Products PH III & IV	0.05545	0.00000	0.00000	0.31422
24003	2460400000	Commercial & Consumer Products - Automotive Aftermarket Products			0.64768	1.03696	POP			0.67162	VOC	15.00%	C&C Products PH III & IV	0.10074	0.00000	0.00000	0.57088
24003	2460500000	Commercial & Consumer Products - Coatings and Related Products			0.54456	1.03696	POP			0.56468	VOC	15.00%	C&C Products PH III & IV	0.08470	0.00000	0.00000	0.47998
24003	2460600000	Commercial & Consumer Products - Adhesives and Sealants			0.28894	1.03696	POP			0.29962	VOC	15.00%	C&C Products PH III & IV	0.04494	0.00000	0.00000	0.25467
24003	2460800000	Commercial & Consumer Products - FIFRA - Regulated			0.95315	1.03696	POP			0.98838	VOC	15.00%	C&C Products PH III	0.14826	0.00000	0.00000	0.84012

State County FIPs Code	SCC (AMS)	Emission Process Description	CO	NOX	VOC	GF 2023	Basis	2023 CO	2023 NOX	2023 VOC	Pollutant Controlled	Control Factor (CF)	Control Program	Reductions	2023 Controlled CO Inv	2023 Controlled NOx Inv	2023 Controlled VOC Inv
		Products															
24003	2460900000	Commercial & Consumer Products - Miscellaneous Products			0.03933	1.03696	POP			0.04078	VOC	15.00%	& IV C&C Product s PH III & IV	0.00612	0.00000	0.00000	0.03466
24003	2461020000	Misc. Asphalt Application			0.10595	1.03696	POP			0.10986					0.00000	0.00000	0.10986
24003	2461021000	Cutback Asphalt Application			0.04845	1.03696	POP			0.05024					0.00000	0.00000	0.05024
24003	2461022000	Emissions from emulsified asphalt.			0.08081	1.03696	POP			0.08380					0.00000	0.00000	0.08380
24003	2461023000	Emissions from Asphalt Roofing.			0.14007	1.03696	POP			0.14525					0.00000	0.00000	0.14525
24003	2461800001	Emissions from Commercial pesticide surface application			0.89880	1.00000	NG			0.89880					0.00000	0.00000	0.89880
24003	2461800002	Emissions from Commercial pesticide soil application			1.13000	1.00000	NG			1.13000					0.00000	0.00000	1.13000
24003	2501011011	Portable Fuel Containers: Residential - Permeation			0.02083	1.03696	POP			0.02160					0.00000	0.00000	0.02160
24003	2501011012	Portable Fuel Containers: Residential - Evaporation (including Diurnal)			0.17991	1.03696	POP			0.18656					0.00000	0.00000	0.18656
24003	2501011013	Portable Fuel Containers: Residential - Transport			0.00987	1.03696	POP			0.01024					0.00000	0.00000	0.01024
24003	2501012011	Portable Fuel Containers: Commercial - Permeation			0.00324	1.03696	POP			0.00336					0.00000	0.00000	0.00336
24003	2501012012	Portable Fuel Containers: Commercial - Evaporation (Including Diurnal)			0.04261	1.03696	POP			0.04418					0.00000	0.00000	0.04418
24003	2501012013	Portable Fuel Containers:			0.64663	1.03696	POP			0.67053					0.00000	0.00000	0.67053

State County FIPs Code	SCC (AMS)	Emission Process Description	CO	NOX	VOC	GF 2023	Basis	2023 CO	2023 NOX	2023 VOC	Pollutant Controlled	Control Factor (CF)	Control Program	Reductions	2023 Controlled CO Inv	2023 Controlled NOx Inv	2023 Controlled VOC Inv
		Commercial - Transport															
24003	2501060051	Gasoline Marketing - Tank Truck Unloading - Submerged Filling			0.27937	1.04918	VMT			0.29311					0.00000	0.00000	0.29311
24003	2501060053	Gasoline Marketing - Tank Truck Unloading - Balanced Submerged Filling			0.11608	1.04918	VMT			0.12179					0.00000	0.00000	0.12179
24003	2501060201	Emissions from underground tank breathing.			0.42522	1.04918	VMT			0.44613					0.00000	0.00000	0.44613
24003	2501080050	AvGas Stage I Aircraft Refueling.			0.00580	1.05197	EMP			0.00610					0.00000	0.00000	0.00610
24003	2501080100	AvGas Stage II Aircraft Refueling.			0.00320	1.05197	EMP			0.00337					0.00000	0.00000	0.00337
24003	2505020090	Emissions from distillate oil marine vessel unloading.			0.00000	1.05197	EMP			0.00000					0.00000	0.00000	0.00000
24003	2505030120	Emissions from tank trucks in transit.			0.03308	1.04918	VMT			0.03470					0.00000	0.00000	0.03470
24003	2620030000	Emissions from solid waste landfills.			0.00600	1.03696	POP			0.00622					0.00000	0.00000	0.00622
24003	2630020000	Emissions from POTWs.			0.02065	1.05287	HSE			0.02174					0.00000	0.00000	0.02174
24003	2660000000	Emissions from soil/groundwater remediation of LUST sites.			0.06099	1.00000	NG			0.06099					0.00000	0.00000	0.06099
24003	2805002000	BEEF			0.00143	1.00000	NG			0.00143					0.00000	0.00000	0.00143
24003	2805007100	LAYERS			0.00007	1.00000	NG			0.00007					0.00000	0.00000	0.00007
24003	2805009100	BROILERS			0.00039	1.00000	NG			0.00039					0.00000	0.00000	0.00039
24003	2805010100	TURKEY			0.00001	1.00000	NG			0.00001					0.00000	0.00000	0.00001
24003	2805018000	DAIRY			0.00301	1.00000	NG			0.00301					0.00000	0.00000	0.00301
24003	2805025000	SWINE			0.00015	1.00000	NG			0.00015					0.00000	0.00000	0.00015
24003	2805035000	HORSES			0.00500	1.00000	NG			0.00500					0.00000	0.00000	0.00500
24003	2805040000	SHEEP			0.00022	1.00000	NG			0.00022					0.00000	0.00000	0.00022

State County FIPs Code	SCC (AMS)	Emission Process Description	CO	NOX	VOC	GF 2023	Basis	2023 CO	2023 NOX	2023 VOC	Pollutant Controlled	Control Factor (CF)	Control Program	Reductions	2023 Controlled CO Inv	2023 Controlled NOx Inv	2023 Controlled VOC Inv
24003	2805045000	GOATS			0.00027	1.00000	NG			0.00027					0.00000	0.00000	0.00027
24003	2810001001	wildfire/smoldering	0.00165	0.00001	0.00039	1.00000	NG	0.00165	0.00001	0.00039					0.00165	0.00001	0.00039
24003	2810001002	wildfire/flaming	0.00368	0.00007	0.00088	1.00000	NG	0.00368	0.00007	0.00088					0.00368	0.00007	0.00088
24003	2810030000	Emissions from structural fires.			0.00681	1.03696	POP			0.00706					0.00000	0.00000	0.00706
24003	2810050000	Emissions from motor vehicle fires.	0.00899	0.00029	0.00230	1.03696	POP	0.00932	0.00030	0.00239					0.00932	0.00030	0.00239
24003	2810060100	Human Cremation	0.00719	0.00236	0.00001	1.03696	POP	0.00745	0.00245	0.00001					0.00745	0.00245	0.00001
24003	2810060200	Animal Cremation	0.00004	0.00001	0.00000	1.00000	NG	0.00004	0.00001	0.00000					0.00004	0.00001	0.00000
24003	2811015001	prescribed/smoldering	0.06993	0.00030	0.01632	1.00000	NG	0.06993	0.00030	0.01632					0.06993	0.00030	0.01632
24003	2811015002	prescribed/flaming	0.14260	0.00289	0.03391	1.00000	NG	0.14260	0.00289	0.03391					0.14260	0.00289	0.03391
24003	2830000000	Emissions from catastrophic/accidenta l releases/oil spills.			0.00158	1.00000	NG			0.00158					0.00000	0.00000	0.00158
24003 Total			2.83592	2.08961	16.53178			2.96448	2.19851	17.14278				0.62473	2.96448	2.19851	16.51805
24005	2102004001	ICI_Oil	0.00213	0.00854	0.00009	1.05711	EMP	0.00226	0.00903	0.00009					0.00226	0.00903	0.00009
24005	2102004002	ICI_Oil	0.03700	0.17190	0.01195	1.05711	EMP	0.03911	0.18171	0.01264					0.03911	0.18171	0.01264
24005	2102005000	ICI_Oil	0.00019	0.00208	0.00001	1.05711	EMP	0.00020	0.00220	0.00001					0.00020	0.00220	0.00001
24005	2102006000	ICI_NG	0.26990	0.32131	0.01767	1.05711	EMP	0.28532	0.33966	0.01868					0.28532	0.33966	0.01868
24005	2102007000	ICI_Other	0.00039	0.00070	0.00003	1.05711	EMP	0.00041	0.00074	0.00003					0.00041	0.00074	0.00003
24005	2102008000	ICI_Biomass	1.08138	0.39651	0.03064	1.05711	EMP	1.14313	0.41915	0.03239					1.14313	0.41915	0.03239
24005	2102011000	ICI_Oil	0.00010	0.00038	0.00000	1.05711	EMP	0.00010	0.00040	0.00000					0.00010	0.00040	0.00000
24005	2103004001	Emissions from commercial and institutional distillate oil combustion.	0.00053	0.00213	0.00004	1.05711	EMP	0.00056	0.00225	0.00004					0.00056	0.00225	0.00004
24005	2103004002	Emissions from commercial and institutional distillate oil combustion.	0.00073	0.00338	0.00024	1.05711	EMP	0.00077	0.00358	0.00025					0.00077	0.00358	0.00025
24005	2103005000	Emissions from commercial and institutional residual	0.00001	0.00009	0.00000	1.05711	EMP	0.00001	0.00009	0.00000					0.00001	0.00009	0.00000

State County FIPs Code	SCC (AMS)	Emission Process Description	CO	NOX	VOC	GF 2023	Basis	2023 CO	2023 NOX	2023 VOC	Pollutant Controlled	Control Factor (CF)	Control Program	Reductions	2023 Controlled CO Inv	2023 Controlled NOx Inv	2023 Controlled VOC Inv
		oil combustion.															
24005	2103006000	Emissions from commercial & institutional natural gas combustion.	0.86912	1.03467	0.05691	1.05711	EMP	0.91875	1.09375	0.06016					0.91875	1.09375	0.06016
24005	2103007000	Emissions from commercial and institutional LPG combustion.	0.02922	0.05217	0.00191	1.05711	EMP	0.03089	0.05515	0.00202					0.03089	0.05515	0.00202
24005	2103008000	ICI_Biomass	0.00955	0.00350	0.00027	1.05711	EMP	0.01009	0.00370	0.00029					0.01009	0.00370	0.00029
24005	2103011000	Emissions from commercial/institutional kerosene combustion.	0.00002	0.00007	0.00000	1.05711	EMP	0.00002	0.00008	0.00000					0.00002	0.00008	0.00000
24005	2104004000	Emissions from residential distillate oil combustion.	0.00217	0.00781	0.00031	1.02169	HSE	0.00222	0.00798	0.00032					0.00222	0.00798	0.00032
24005	2104006000	Emissions from residential natural gas combustion.	0.47335	1.11237	0.06509	1.02169	HSE	0.48362	1.13650	0.06650					0.48362	1.13650	0.06650
24005	2104007000	Emissions from residential LPG combustion.	0.01864	0.06573	0.00256	1.02169	HSE	0.01904	0.06715	0.00261					0.01904	0.06715	0.00261
24005	2104008100	Fireplace: general	0.02126	0.00037	0.00270	1.02169	HSE	0.02172	0.00038	0.00275					0.02172	0.00038	0.00275
24005	2104008210	Woodstove: fireplace inserts; non EPA-certified	0.01317	0.00016	0.00302	1.02169	HSE	0.01346	0.00016	0.00309					0.01346	0.00016	0.00309
24005	2104008220	Woodstove: fireplace inserts; EPA-certified; non-catalytic	0.00527	0.00009	0.00045	1.02169	HSE	0.00539	0.00009	0.00046					0.00539	0.00009	0.00046
24005	2104008230	Woodstove: fireplace inserts; EPA-certified; catalytic	0.00114	0.00002	0.00016	1.02169	HSE	0.00116	0.00002	0.00017					0.00116	0.00002	0.00017
24005	2104008310	Woodstove: freestanding, non-EPA certified	0.03846	0.00047	0.00883	1.02169	HSE	0.03930	0.00048	0.00902					0.03930	0.00048	0.00902
24005	2104008320	Woodstove: freestanding, EPA certified, non-catalytic	0.02910	0.00047	0.00248	1.02169	HSE	0.02973	0.00048	0.00253					0.02973	0.00048	0.00253
24005	2104008330	Woodstove: freestanding, EPA	0.01438	0.00028	0.00207	1.02169	HSE	0.01469	0.00028	0.00211					0.01469	0.00028	0.00211

State County FIPs Code	SCC (AMS)	Emission Process Description	CO	NOX	VOC	GF 2023	Basis	2023 CO	2023 NOX	2023 VOC	Pollutant Controlled	Control Factor (CF)	Control Program	Reductions	2023 Controlled CO Inv	2023 Controlled NOx Inv	2023 Controlled VOC Inv
		certified, catalytic															
24005	2104008400	Woodstove: pellet-fired, general	0.00112	0.00027	0.00016	1.02169	HSE	0.00115	0.00027	0.00016					0.00115	0.00027	0.00016
24005	2104008510	Furnace: Indoor, cordwood-fired, non-EPA certified	0.00089	0.00001	0.00006	1.02169	HSE	0.00091	0.00001	0.00006					0.00091	0.00001	0.00006
24005	2104008610	Hydronic heater: outdoor	0.01180	0.00007	0.00221	1.02169	HSE	0.01205	0.00007	0.00226					0.01205	0.00007	0.00226
24005	2104008700	Outdoor wood burning device, NEC	0.00001	0.00000	0.00000	1.02169	HSE	0.00001	0.00000	0.00000					0.00001	0.00000	0.00000
24005	2104009000	Total: All Combustor Types	0.00372	0.00023	0.00118	1.02169	HSE	0.00380	0.00023	0.00120					0.00380	0.00023	0.00120
24005	2104011000	Emissions from residential kerosene combustion.	0.00005	0.00018	0.00001	1.02169	HSE	0.00005	0.00019	0.00001					0.00005	0.00019	0.00001
24005	2201000062	Emissions from gasoline marketing refueling.			0.82018	1.04918	VMT			0.86052					0.00000	0.00000	0.86052
24005	2302002100	Conveyorized Charbroiling	0.15863		0.04750	1.02309	POP	0.16229		0.04860					0.16229	0.00000	0.04860
24005	2302002200	Under-fired Charbroiling	0.47925		0.14651	1.02309	POP	0.49032		0.14989					0.49032	0.00000	0.14989
24005	2302003000	Deep Fat Frying			0.02538	1.02309	POP			0.02597					0.00000	0.00000	0.02597
24005	2302003100	Flat Griddle Frying	0.03873		0.01875	1.02309	POP	0.03962		0.01919					0.03962	0.00000	0.01919
24005	2302003200	Clamshell Griddle Frying			0.00087	1.02309	POP			0.00089					0.00000	0.00000	0.00089
24005	2302050000	Emissions from bakeries.			0.23490	1.02309	POP			0.24032					0.00000	0.00000	0.24032
24005	2302070001	Emissions from small breweries			0.00818	1.02309	POP			0.00837					0.00000	0.00000	0.00837
24005	2302070005	Emissions from small wineries			0.00078	1.02309	POP			0.00079					0.00000	0.00000	0.00079
24005	2401001000	Emissions from ALL SOLVENT TYPES architectural surface coatings.			2.55374	1.02309	POP			2.61270					0.00000	0.00000	2.61270
24005	2401005000	Emissions from automobile refinishing.			0.80132	1.05711	EMP			0.84708					0.00000	0.00000	0.84708
24005	2401008000	Emissions from traffic paints.			0.09401	1.02309	POP			0.09618					0.00000	0.00000	0.09618

State County FIPs Code	SCC (AMS)	Emission Process Description	CO	NOX	VOC	GF 2023	Basis	2023 CO	2023 NOX	2023 VOC	Pollutant Controlled	Control Factor (CF)	Control Program	Reductions	2023 Controlled CO Inv	2023 Controlled NOx Inv	2023 Controlled VOC Inv
24005	2401020000	Emissions from surface coatings of wood furniture and fixtures.			0.20547	1.05711	EMP			0.21721					0.00000	0.00000	0.21721
24005	2401025000	Emissions from surface coatings of metal furniture & fixtures.			0.02969	1.05711	EMP			0.03139					0.00000	0.00000	0.03139
24005	2401040000	Emissions from surface coatings of metal cans.			0.43389	1.05711	EMP			0.45867					0.00000	0.00000	0.45867
24005	2401065000	Emissions from Electronic and Other Electrical Coatings.			0.00048	1.05711	EMP			0.00050					0.00000	0.00000	0.00050
24005	2401070000	Emissions from surface coatings of Motor Vehicle.			0.13305	1.05711	EMP			0.14065					0.00000	0.00000	0.14065
24005	2401075000	Emissions from surface coatings of Aircraft.			0.02109	1.05711	EMP			0.02230					0.00000	0.00000	0.02230
24005	2401080000	Emissions from surface coatings of marine.			0.00262	1.05711	EMP			0.00277					0.00000	0.00000	0.00277
24005	2401090000	Emissions from surface coatings - misc. manufacturing.			0.11586	1.05711	EMP			0.12248					0.00000	0.00000	0.12248
24005	2401100000	Emissions from surface coatings for industrial maintenance.			0.93157	1.05711	EMP			0.98477					0.00000	0.00000	0.98477
24005	2401200000	Emissions from surface coatings - other categories.			0.93157	1.05711	EMP			0.98477					0.00000	0.00000	0.98477
24005	2415000000	Emissions from Cleaning Products: Industrial and Institutional Cleaning.			1.34464	1.05711	EMP			1.42143					0.00000	0.00000	1.42143
24005	2420000000	Dry Cleaners			0.44305	1.02309	POP			0.45328					0.00000	0.00000	0.45328
24005	2425000000	Emissions from Screen & Plateless printing			0.08975	1.02309	POP			0.09182					0.00000	0.00000	0.09182
24005	2425010000	Emissions from Offset Lithography printing			0.39058	1.02309	POP			0.39960					0.00000	0.00000	0.39960
24005	2425020000	Emissions from Letterpress printing			0.16621	1.02309	POP			0.17004					0.00000	0.00000	0.17004
24005	2425030000	Emissions from Rotogravure printing			0.18549	1.02309	POP			0.18977					0.00000	0.00000	0.18977
24005	2425040000	Emissions from Flexography printing			0.14297	1.02309	POP			0.14627					0.00000	0.00000	0.14627

State County FIPs Code	SCC (AMS)	Emission Process Description	CO	NOX	VOC	GF 2023	Basis	2023 CO	2023 NOX	2023 VOC	Pollutant Controlled	Control Factor (CF)	Control Program	Reductions	2023 Controlled CO Inv	2023 Controlled NOx Inv	2023 Controlled VOC Inv
24005	2440000000	Emissions from industrial adhesives.			0.49929	1.02309	POP			0.51082					0.00000	0.00000	0.51082
24005	2460100000	Commercial & Consumer Products - Personal Care Products			1.73453	1.02309	POP			1.77458	VOC	15.00%	C&C Products PH III & IV	0.26619	0.00000	0.00000	1.50839
24005	2460200000	Commercial & Consumer Products - Household Products			0.52127	1.02309	POP			0.53330	VOC	15.00%	C&C Products PH III & IV	0.08000	0.00000	0.00000	0.45331
24005	2460400000	Commercial & Consumer Products - Automotive Aftermarket Products			0.94703	1.02309	POP			0.96890	VOC	15.00%	C&C Products PH III & IV	0.14533	0.00000	0.00000	0.82356
24005	2460500000	Commercial & Consumer Products - Coatings and Related Products			0.79624	1.02309	POP			0.81463	VOC	15.00%	C&C Products PH III & IV	0.12219	0.00000	0.00000	0.69243
24005	2460600000	Commercial & Consumer Products - Adhesives and Sealants			0.42248	1.02309	POP			0.43223	VOC	15.00%	C&C Products PH III & IV	0.06483	0.00000	0.00000	0.36740
24005	2460800000	Commercial & Consumer Products - FIFRA - Regulated Products			1.39368	1.02309	POP			1.42586	VOC	15.00%	C&C Products PH III & IV	0.21388	0.00000	0.00000	1.21198
24005	2460900000	Commercial & Consumer Products - Miscellaneous Products			0.05750	1.02309	POP			0.05883	VOC	15.00%	C&C Products PH III & IV	0.00882	0.00000	0.00000	0.05001
24005	2461020000	Misc. Asphalt Application			0.15491	1.02309	POP			0.15849					0.00000	0.00000	0.15849
24005	2461021000	Cutback Asphalt Application			0.07085	1.02309	POP			0.07248					0.00000	0.00000	0.07248
24005	2461022000	Emissions from emulsified asphalt.			0.11816	1.02309	POP			0.12089					0.00000	0.00000	0.12089
24005	2461023000	Emissions from Asphalt Roofing.			0.20481	1.02309	POP			0.20953					0.00000	0.00000	0.20953
24005	2461800001	Emissions from Commercial pesticide surface application			0.02178	1.00000	NG			0.02178					0.00000	0.00000	0.02178
24005	2461800002	Emissions from Commercial pesticide			0.11936	1.00000	NG			0.11936					0.00000	0.00000	0.11936

State County FIPs Code	SCC (AMS)	Emission Process Description	CO	NOX	VOC	GF 2023	Basis	2023 CO	2023 NOX	2023 VOC	Pollutant Controlled	Control Factor (CF)	Control Program	Reductions	2023 Controlled CO Inv	2023 Controlled NOx Inv	2023 Controlled VOC Inv
		soil application															
24005	2501011011	Portable Fuel Containers: Residential - Permeation			0.02472	1.02309	POP			0.02529					0.00000	0.00000	0.02529
24005	2501011012	Portable Fuel Containers: Residential - Evaporation (including Diurnal)			0.21349	1.02309	POP			0.21842					0.00000	0.00000	0.21842
24005	2501011013	Portable Fuel Containers: Residential - Transport			0.01172	1.02309	POP			0.01199					0.00000	0.00000	0.01199
24005	2501012011	Portable Fuel Containers: Commercial - Permeation			0.00386	1.02309	POP			0.00395					0.00000	0.00000	0.00395
24005	2501012012	Portable Fuel Containers: Commercial - Evaporation (Including Diurnal)			0.05065	1.02309	POP			0.05182					0.00000	0.00000	0.05182
24005	2501012013	Portable Fuel Containers: Commercial - Transport			0.76865	1.02309	POP			0.78640					0.00000	0.00000	0.78640
24005	2501060051	Gasoline Marketing - Tank Truck Unloading - Submerged Filling			0.39000	1.04918	VMT			0.40918					0.00000	0.00000	0.40918
24005	2501060053	Gasoline Marketing - Tank Truck Unloading - Balanced Submerged Filling			0.16206	1.04918	VMT			0.17003					0.00000	0.00000	0.17003
24005	2501060201	Emissions from underground tank breathing.			0.59361	1.04918	VMT			0.62280					0.00000	0.00000	0.62280
24005	2501080050	AvGas Stage I Aircraft Refueling.			0.00080	1.05711	EMP			0.00085					0.00000	0.00000	0.00085
24005	2501080100	AvGas Stage II Aircraft Refueling.			0.00044	1.05711	EMP			0.00047					0.00000	0.00000	0.00047
24005	2505030120	Emissions from tank trucks in transit.			0.04351	1.04918	VMT			0.04565					0.00000	0.00000	0.04565

State County FIPs Code	SCC (AMS)	Emission Process Description	CO	NOX	VOC	GF 2023	Basis	2023 CO	2023 NOX	2023 VOC	Pollutant Controlled	Control Factor (CF)	Control Program	Reductions	2023 Controlled CO Inv	2023 Controlled NOx Inv	2023 Controlled VOC Inv
24005	2620030000	Emissions from solid waste landfills.			0.02001	1.02309	POP			0.02047					0.00000	0.00000	0.02047
24005	2630020000	Emissions from POTWs.			0.07567	1.05287	HSE			0.07968					0.00000	0.00000	0.07968
24005	2660000000	Emissions from soil/groundwater remediation of LUST sites.			0.03912	1.00000	NG			0.03912					0.00000	0.00000	0.03912
24005	2805002000	BEEF			0.00339	1.00000	NG			0.00339					0.00000	0.00000	0.00339
24005	2805007100	LAYERS			0.00037	1.00000	NG			0.00037					0.00000	0.00000	0.00037
24005	2805009100	BROILERS			0.00039	1.00000	NG			0.00039					0.00000	0.00000	0.00039
24005	2805010100	TURKEY			0.00024	1.00000	NG			0.00024					0.00000	0.00000	0.00024
24005	2805018000	DAIRY			0.01303	1.00000	NG			0.01303					0.00000	0.00000	0.01303
24005	2805025000	SWINE			0.00258	1.00000	NG			0.00258					0.00000	0.00000	0.00258
24005	2805035000	HORSES			0.00765	1.00000	NG			0.00765					0.00000	0.00000	0.00765
24005	2805040000	SHEEP			0.00073	1.00000	NG			0.00073					0.00000	0.00000	0.00073
24005	2805045000	GOATS			0.00057	1.00000	NG			0.00057					0.00000	0.00000	0.00057
24005	2810001001	wildfire/smoldering	0.02607	0.00011	0.00608	1.00000	NG	0.02607	0.00011	0.00608					0.02607	0.00011	0.00608
24005	2810001002	wildfire/flaming	0.17868	0.00387	0.04256	1.00000	NG	0.17868	0.00387	0.04256					0.17868	0.00387	0.04256
24005	2810030000	Emissions from structural fires.			0.00509	1.02309	POP			0.00521					0.00000	0.00000	0.00521
24005	2810050000	Emissions from motor vehicle fires.	0.01503	0.00048	0.00385	1.02309	POP	0.01537	0.00049	0.00394					0.01537	0.00049	0.00394
24005	2810060100	Human Cremation	0.00441	0.00158	0.00002	1.02309	POP	0.00451	0.00162	0.00002					0.00451	0.00162	0.00002
24005	2811015001	prescribed/smoldering	0.04690	0.00020	0.01094	1.00000	NG	0.04690	0.00020	0.01094					0.04690	0.00020	0.01094
24005	2811015002	prescribed/flaming	0.32339	0.00761	0.07719	1.00000	NG	0.32339	0.00761	0.07719					0.32339	0.00761	0.07719
24005	2830000000	Emissions from catastrophic/accidental releases/oil spills.			0.00188	1.00000	NG			0.00188					0.00000	0.00000	0.00188
24005 Total			4.20587	3.19979	20.16787			4.36707	3.33968	20.85259				0.90125	4.36707	3.33968	19.95135
24013	2102004001	ICI_Oil	0.00052	0.00208	0.00002	1.04948	EMP	0.00055	0.00218	0.00002					0.00055	0.00218	0.00002
24013	2102004002	ICI_Oil	0.00901	0.04187	0.00291	1.04948	EMP	0.00946	0.04395	0.00306					0.00946	0.04395	0.00306

State County FIPs Code	SCC (AMS)	Emission Process Description	CO	NOX	VOC	GF 2023	Basis	2023 CO	2023 NOX	2023 VOC	Pollutant Controlled	Control Factor (CF)	Control Program	Reductions	2023 Controlled CO Inv	2023 Controlled NOx Inv	2023 Controlled VOC Inv
24013	2102005000	ICI_Oil	0.00005	0.00051	0.00000	1.04948	EMP	0.00005	0.00053	0.00000					0.00005	0.00053	0.00000
24013	2102006000	ICI_NG	0.06575	0.07827	0.00430	1.04948	EMP	0.06900	0.08214	0.00452					0.06900	0.08214	0.00452
24013	2102007000	ICI_Other	0.00010	0.00017	0.00001	1.04948	EMP	0.00010	0.00018	0.00001					0.00010	0.00018	0.00001
24013	2102008000	ICI_Biomass	0.26342	0.09659	0.00746	1.04948	EMP	0.27645	0.10137	0.00783					0.27645	0.10137	0.00783
24013	2102011000	ICI_Oil	0.00002	0.00009	0.00000	1.04948	EMP	0.00002	0.00010	0.00000					0.00002	0.00010	0.00000
24013	2103004001	Emissions from commercial and institutional distillate oil combustion.	0.00008	0.00031	0.00001	1.04948	EMP	0.00008	0.00032	0.00001					0.00008	0.00032	0.00001
24013	2103004002	Emissions from commercial and institutional distillate oil combustion.	0.00011	0.00049	0.00003	1.04948	EMP	0.00011	0.00052	0.00004					0.00011	0.00052	0.00004
24013	2103005000	Emissions from commercial and institutional residual oil combustion.	0.00000	0.00001	0.00000	1.04948	EMP	0.00000	0.00001	0.00000					0.00000	0.00001	0.00000
24013	2103006000	Emissions from commercial & institutional natural gas combustion.	0.12640	0.15048	0.00828	1.04948	EMP	0.13265	0.15792	0.00869					0.13265	0.15792	0.00869
24013	2103007000	Emissions from commercial and institutional LPG combustion.	0.00425	0.00759	0.00028	1.04948	EMP	0.00446	0.00796	0.00029					0.00446	0.00796	0.00029
24013	2103008000	ICI_Biomass	0.00139	0.00051	0.00004	1.04948	EMP	0.00146	0.00053	0.00004					0.00146	0.00053	0.00004
24013	2103011000	Emissions from commercial/institutional kerosene combustion.	0.00000	0.00001	0.00000	1.04948	EMP	0.00000	0.00001	0.00000					0.00000	0.00001	0.00000
24013	2104004000	Emissions from residential distillate oil combustion.	0.00160	0.00577	0.00023	1.03818	HSE	0.00166	0.00599	0.00024					0.00166	0.00599	0.00024
24013	2104006000	Emissions from residential natural gas combustion.	0.03489	0.08200	0.00480	1.03818	HSE	0.03623	0.08513	0.00498					0.03623	0.08513	0.00498
24013	2104007000	Emissions from residential LPG combustion.	0.01735	0.06119	0.00238	1.03818	HSE	0.01801	0.06352	0.00247					0.01801	0.06352	0.00247

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24013	2104008100	Fireplace: general	0.01053	0.00018	0.00134	1.03818	HSE	0.01093	0.00019	0.00139					0.01093	0.00019	0.00139
24013	2104008210	Woodstove: fireplace inserts; non EPA- certified	0.00652	0.00008	0.00150	1.03818	HSE	0.00677	0.00008	0.00156					0.00677	0.00008	0.00156
24013	2104008220	Woodstove: fireplace inserts; EPA-certified; non-catalytic	0.00261	0.00004	0.00022	1.03818	HSE	0.00271	0.00004	0.00023					0.00271	0.00004	0.00023
24013	2104008230	Woodstove: fireplace inserts; EPA-certified; catalytic	0.00056	0.00001	0.00008	1.03818	HSE	0.00059	0.00001	0.00008					0.00059	0.00001	0.00008
24013	2104008310	Woodstove: freestanding, non-EPA certified	0.03528	0.00043	0.00810	1.03818	HSE	0.03663	0.00044	0.00841					0.03663	0.00044	0.00841
24013	2104008320	Woodstove: freestanding, EPA certified, non-catalytic	0.02669	0.00043	0.00227	1.03818	HSE	0.02771	0.00045	0.00236					0.02771	0.00045	0.00236
24013	2104008330	Woodstove: freestanding, EPA certified, catalytic	0.01319	0.00025	0.00190	1.03818	HSE	0.01370	0.00026	0.00197					0.01370	0.00026	0.00197
24013	2104008400	Woodstove: pellet- fired, general	0.00103	0.00025	0.00014	1.03818	HSE	0.00107	0.00026	0.00015					0.00107	0.00026	0.00015
24013	2104008510	Furnace: Indoor, cordwood-fired, non- EPA certified	0.00162	0.00002	0.00010	1.03818	HSE	0.00168	0.00002	0.00011					0.00168	0.00002	0.00011
24013	2104008610	Hydronic heater: outdoor	0.01568	0.00009	0.00294	1.03818	HSE	0.01628	0.00009	0.00305					0.01628	0.00009	0.00305
24013	2104008700	Outdoor wood burning device, NEC	0.00000	0.00000	0.00000	1.03818	HSE	0.00000	0.00000	0.00000					0.00000	0.00000	0.00000
24013	2104009000	Total: All Combustor Types	0.00071	0.00004	0.00023	1.03818	HSE	0.00074	0.00005	0.00023					0.00074	0.00005	0.00023
24013	2104011000	Emissions from residential kerosene combustion.	0.00004	0.00014	0.00001	1.03818	HSE	0.00004	0.00014	0.00001					0.00004	0.00014	0.00001
24013	2201000062	Emissions from gasoline marketing refueling.			0.16212	1.04918	VMT			0.17009					0.00000	0.00000	0.17009
24013	2302002100	Conveyorized Charbroiling	0.03627		0.01086	1.01909	POP	0.03696		0.01107					0.03696	0.00000	0.01107
24013	2302002200	Under-fired Charbroiling	0.09047		0.02766	1.01909	POP	0.09219		0.02818					0.09219	0.00000	0.02818
24013	2302003000	Deep Fat Frying			0.00531	1.01909	POP			0.00541					0.00000	0.00000	0.00541

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24013	2302003100	Flat Griddle Frying	0.00755		0.00366	1.01909	POP	0.00770		0.00373					0.00770	0.00000	0.00373
24013	2302003200	Clamshell Griddle Frying			0.00019	1.01909	POP			0.00019					0.00000	0.00000	0.00019
24013	2302050000	Emissions from bakeries.			0.02666	1.01909	POP			0.02717					0.00000	0.00000	0.02717
24013	2302070001	Emissions from small breweries			0.00188	1.01909	POP			0.00191					0.00000	0.00000	0.00191
24013	2302070005	Emissions from small wineries			0.00007	1.01909	POP			0.00007					0.00000	0.00000	0.00007
24013	2401001000	Emissions from ALL SOLVENT TYPES architectural surface coatings.			0.51521	1.01909	POP			0.52504					0.00000	0.00000	0.52504
24013	2401005000	Emissions from automobile refinishing.			0.15150	1.04948	EMP			0.15900					0.00000	0.00000	0.15900
24013	2401008000	Emissions from traffic paints.			0.06037	1.01909	POP			0.06152					0.00000	0.00000	0.06152
24013	2401015000	Industrial surface coatings of finished wood product manufacturing.			0.02314	1.04948	EMP			0.02428					0.00000	0.00000	0.02428
24013	2401020000	Emissions from surface coatings of wood furniture and fixtures.			0.07631	1.04948	EMP			0.08008					0.00000	0.00000	0.08008
24013	2401025000	Emissions from surface coatings of metal furniture & fixtures.			0.01485	1.04948	EMP			0.01558					0.00000	0.00000	0.01558
24013	2401060000	Emissions from Household Appliance Manufacturing			0.00488	1.04948	EMP			0.00513					0.00000	0.00000	0.00513
24013	2401070000	Emissions from surface coatings of Motor Vehicle.			0.02258	1.04948	EMP			0.02369					0.00000	0.00000	0.02369
24013	2401085000	Emissions from surface coatings of Railroads.			0.16010	1.04948	EMP			0.16802					0.00000	0.00000	0.16802
24013	2401090000	Emissions from surface coatings - misc. manufacturing.			0.02772	1.04948	EMP			0.02909					0.00000	0.00000	0.02909
24013	2401100000	Emissions from surface coatings for industrial maintenance.			0.18794	1.04948	EMP			0.19724					0.00000	0.00000	0.19724

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24013	2401200000	Emissions from surface coatings - other categories.			0.18794	1.04948	EMP			0.19724					0.00000	0.00000	0.19724
24013	2415000000	Emissions from Cleaning Products: Industrial and Institutional Cleaning.			0.21928	1.04948	EMP			0.23013					0.00000	0.00000	0.23013
24013	2420000000	Dry Cleaners			0.03365	1.01909	POP			0.03429					0.00000	0.00000	0.03429
24013	2425000000	Emissions from Screen & Plateless printing			0.01811	1.01909	POP			0.01845					0.00000	0.00000	0.01845
24013	2425010000	Emissions from Offset Lithography printing			0.07880	1.01909	POP			0.08030					0.00000	0.00000	0.08030
24013	2425020000	Emissions from Letterpress printing			0.03353	1.01909	POP			0.03417					0.00000	0.00000	0.03417
24013	2425030000	Emissions from Rotogravure printing			0.03742	1.01909	POP			0.03814					0.00000	0.00000	0.03814
24013	2425040000	Emissions from Flexography printing			0.04285	1.01909	POP			0.04367					0.00000	0.00000	0.04367
24013	2440000000	Emissions from industrial adhesives.			0.10073	1.01909	POP			0.10265					0.00000	0.00000	0.10265
24013	2460100000	Commercial & Consumer Products - Personal Care Products			0.34993	1.01909	POP			0.35662	VOC	15.00%	C&C Products PH III & IV	0.05349	0.00000	0.00000	0.30312
24013	2460200000	Commercial & Consumer Products - Household Products			0.10516	1.01909	POP			0.10717	VOC	15.00%	C&C Products PH III & IV	0.01608	0.00000	0.00000	0.09110
24013	2460400000	Commercial & Consumer Products - Automotive Aftermarket Products			0.19106	1.01909	POP			0.19471	VOC	15.00%	C&C Products PH III & IV	0.02921	0.00000	0.00000	0.16550
24013	2460500000	Commercial & Consumer Products - Coatings and Related Products			0.16064	1.01909	POP			0.16371	VOC	15.00%	C&C Products PH III & IV	0.02456	0.00000	0.00000	0.13915
24013	2460600000	Commercial & Consumer Products - Adhesives and Sealants			0.08523	1.01909	POP			0.08686	VOC	15.00%	C&C Products PH III & IV	0.01303	0.00000	0.00000	0.07383
24013	2460800000	Commercial & Consumer Products -			0.28117	1.01909	POP			0.28654	VOC	15.00%	C&C Product	0.04298	0.00000	0.00000	0.24356

State County FIPs Code	SCC (AMS)	Emission Process Description	CO	NOX	VOC	GF 2023	Basis	2023 CO	2023 NOX	2023 VOC	Pollutant Controlled	Control Factor (CF)	Control Program	Reductions	2023 Controlled CO Inv	2023 Controlled NOx Inv	2023 Controlled VOC Inv
		FIFRA - Regulated Products															
24013	2460900000	Commercial & Consumer Products - Miscellaneous Products			0.01160	1.01909	POP			0.01182	VOC	15.00%	s PH III & IV C&C Product s PH III & IV	0.00177	0.00000	0.00000	0.01005
24013	2461020000	Misc. Asphalt Application			0.03125	1.01909	POP			0.03185					0.00000	0.00000	0.03185
24013	2461021000	Cutback Asphalt Application			0.01429	1.01909	POP			0.01457					0.00000	0.00000	0.01457
24013	2461022000	Emissions from emulsified asphalt.			0.02384	1.01909	POP			0.02429					0.00000	0.00000	0.02429
24013	2461023000	Emissions from Asphalt Roofing.			0.04132	1.01909	POP			0.04211					0.00000	0.00000	0.04211
24013	2461800001	Emissions from Commercial pesticide surface application			0.10984	1.00000	NG			0.10984					0.00000	0.00000	0.10984
24013	2461800002	Emissions from Commercial pesticide soil application			0.19206	1.00000	NG			0.19206					0.00000	0.00000	0.19206
24013	2501011011	Portable Fuel Containers: Residential - Permeation			0.00759	1.01909	POP			0.00773					0.00000	0.00000	0.00773
24013	2501011012	Portable Fuel Containers: Residential - Evaporation (including Diurnal)			0.06552	1.01909	POP			0.06677					0.00000	0.00000	0.06677
24013	2501011013	Portable Fuel Containers: Residential - Transport			0.00360	1.01909	POP			0.00366					0.00000	0.00000	0.00366
24013	2501012011	Portable Fuel Containers: Commercial - Permeation			0.00129	1.01909	POP			0.00131					0.00000	0.00000	0.00131
24013	2501012012	Portable Fuel Containers: Commercial - Evaporation (Including Diurnal)			0.01694	1.01909	POP			0.01726					0.00000	0.00000	0.01726
24013	2501012013	Portable Fuel Containers:			0.25710	1.01909	POP			0.26201					0.00000	0.00000	0.26201

State County FIPs Code	SCC (AMS)	Emission Process Description	CO	NOX	VOC	GF 2023	Basis	2023 CO	2023 NOX	2023 VOC	Pollutant Controlled	Control Factor (CF)	Control Program	Reductions	2023 Controlled CO Inv	2023 Controlled NOx Inv	2023 Controlled VOC Inv
		Commercial - Transport															
24013	2501060051	Gasoline Marketing - Tank Truck Unloading - Submerged Filling			0.08485	1.04918	VMT			0.08903					0.00000	0.00000	0.08903
24013	2501060053	Gasoline Marketing - Tank Truck Unloading - Balanced Submerged Filling			0.03526	1.04918	VMT			0.03699					0.00000	0.00000	0.03699
24013	2501060201	Emissions from underground tank breathing.			0.12915	1.04918	VMT			0.13550					0.00000	0.00000	0.13550
24013	2501080050	AvGas Stage I Aircraft Refueling.			0.00492	1.04948	EMP			0.00516					0.00000	0.00000	0.00516
24013	2501080100	AvGas Stage II Aircraft Refueling.			0.00272	1.04948	EMP			0.00285					0.00000	0.00000	0.00285
24013	2505030120	Emissions from tank trucks in transit.			0.01048	1.04918	VMT			0.01099					0.00000	0.00000	0.01099
24013	2610000100	Open Burning of Yard Waste - Leaf Species Unspecified	0.00000	0.00000	0.00000	1.03818	HSE	0.00000	0.00000	0.00000					0.00000	0.00000	0.00000
24013	2610000400	Open Burning of Yard Waste - Brush Species Unspecified	0.00000	0.00000	0.00000	1.03818	HSE	0.00000	0.00000	0.00000					0.00000	0.00000	0.00000
24013	2610000500	Emissions from the Open Burning of Land Clearing Debris	2.13040	0.06303	0.14623	1.03818	HSE	2.21174	0.06544	0.15181					2.21174	0.06544	0.15181
24013	2610030000	Open Burning of Residential Household Waste	0.01031	0.00073	0.00104	1.03818	HSE	0.01070	0.00076	0.00108					0.01070	0.00076	0.00108
24013	2620030000	Emissions from solid waste landfills.			0.00741	1.01909	POP			0.00756					0.00000	0.00000	0.00756
24013	2630020000	Emissions from POTWs.			0.00516	1.03818	HSE			0.00536					0.00000	0.00000	0.00536
24013	2660000000	Emissions from soil/groundwater remediation of LUST sites.			0.00805	1.00000	NG			0.00805					0.00000	0.00000	0.00805
24013	2805002000	BEEF			0.01214	1.00000	NG			0.01214					0.00000	0.00000	0.01214
24013	2805007100	LAYERS			0.03511	1.00000	NG			0.03511					0.00000	0.00000	0.03511
24013	2805009100	BROILERS			0.00001	1.00000	NG			0.00001					0.00000	0.00000	0.00001

State County FIPs Code	SCC (AMS)	Emission Process Description	CO	NOX	VOC	GF 2023	Basis	2023 CO	2023 NOX	2023 VOC	Pollutant Controlled	Control Factor (CF)	Control Program	Reductions	2023 Controlled CO Inv	2023 Controlled NOx Inv	2023 Controlled VOC Inv
24013	2805010100	TURKEY			0.00002	1.00000	NG			0.00002					0.00000	0.00000	0.00002
24013	2805018000	DAIRY			0.07480	1.00000	NG			0.07480					0.00000	0.00000	0.07480
24013	2805025000	SWINE			0.00208	1.00000	NG			0.00208					0.00000	0.00000	0.00208
24013	2805035000	HORSES			0.00868	1.00000	NG			0.00868					0.00000	0.00000	0.00868
24013	2805040000	SHEEP			0.00247	1.00000	NG			0.00247					0.00000	0.00000	0.00247
24013	2805045000	GOATS			0.00023	1.00000	NG			0.00023					0.00000	0.00000	0.00023
24013	2810001001	wildfire/smodering	0.00037	0.00000	0.00009	1.00000	NG	0.00037	0.00000	0.00009					0.00037	0.00000	0.00009
24013	2810001002	wildfire/flaming	0.00214	0.00005	0.00051	1.00000	NG	0.00214	0.00005	0.00051					0.00214	0.00005	0.00051
24013	2810030000	Emissions from structural fires.			0.00219	1.01909	POP			0.00223					0.00000	0.00000	0.00223
24013	2810050000	Emissions from motor vehicle fires.	0.00270	0.00009	0.00069	1.01909	POP	0.00275	0.00009	0.00070					0.00275	0.00009	0.00070
24013	2810060100	Human Cremation	0.00233	0.00106	0.00055	1.01909	POP	0.00237	0.00108	0.00056					0.00237	0.00108	0.00056
24013	2830000000	Emissions from catastrophic/accidenta l releases/oil spills.			0.00038	1.00000	NG			0.00038					0.00000	0.00000	0.00038
24013 Total			2.92194	0.59485	4.80951			3.03607	0.62182	4.94256				0.18111	3.03607	0.62182	4.76145
24025	2102004001	ICI_Oil	0.00055	0.00221	0.00002	1.12525	EMP	0.00062	0.00248	0.00002					0.00062	0.00248	0.00002
24025	2102004002	ICI_Oil	0.00956	0.04440	0.00309	1.12525	EMP	0.01075	0.04996	0.00347					0.01075	0.04996	0.00347
24025	2102005000	ICI_Oil	0.00005	0.00054	0.00000	1.12525	EMP	0.00005	0.00060	0.00000					0.00005	0.00060	0.00000
24025	2102006000	ICI_NG	0.06971	0.08299	0.00456	1.12525	EMP	0.07845	0.09339	0.00514					0.07845	0.09339	0.00514
24025	2102007000	ICI_Other	0.00010	0.00018	0.00001	1.12525	EMP	0.00011	0.00020	0.00001					0.00011	0.00020	0.00001
24025	2102008000	ICI_Biomass	0.27931	0.10242	0.00791	1.12525	EMP	0.31430	0.11524	0.00891					0.31430	0.11524	0.00891
24025	2102011000	ICI_Oil	0.00002	0.00010	0.00000	1.12525	EMP	0.00003	0.00011	0.00000					0.00003	0.00011	0.00000
24025	2103004001	Emissions from commercial and institutional distillate oil combustion.	0.00011	0.00046	0.00001	1.12525	EMP	0.00013	0.00051	0.00001					0.00013	0.00052	0.00001
24025	2103004002	Emissions from commercial and institutional distillate oil combustion.	0.00016	0.00073	0.00005	1.12525	EMP	0.00018	0.00082	0.00006					0.00018	0.00082	0.00006

State County FIPs Code	SCC (AMS)	Emission Process Description	CO	NOX	VOC	GF 2023	Basis	2023 CO	2023 NOX	2023 VOC	Pollutant Controlled	Control Factor (CF)	Control Program	Reductions	2023 Controlled CO Inv	2023 Controlled NOx Inv	2023 Controlled VOC Inv
24025	2103005000	Emissions from commercial and institutional residual oil combustion.	0.00000	0.00002	0.00000	1.12525	EMP	0.00000	0.00002	0.00000					0.00000	0.00002	0.00000
24025	2103006000	Emissions from commercial & institutional natural gas combustion.	0.18684	0.22243	0.01223	1.12525	EMP	0.21024	0.25028	0.01377					0.21024	0.25028	0.01377
24025	2103007000	Emissions from commercial and institutional LPG combustion.	0.00628	0.01121	0.00041	1.12525	EMP	0.00707	0.01262	0.00046					0.00707	0.01262	0.00046
24025	2103008000	ICI_Biomass	0.00205	0.00075	0.00006	1.12525	EMP	0.00231	0.00085	0.00007					0.00231	0.00085	0.00007
24025	2103011000	Emissions from commercial/institutional kerosene combustion.	0.00000	0.00002	0.00000	1.12525	EMP	0.00000	0.00002	0.00000					0.00000	0.00002	0.00000
24025	2104004000	Emissions from residential distillate oil combustion.	0.00158	0.00569	0.00023	1.05638	HSE	0.00167	0.00601	0.00024					0.00167	0.00601	0.00024
24025	2104006000	Emissions from residential natural gas combustion.	0.09504	0.22335	0.01307	1.05638	HSE	0.10040	0.23594	0.01381					0.10040	0.23594	0.01381
24025	2104007000	Emissions from residential LPG combustion.	0.02024	0.07137	0.00278	1.05638	HSE	0.02138	0.07539	0.00294					0.02138	0.07539	0.00294
24025	2104008100	Fireplace: general	0.00942	0.00016	0.00119	1.05638	HSE	0.00995	0.00017	0.00126					0.00995	0.00017	0.00126
24025	2104008210	Woodstove: fireplace inserts; non EPA-certified	0.00584	0.00007	0.00134	1.05638	HSE	0.00617	0.00007	0.00142					0.00617	0.00007	0.00142
24025	2104008220	Woodstove: fireplace inserts; EPA-certified; non-catalytic	0.00234	0.00004	0.00020	1.05638	HSE	0.00247	0.00004	0.00021					0.00247	0.00004	0.00021
24025	2104008230	Woodstove: fireplace inserts; EPA-certified; catalytic	0.00051	0.00001	0.00007	1.05638	HSE	0.00053	0.00001	0.00008					0.00053	0.00001	0.00008
24025	2104008310	Woodstove: freestanding, non-EPA certified	0.02396	0.00029	0.00550	1.05638	HSE	0.02531	0.00031	0.00581					0.02531	0.00031	0.00581
24025	2104008320	Woodstove: freestanding, EPA certified, non-catalytic	0.01812	0.00029	0.00154	1.05638	HSE	0.01915	0.00031	0.00163					0.01915	0.00031	0.00163

State County FIPs Code	SCC (AMS)	Emission Process Description	CO	NOX	VOC	GF 2023	Basis	2023 CO	2023 NOX	2023 VOC	Pollutant Controlled	Control Factor (CF)	Control Program	Reductions	2023 Controlled CO Inv	2023 Controlled NOx Inv	2023 Controlled VOC Inv
24025	2104008330	Woodstove: freestanding, EPA certified, catalytic	0.00896	0.00017	0.00129	1.05638	HSE	0.00946	0.00018	0.00136					0.00946	0.00018	0.00136
24025	2104008400	Woodstove: pellet- fired, general	0.00070	0.00017	0.00010	1.05638	HSE	0.00074	0.00018	0.00010					0.00074	0.00018	0.00010
24025	2104008510	Furnace: Indoor, cordwood-fired, non- EPA certified	0.00087	0.00001	0.00006	1.05638	HSE	0.00092	0.00001	0.00006					0.00092	0.00001	0.00006
24025	2104008610	Hydronic heater: outdoor	0.01016	0.00006	0.00190	1.05638	HSE	0.01073	0.00006	0.00201					0.01073	0.00006	0.00201
24025	2104008700	Outdoor wood burning device, NEC	0.00000	0.00000	0.00000	1.05638	HSE	0.00000	0.00000	0.00000					0.00000	0.00000	0.00000
24025	2104009000	Total: All Combustor Types	0.00108	0.00007	0.00034	1.05638	HSE	0.00114	0.00007	0.00036					0.00114	0.00007	0.00036
24025	2104011000	Emissions from residential kerosene combustion.	0.00004	0.00013	0.00001	1.05638	HSE	0.00004	0.00014	0.00001					0.00004	0.00014	0.00001
24025	2201000062	Emissions from gasoline marketing refueling.			0.25396	1.04918	VMT			0.26645					0.00000	0.00000	0.26645
24025	2302002100	Conveyorized Charbroiling	0.04064		0.01217	1.04069	POP	0.04229		0.01266					0.04229	0.00000	0.01266
24025	2302002200	Under-fired Charbroiling	0.11873		0.03629	1.04069	POP	0.12356		0.03777					0.12356	0.00000	0.03777
24025	2302003000	Deep Fat Frying			0.00671	1.04069	POP			0.00698					0.00000	0.00000	0.00698
24025	2302003100	Flat Griddle Frying	0.00927		0.00449	1.04069	POP	0.00964		0.00467					0.00964	0.00000	0.00467
24025	2302003200	Clamshell Griddle Frying			0.00024	1.04069	POP			0.00025					0.00000	0.00000	0.00025
24025	2302050000	Emissions from bakeries.			0.01333	1.04069	POP			0.01387					0.00000	0.00000	0.01387
24025	2302070001	Emissions from small breweries			0.00016	1.04069	POP			0.00016					0.00000	0.00000	0.00016
24025	2302070005	Emissions from small wineries			0.00004	1.04069	POP			0.00004					0.00000	0.00000	0.00004
24025	2401001000	Emissions from ALL SOLVENT TYPES architectural surface coatings.			0.77142	1.04069	POP			0.80281					0.00000	0.00000	0.80281
24025	2401005000	Emissions from automobile refinishing.			0.25211	1.12525	EMP			0.28369					0.00000	0.00000	0.28369

State County FIPs Code	SCC (AMS)	Emission Process Description	CO	NOX	VOC	GF 2023	Basis	2023 CO	2023 NOX	2023 VOC	Pollutant Controlled	Control Factor (CF)	Control Program	Reductions	2023 Controlled CO Inv	2023 Controlled NOx Inv	2023 Controlled VOC Inv
24025	2401008000	Emissions from traffic paints.			0.03762	1.04069	POP			0.03915					0.00000	0.00000	0.03915
24025	2401015000	Industrial surface coatings of finished wood product manufacturing.			0.00062	1.12525	EMP			0.00069					0.00000	0.00000	0.00069
24025	2401020000	Emissions from surface coatings of wood furniture and fixtures.			0.01218	1.12525	EMP			0.01370					0.00000	0.00000	0.01370
24025	2401040000	Emissions from surface coatings of metal cans.			1.35292	1.12525	EMP			1.52237					0.00000	0.00000	1.52237
24025	2401070000	Emissions from surface coatings of Motor Vehicle.			0.01507	1.12525	EMP			0.01696					0.00000	0.00000	0.01696
24025	2401090000	Emissions from surface coatings - misc. manufacturing.			0.02066	1.12525	EMP			0.02325					0.00000	0.00000	0.02325
24025	2401100000	Emissions from surface coatings for industrial maintenance.			0.28140	1.12525	EMP			0.31665					0.00000	0.00000	0.31665
24025	2401200000	Emissions from surface coatings - other categories.			0.28140	1.12525	EMP			0.31665					0.00000	0.00000	0.31665
24025	2415000000	Emissions from Cleaning Products: Industrial and Institutional Cleaning.			0.42275	1.12525	EMP			0.47570					0.00000	0.00000	0.47570
24025	2420000000	Dry Cleaners			0.09606	1.04069	POP			0.09997					0.00000	0.00000	0.09997
24025	2425000000	Emissions from Screen & Plateless printing			0.02711	1.04069	POP			0.02821					0.00000	0.00000	0.02821
24025	2425010000	Emissions from Offset Lithography printing			0.11799	1.04069	POP			0.12279					0.00000	0.00000	0.12279
24025	2425020000	Emissions from Letterpress printing			0.05021	1.04069	POP			0.05225					0.00000	0.00000	0.05225
24025	2425030000	Emissions from Rotogravure printing			0.05603	1.04069	POP			0.05831					0.00000	0.00000	0.05831
24025	2425040000	Emissions from Flexography printing			0.06416	1.04069	POP			0.06677					0.00000	0.00000	0.06677
24025	2440000000	Emissions from industrial adhesives.			0.15082	1.04069	POP			0.15696					0.00000	0.00000	0.15696
24025	2460100000	Commercial & Consumer Products -			0.52396	1.04069	POP			0.54528	VOC	15.00%	C&C Product	0.08179	0.00000	0.00000	0.46349

State County FIPs Code	SCC (AMS)	Emission Process Description	CO	NOX	VOC	GF 2023	Basis	2023 CO	2023 NOX	2023 VOC	Pollutant Controlled	Control Factor (CF)	Control Program	Reductions	2023 Controlled CO Inv	2023 Controlled NOx Inv	2023 Controlled VOC Inv
		Personal Care Products															
24025	2460200000	Commercial & Consumer Products - Household Products			0.15746	1.04069	POP			0.16387	VOC	15.00%	s PH III & IV C&C Products PH III & IV	0.02458	0.00000	0.00000	0.13929
24025	2460400000	Commercial & Consumer Products - Automotive Aftermarket Products			0.28608	1.04069	POP			0.29772	VOC	15.00%	s PH III & IV C&C Products PH III & IV	0.04466	0.00000	0.00000	0.25306
24025	2460500000	Commercial & Consumer Products - Coatings and Related Products			0.24052	1.04069	POP			0.25031	VOC	15.00%	s PH III & IV C&C Products PH III & IV	0.03755	0.00000	0.00000	0.21277
24025	2460600000	Commercial & Consumer Products - Adhesives and Sealants			0.12762	1.04069	POP			0.13281	VOC	15.00%	s PH III & IV C&C Products PH III & IV	0.01992	0.00000	0.00000	0.11289
24025	2460800000	Commercial & Consumer Products - FIFRA - Regulated Products			0.42100	1.04069	POP			0.43813	VOC	15.00%	s PH III & IV C&C Products PH III & IV	0.06572	0.00000	0.00000	0.37241
24025	2460900000	Commercial & Consumer Products - Miscellaneous Products			0.01737	1.04069	POP			0.01808	VOC	15.00%	s PH III & IV C&C Products PH III & IV	0.00271	0.00000	0.00000	0.01537
24025	2461020000	Misc. Asphalt Application			0.04679	1.04069	POP			0.04870					0.00000	0.00000	0.04870
24025	2461021000	Cutback Asphalt Application			0.02140	1.04069	POP			0.02227					0.00000	0.00000	0.02227
24025	2461022000	Emissions from emulsified asphalt.			0.03569	1.04069	POP			0.03715					0.00000	0.00000	0.03715
24025	2461023000	Emissions from Asphalt Roofing.			0.06187	1.04069	POP			0.06438					0.00000	0.00000	0.06438
24025	2461800001	Emissions from Commercial pesticide surface application			0.01035	1.00000	NG			0.01035					0.00000	0.00000	0.01035
24025	2461800002	Emissions from Commercial pesticide soil application			0.03138	1.00000	NG			0.03138					0.00000	0.00000	0.03138
24025	2501011011	Portable Fuel Containers: Residential -			0.00920	1.04069	POP			0.00958					0.00000	0.00000	0.00958

State County FIPs Code	SCC (AMS)	Emission Process Description	CO	NOX	VOC	GF 2023	Basis	2023 CO	2023 NOX	2023 VOC	Pollutant Controlled	Control Factor (CF)	Control Program	Reductions	2023 Controlled CO Inv	2023 Controlled NOx Inv	2023 Controlled VOC Inv
		Permeation															
24025	2501011012	Portable Fuel Containers: Residential - Evaporation (including Diurnal)			0.07949	1.04069	POP			0.08272					0.00000	0.00000	0.08272
24025	2501011013	Portable Fuel Containers: Residential - Transport			0.00436	1.04069	POP			0.00454					0.00000	0.00000	0.00454
24025	2501012011	Portable Fuel Containers: Commercial - Permeation			0.00143	1.04069	POP			0.00149					0.00000	0.00000	0.00149
24025	2501012012	Portable Fuel Containers: Commercial - Evaporation (Including Diurnal)			0.01875	1.04069	POP			0.01951					0.00000	0.00000	0.01951
24025	2501012013	Portable Fuel Containers: Commercial - Transport			0.28453	1.04069	POP			0.29611					0.00000	0.00000	0.29611
24025	2501060051	Gasoline Marketing - Tank Truck Unloading - Submerged Filling			0.11803	1.04918	VMT			0.12384					0.00000	0.00000	0.12384
24025	2501060053	Gasoline Marketing - Tank Truck Unloading - Balanced Submerged Filling			0.04905	1.04918	VMT			0.05146					0.00000	0.00000	0.05146
24025	2501060201	Emissions from underground tank breathing.			0.17965	1.04918	VMT			0.18849					0.00000	0.00000	0.18849
24025	2501080050	AvGas Stage I Aircraft Refueling.			0.00331	1.12525	EMP			0.00372					0.00000	0.00000	0.00372
24025	2501080100	AvGas Stage II Aircraft Refueling.			0.00183	1.12525	EMP			0.00206					0.00000	0.00000	0.00206
24025	2505030120	Emissions from tank trucks in transit.			0.01483	1.04918	VMT			0.01556					0.00000	0.00000	0.01556
24025	2610000500	Emissions from the Open Burning of Land Clearing Debris	5.27210	0.15598	0.36187	1.05638	HSE	5.56932	0.16477	0.38227					5.56932	0.16477	0.38227
24025	2620030000	Emissions from solid			0.00238	1.04069	POP			0.00247					0.00000	0.00000	0.00247

State County FIPs Code	SCC (AMS)	Emission Process Description	CO	NOX	VOC	GF 2023	Basis	2023 CO	2023 NOX	2023 VOC	Pollutant Controlled	Control Factor (CF)	Control Program	Reductions	2023 Controlled CO Inv	2023 Controlled NOx Inv	2023 Controlled VOC Inv
		waste landfills.															
24025	2630020000	Emissions from POTWs.			0.00913	1.05638	HSE			0.00964					0.00000	0.00000	0.00964
24025	2660000000	Emissions from soil/groundwater remediation of LUST sites.			0.01036	1.00000	NG			0.01036					0.00000	0.00000	0.01036
24025	2805002000	BEEF			0.00645	1.00000	NG			0.00645					0.00000	0.00000	0.00645
24025	2805007100	LAYERS			0.00095	1.00000	NG			0.00095					0.00000	0.00000	0.00095
24025	2805009100	BROILERS			0.00039	1.00000	NG			0.00039					0.00000	0.00000	0.00039
24025	2805010100	TURKEY			0.00007	1.00000	NG			0.00007					0.00000	0.00000	0.00007
24025	2805018000	DAIRY			0.03473	1.00000	NG			0.03473					0.00000	0.00000	0.03473
24025	2805025000	SWINE			0.00038	1.00000	NG			0.00038					0.00000	0.00000	0.00038
24025	2805035000	HORSES			0.00532	1.00000	NG			0.00532					0.00000	0.00000	0.00532
24025	2805040000	SHEEP			0.00229	1.00000	NG			0.00229					0.00000	0.00000	0.00229
24025	2805045000	GOATS			0.00031	1.00000	NG			0.00031					0.00000	0.00000	0.00031
24025	2810001001	wildfire/smoldering	0.00259	0.00001	0.00060	1.00000	NG	0.00259	0.00001	0.00060					0.00259	0.00001	0.00060
24025	2810001002	wildfire/flaming	0.02659	0.00065	0.00635	1.00000	NG	0.02659	0.00065	0.00635					0.02659	0.00065	0.00635
24025	2810030000	Emissions from structural fires.			0.00288	1.04069	POP			0.00300					0.00000	0.00000	0.00300
24025	2810050000	Emissions from motor vehicle fires.	0.00321	0.00010	0.00082	1.04069	POP	0.00334	0.00011	0.00086					0.00334	0.00011	0.00086
24025	2810060100	Human Cremation	0.00238	0.00077	0.00000	1.04069	POP	0.00248	0.00080	0.00000					0.00248	0.00080	0.00000
24025	2810060200	Animal Cremation	0.00011	0.00003		1.00000	NG	0.00011	0.00003						0.00011	0.00003	0.00000
24025	2811015001	prescribed/smoldering	2.06187	0.00891	0.48109	1.00000	NG	2.06187	0.00891	0.48109					2.06187	0.00891	0.48109
24025	2811015002	prescribed/flaming	4.39396	0.06984	1.03943	1.00000	NG	4.39396	0.06984	1.03943					4.39396	0.06984	1.03943
24025	2830000000	Emissions from catastrophic/accidenta l releases/oil spills.			0.00372	1.00000	NG			0.00372					0.00000	0.00000	0.00372
24025 Total			12.6850 5	1.00662	9.11138			13.0700 5	1.09114	9.65315				0.27693	13.0700 5	1.09114	9.37622
24027	2102004001	ICI_Oil	0.00097	0.00388	0.00004	1.09998	EMP	0.00107	0.00427	0.00004					0.00107	0.00427	0.00004

State County FIPs Code	SCC (AMS)	Emission Process Description	CO	NOX	VOC	GF 2023	Basis	2023 CO	2023 NOX	2023 VOC	Pollutant Controlled	Control Factor (CF)	Control Program	Reductions	2023 Controlled CO Inv	2023 Controlled NOx Inv	2023 Controlled VOC Inv
24027	2102004002	ICI_Oil	0.01680	0.07807	0.00543	1.09998	EMP	0.01848	0.08588	0.00597					0.01848	0.08588	0.00597
24027	2102005000	ICI_Oil	0.00009	0.00094	0.00000	1.09998	EMP	0.00009	0.00104	0.00001					0.00009	0.00104	0.00001
24027	2102006000	ICI_NG	0.12259	0.14594	0.00803	1.09998	EMP	0.13484	0.16053	0.00883					0.13484	0.16053	0.00883
24027	2102007000	ICI_Other	0.00018	0.00032	0.00001	1.09998	EMP	0.00020	0.00035	0.00001					0.00020	0.00035	0.00001
24027	2102008000	ICI_Biomass	0.49115	0.18009	0.01392	1.09998	EMP	0.54025	0.19809	0.01531					0.54025	0.19809	0.01531
24027	2102011000	ICI_Oil	0.00004	0.00017	0.00000	1.09998	EMP	0.00005	0.00019	0.00000					0.00005	0.00019	0.00000
24027	2103004001	Emissions from commercial and institutional distillate oil combustion.	0.00030	0.00119	0.00002	1.09998	EMP	0.00033	0.00130	0.00002					0.00033	0.00130	0.00002
24027	2103004002	Emissions from commercial and institutional distillate oil combustion.	0.00041	0.00188	0.00013	1.09998	EMP	0.00045	0.00207	0.00014					0.00045	0.00207	0.00014
24027	2103005000	Emissions from commercial and institutional residual oil combustion.	0.00000	0.00005	0.00000	1.09998	EMP	0.00000	0.00005	0.00000					0.00000	0.00005	0.00000
24027	2103006000	Emissions from commercial & institutional natural gas combustion.	0.48398	0.57617	0.03169	1.09998	EMP	0.53237	0.63377	0.03486					0.53237	0.63377	0.03486
24027	2103007000	Emissions from commercial and institutional LPG combustion.	0.01627	0.02905	0.00106	1.09998	EMP	0.01790	0.03195	0.00117					0.01790	0.03195	0.00117
24027	2103008000	ICI_Biomass	0.00532	0.00195	0.00015	1.09998	EMP	0.00585	0.00214	0.00017					0.00585	0.00214	0.00017
24027	2103011000	Emissions from commercial/institutional kerosene combustion.	0.00001	0.00004	0.00000	1.09998	EMP	0.00001	0.00005	0.00000					0.00001	0.00005	0.00000
24027	2104004000	Emissions from residential distillate oil combustion.	0.00041	0.00149	0.00006	1.09382	HSE	0.00045	0.00163	0.00006					0.00045	0.00163	0.00006
24027	2104006000	Emissions from residential natural gas combustion.	0.13807	0.32447	0.01898	1.09382	HSE	0.15103	0.35491	0.02077					0.15103	0.35491	0.02077
24027	2104007000	Emissions from residential LPG	0.00793	0.02797	0.00109	1.09382	HSE	0.00868	0.03059	0.00119					0.00868	0.03059	0.00119

State County FIPs Code	SCC (AMS)	Emission Process Description	CO	NOX	VOC	GF 2023	Basis	2023 CO	2023 NOX	2023 VOC	Pollutant Controlled	Control Factor (CF)	Control Program	Reductions	2023 Controlled CO Inv	2023 Controlled NOx Inv	2023 Controlled VOC Inv
		combustion.															
24027	2104008100	Fireplace: general	0.00821	0.00014	0.00104	1.09382	HSE	0.00898	0.00016	0.00114					0.00898	0.00016	0.00114
24027	2104008210	Woodstove: fireplace inserts; non EPA- certified	0.00509	0.00006	0.00117	1.09382	HSE	0.00557	0.00007	0.00128					0.00557	0.00007	0.00128
24027	2104008220	Woodstove: fireplace inserts; EPA-certified; non-catalytic	0.00204	0.00003	0.00017	1.09382	HSE	0.00223	0.00004	0.00019					0.00223	0.00004	0.00019
24027	2104008230	Woodstove: fireplace inserts; EPA-certified; catalytic	0.00044	0.00001	0.00006	1.09382	HSE	0.00048	0.00001	0.00007					0.00048	0.00001	0.00007
24027	2104008310	Woodstove: freestanding, non-EPA certified	0.01626	0.00020	0.00373	1.09382	HSE	0.01779	0.00022	0.00408					0.01779	0.00022	0.00408
24027	2104008320	Woodstove: freestanding, EPA certified, non-catalytic	0.01230	0.00020	0.00105	1.09382	HSE	0.01346	0.00022	0.00115					0.01346	0.00022	0.00115
24027	2104008330	Woodstove: freestanding, EPA certified, catalytic	0.00608	0.00012	0.00087	1.09382	HSE	0.00665	0.00013	0.00096					0.00665	0.00013	0.00096
24027	2104008400	Woodstove: pellet- fired, general	0.00048	0.00011	0.00007	1.09382	HSE	0.00052	0.00012	0.00007					0.00052	0.00012	0.00007
24027	2104008510	Furnace: Indoor, cordwood-fired, non- EPA certified	0.00044	0.00000	0.00003	1.09382	HSE	0.00048	0.00000	0.00003					0.00048	0.00000	0.00003
24027	2104008610	Hydronic heater: outdoor	0.00550	0.00003	0.00103	1.09382	HSE	0.00601	0.00003	0.00113					0.00601	0.00003	0.00113
24027	2104008700	Outdoor wood burning device, NEC	0.00000	0.00000	0.00000	1.09382	HSE	0.00000	0.00000	0.00000					0.00000	0.00000	0.00000
24027	2104009000	Total: All Combustor Types	0.00128	0.00008	0.00040	1.09382	HSE	0.00140	0.00009	0.00044					0.00140	0.00009	0.00044
24027	2104011000	Emissions from residential kerosene combustion.	0.00001	0.00003	0.00000	1.09382	HSE	0.00001	0.00004	0.00000					0.00001	0.00004	0.00000
24027	2201000062	Emissions from gasoline marketing refueling.			0.35932	1.04918	VMT			0.37699					0.00000	0.00000	0.37699
24027	2302002100	Conveyorized Charbroiling	0.06315		0.01891	1.06906	POP	0.06751		0.02022					0.06751	0.00000	0.02022
24027	2302002200	Under-fired Charbroiling	0.18356		0.05611	1.06906	POP	0.19623		0.05999					0.19623	0.00000	0.05999

State County FIPs Code	SCC (AMS)	Emission Process Description	CO	NOX	VOC	GF 2023	Basis	2023 CO	2023 NOX	2023 VOC	Pollutant Controlled	Control Factor (CF)	Control Program	Reductions	2023 Controlled CO Inv	2023 Controlled NOx Inv	2023 Controlled VOC Inv
24027	2302003000	Deep Fat Frying			0.00977	1.06906	POP			0.01044					0.00000	0.00000	0.01044
24027	2302003100	Flat Griddle Frying	0.01489		0.00721	1.06906	POP	0.01592		0.00771					0.01592	0.00000	0.00771
24027	2302003200	Clamshell Griddle Frying			0.00035	1.06906	POP			0.00038					0.00000	0.00000	0.00038
24027	2302050000	Emissions from bakeries.			0.05151	1.06906	POP			0.05507					0.00000	0.00000	0.05507
24027	2302070001	Emissions from small breweries			0.00165	1.06906	POP			0.00176					0.00000	0.00000	0.00176
24027	2401001000	Emissions from ALL SOLVENT TYPES architectural surface coatings.			0.97485	1.06906	POP			1.04218					0.00000	0.00000	1.04218
24027	2401005000	Emissions from automobile refinishing.			0.29591	1.09998	EMP			0.32549					0.00000	0.00000	0.32549
24027	2401008000	Emissions from traffic paints.			0.05370	1.06906	POP			0.05741					0.00000	0.00000	0.05741
24027	2401020000	Emissions from surface coatings of wood furniture and fixtures.			0.06707	1.09998	EMP			0.07377					0.00000	0.00000	0.07377
24027	2401025000	Emissions from surface coatings of metal furniture & fixtures.			0.01485	1.09998	EMP			0.01633					0.00000	0.00000	0.01633
24027	2401065000	Emissions from Electronic and Other Electrical Coatings.			0.00095	1.09998	EMP			0.00104					0.00000	0.00000	0.00105
24027	2401090000	Emissions from surface coatings - misc. manufacturing.			0.04045	1.09998	EMP			0.04450					0.00000	0.00000	0.04450
24027	2401100000	Emissions from surface coatings for industrial maintenance.			0.35561	1.09998	EMP			0.39117					0.00000	0.00000	0.39117
24027	2401200000	Emissions from surface coatings - other categories.			0.35561	1.09998	EMP			0.39117					0.00000	0.00000	0.39117
24027	2415000000	Emissions from Cleaning Products: Industrial and Institutional Cleaning.			0.56073	1.09998	EMP			0.61679					0.00000	0.00000	0.61679
24027	2420000000	Dry Cleaners			0.28537	1.06906	POP			0.30508					0.00000	0.00000	0.30508
24027	2425000000	Emissions from Screen & Plateless printing			0.03426	1.06906	POP			0.03663					0.00000	0.00000	0.03663

State County FIPs Code	SCC (AMS)	Emission Process Description	CO	NOX	VOC	GF 2023	Basis	2023 CO	2023 NOX	2023 VOC	Pollutant Controlled	Control Factor (CF)	Control Program	Reductions	2023 Controlled CO Inv	2023 Controlled NOx Inv	2023 Controlled VOC Inv
24027	2425010000	Emissions from Offset Lithography printing			0.14910	1.06906	POP			0.15940					0.00000	0.00000	0.15940
24027	2425020000	Emissions from Letterpress printing			0.06345	1.06906	POP			0.06783					0.00000	0.00000	0.06783
24027	2425030000	Emissions from Rotogravure printing			0.07081	1.06906	POP			0.07570					0.00000	0.00000	0.07570
24027	2425040000	Emissions from Flexography printing			0.08108	1.06906	POP			0.08668					0.00000	0.00000	0.08668
24027	2440000000	Emissions from industrial adhesives.			0.19060	1.06906	POP			0.20376					0.00000	0.00000	0.20376
24027	2460100000	Commercial & Consumer Products - Personal Care Products			0.66213	1.06906	POP			0.70786	VOC	15.00%	C&C Products PH III & IV	0.10618	0.00000	0.00000	0.60168
24027	2460200000	Commercial & Consumer Products - Household Products			0.19899	1.06906	POP			0.21273	VOC	15.00%	C&C Products PH III & IV	0.03191	0.00000	0.00000	0.18082
24027	2460400000	Commercial & Consumer Products - Automotive Aftermarket Products			0.36152	1.06906	POP			0.38648	VOC	15.00%	C&C Products PH III & IV	0.05797	0.00000	0.00000	0.32851
24027	2460500000	Commercial & Consumer Products - Coatings and Related Products			0.30395	1.06906	POP			0.32495	VOC	15.00%	C&C Products PH III & IV	0.04874	0.00000	0.00000	0.27620
24027	2460600000	Commercial & Consumer Products - Adhesives and Sealants			0.16128	1.06906	POP			0.17241	VOC	15.00%	C&C Products PH III & IV	0.02586	0.00000	0.00000	0.14655
24027	2460800000	Commercial & Consumer Products - FIFRA - Regulated Products			0.53202	1.06906	POP			0.56876	VOC	15.00%	C&C Products PH III & IV	0.08531	0.00000	0.00000	0.48345
24027	2460900000	Commercial & Consumer Products - Miscellaneous Products			0.02195	1.06906	POP			0.02347	VOC	15.00%	C&C Products PH III & IV	0.00352	0.00000	0.00000	0.01995
24027	2461020000	Misc. Asphalt Application			0.05914	1.06906	POP			0.06322					0.00000	0.00000	0.06322
24027	2461021000	Cutback Asphalt Application			0.02704	1.06906	POP			0.02891					0.00000	0.00000	0.02891

State County FIPs Code	SCC (AMS)	Emission Process Description	CO	NOX	VOC	GF 2023	Basis	2023 CO	2023 NOX	2023 VOC	Pollutant Controlled	Control Factor (CF)	Control Program	Reductions	2023 Controlled CO Inv	2023 Controlled NOx Inv	2023 Controlled VOC Inv
24027	2461022000	Emissions from emulsified asphalt.			0.04511	1.06906	POP			0.04822					0.00000	0.00000	0.04822
24027	2461023000	Emissions from Asphalt Roofing.			0.07818	1.06906	POP			0.08358					0.00000	0.00000	0.08358
24027	2461800001	Emissions from Commercial pesticide surface application			0.08324	1.00000	NG			0.08324					0.00000	0.00000	0.08324
24027	2461800002	Emissions from Commercial pesticide soil application			0.05363	1.00000	NG			0.05363					0.00000	0.00000	0.05363
24027	2501011011	Portable Fuel Containers: Residential - Permeation			0.00923	1.06906	POP			0.00986					0.00000	0.00000	0.00986
24027	2501011012	Portable Fuel Containers: Residential - Evaporation (including Diurnal)			0.07967	1.06906	POP			0.08518					0.00000	0.00000	0.08518
24027	2501011013	Portable Fuel Containers: Residential - Transport			0.00437	1.06906	POP			0.00467					0.00000	0.00000	0.00467
24027	2501012011	Portable Fuel Containers: Commercial - Permeation			0.00163	1.06906	POP			0.00174					0.00000	0.00000	0.00174
24027	2501012012	Portable Fuel Containers: Commercial - Evaporation (Including Diurnal)			0.02135	1.06906	POP			0.02283					0.00000	0.00000	0.02283
24027	2501012013	Portable Fuel Containers: Commercial - Transport			0.32407	1.06906	POP			0.34645					0.00000	0.00000	0.34645
24027	2501060051	Gasoline Marketing - Tank Truck Unloading - Submerged Filling			0.15337	1.04918	VMT			0.16092					0.00000	0.00000	0.16092
24027	2501060053	Gasoline Marketing - Tank Truck Unloading - Balanced Submerged Filling			0.06373	1.04918	VMT			0.06687					0.00000	0.00000	0.06687

State County FIPs Code	SCC (AMS)	Emission Process Description	CO	NOX	VOC	GF 2023	Basis	2023 CO	2023 NOX	2023 VOC	Pollutant Controlled	Control Factor (CF)	Control Program	Reductions	2023 Controlled CO Inv	2023 Controlled NOx Inv	2023 Controlled VOC Inv
24027	2501060201	Emissions from underground tank breathing.			0.23345	1.04918	VMT			0.24493					0.00000	0.00000	0.24493
24027	2501080050	AvGas Stage I Aircraft Refueling.			0.00000	1.09998	EMP			0.00000					0.00000	0.00000	0.00000
24027	2501080100	AvGas Stage II Aircraft Refueling.			0.00000	1.09998	EMP			0.00000					0.00000	0.00000	0.00000
24027	2505030120	Emissions from tank trucks in transit.			0.01711	1.04918	VMT			0.01795					0.00000	0.00000	0.01795
24027	2620030000	Emissions from solid waste landfills.			0.01537	1.06906	POP			0.01643					0.00000	0.00000	0.01643
24027	2630020000	Emissions from POTWs.			0.01022	1.09382	HSE			0.01118					0.00000	0.00000	0.01118
24027	2660000000	Emissions from soil/groundwater remediation of LUST sites.			0.00921	1.00000	NG			0.00921					0.00000	0.00000	0.00921
24027	2805002000	BEEF			0.00193	1.00000	NG			0.00193					0.00000	0.00000	0.00193
24027	2805007100	LAYERS			0.00009	1.00000	NG			0.00009					0.00000	0.00000	0.00009
24027	2805009100	BROILERS			0.00039	1.00000	NG			0.00039					0.00000	0.00000	0.00039
24027	2805010100	TURKEY			0.00211	1.00000	NG			0.00211					0.00000	0.00000	0.00211
24027	2805018000	DAIRY			0.00805	1.00000	NG			0.00805					0.00000	0.00000	0.00805
24027	2805025000	SWINE			0.00036	1.00000	NG			0.00036					0.00000	0.00000	0.00036
24027	2805035000	HORSES			0.00397	1.00000	NG			0.00397					0.00000	0.00000	0.00397
24027	2805040000	SHEEP			0.00073	1.00000	NG			0.00073					0.00000	0.00000	0.00073
24027	2805045000	GOATS			0.00023	1.00000	NG			0.00023					0.00000	0.00000	0.00023
24027	2810001001	wildfire/smoldering	0.00124	0.00001	0.00029	1.00000	NG	0.00124	0.00001	0.00029					0.00124	0.00001	0.00029
24027	2810001002	wildfire/flaming	0.00511	0.00011	0.00122	1.00000	NG	0.00511	0.00011	0.00122					0.00511	0.00011	0.00122
24027	2810030000	Emissions from structural fires.			0.00329	1.06906	POP			0.00351					0.00000	0.00000	0.00351
24027	2810050000	Emissions from motor vehicle fires.	0.00625	0.00020	0.00160	1.06906	POP	0.00668	0.00021	0.00171					0.00668	0.00021	0.00171
24027	2830000000	Emissions from catastrophic/accidenta l releases/oil spills.			0.00031	1.00000	NG			0.00031					0.00000	0.00000	0.00031

State County FIPs Code	SCC (AMS)	Emission Process Description	CO	NOX	VOC	GF 2023	Basis	2023 CO	2023 NOX	2023 VOC	Pollutant Controlled	Control Factor (CF)	Control Program	Reductions	2023 Controlled CO Inv	2023 Controlled NOx Inv	2023 Controlled VOC Inv
24027 Total			1.61684	1.37499	7.74502			1.76831	1.51026	8.30714				0.35950	1.76831	1.51026	7.94764
24510	2102004001	ICI_Oil	0.00109	0.00436	0.00004	1.06063	EMP	0.00116	0.00462	0.00005					0.00116	0.00462	0.00005
24510	2102004002	ICI_Oil	0.01888	0.08772	0.00610	1.06063	EMP	0.02002	0.09304	0.00647					0.02002	0.09304	0.00647
24510	2102005000	ICI_Oil	0.00010	0.00106	0.00001	1.06063	EMP	0.00010	0.00112	0.00001					0.00010	0.00112	0.00001
24510	2102006000	ICI_NG	0.13773	0.16396	0.00902	1.06063	EMP	0.14608	0.17391	0.00956					0.14608	0.17391	0.00956
24510	2102007000	ICI_Other	0.00020	0.00036	0.00001	1.06063	EMP	0.00021	0.00038	0.00001					0.00021	0.00038	0.00001
24510	2102008000	ICI_Biomass	0.55182	0.20233	0.01563	1.06063	EMP	0.58528	0.21460	0.01658					0.58528	0.21460	0.01658
24510	2102011000	ICI_Oil	0.00005	0.00019	0.00000	1.06063	EMP	0.00005	0.00021	0.00000					0.00005	0.00021	0.00000
24510	2103004001	Emissions from commercial and institutional distillate oil combustion.	0.00051	0.00204	0.00003	1.06063	EMP	0.00054	0.00217	0.00004					0.00054	0.00217	0.00004
24510	2103004002	Emissions from commercial and institutional distillate oil combustion.	0.00070	0.00325	0.00023	1.06063	EMP	0.00074	0.00345	0.00024					0.00074	0.00345	0.00024
24510	2103005000	Emissions from commercial and institutional residual oil combustion.	0.00001	0.00008	0.00000	1.06063	EMP	0.00001	0.00009	0.00000					0.00001	0.00009	0.00000
24510	2103006000	Emissions from commercial & institutional natural gas combustion.	0.83477	0.99378	0.05466	1.06063	EMP	0.88539	1.05403	0.05797					0.88539	1.05403	0.05797
24510	2103007000	Emissions from commercial and institutional LPG combustion.	0.02806	0.05011	0.00183	1.06063	EMP	0.02976	0.05314	0.00194					0.02976	0.05314	0.00194
24510	2103008000	ICI_Biomass	0.00917	0.00336	0.00026	1.06063	EMP	0.00973	0.00357	0.00028					0.00973	0.00357	0.00028
24510	2103011000	Emissions from commercial/institutional kerosene combustion.	0.00002	0.00007	0.00000	1.06063	EMP	0.00002	0.00008	0.00000					0.00002	0.00008	0.00000
24510	2104004000	Emissions from residential distillate oil combustion.	0.00096	0.00346	0.00014	1.02651	HSE	0.00099	0.00355	0.00014					0.00099	0.00355	0.00014

State County FIPs Code	SCC (AMS)	Emission Process Description	CO	NOX	VOC	GF 2023	Basis	2023 CO	2023 NOX	2023 VOC	Pollutant Controlled	Control Factor (CF)	Control Program	Reductions	2023 Controlled CO Inv	2023 Controlled NOx Inv	2023 Controlled VOC Inv
24510	2104006000	Emissions from residential natural gas combustion.	0.43225	1.01578	0.05943	1.02651	HSE	0.44371	1.04271	0.06101					0.44371	1.04271	0.06101
24510	2104007000	Emissions from residential LPG combustion.	0.00763	0.02689	0.00105	1.02651	HSE	0.00783	0.02761	0.00107					0.00783	0.02761	0.00107
24510	2104008100	Fireplace: general	0.00834	0.00015	0.00106	1.02651	HSE	0.00856	0.00015	0.00109					0.00856	0.00015	0.00109
24510	2104008210	Woodstove: fireplace inserts; non EPA-certified	0.00517	0.00006	0.00119	1.02651	HSE	0.00531	0.00006	0.00122					0.00531	0.00006	0.00122
24510	2104008220	Woodstove: fireplace inserts; EPA-certified; non-catalytic	0.00207	0.00003	0.00018	1.02651	HSE	0.00213	0.00003	0.00018					0.00213	0.00003	0.00018
24510	2104008230	Woodstove: fireplace inserts; EPA-certified; catalytic	0.00045	0.00001	0.00006	1.02651	HSE	0.00046	0.00001	0.00007					0.00046	0.00001	0.00007
24510	2104008310	Woodstove: freestanding, non-EPA certified	0.00921	0.00011	0.00212	1.02651	HSE	0.00946	0.00011	0.00217					0.00946	0.00011	0.00217
24510	2104008320	Woodstove: freestanding, EPA certified, non-catalytic	0.00697	0.00011	0.00059	1.02651	HSE	0.00715	0.00012	0.00061					0.00715	0.00012	0.00061
24510	2104008330	Woodstove: freestanding, EPA certified, catalytic	0.00345	0.00007	0.00050	1.02651	HSE	0.00354	0.00007	0.00051					0.00354	0.00007	0.00051
24510	2104008400	Woodstove: pellet-fired, general	0.00027	0.00006	0.00004	1.02651	HSE	0.00028	0.00007	0.00004					0.00028	0.00007	0.00004
24510	2104008510	Furnace: Indoor, cordwood-fired, non-EPA certified	0.00005	0.00000	0.00000	1.02651	HSE	0.00005	0.00000	0.00000					0.00005	0.00000	0.00000
24510	2104009000	Total: All Combustor Types	0.00210	0.00013	0.00066	1.02651	HSE	0.00216	0.00013	0.00068					0.00216	0.00013	0.00068
24510	2104011000	Emissions from residential kerosene combustion.	0.00002	0.00008	0.00000	1.02651	HSE	0.00002	0.00008	0.00000					0.00002	0.00008	0.00000
24510	2201000062	Emissions from gasoline marketing refueling.			0.36920	1.04918	VMT			0.38735					0.00000	0.00000	0.38735
24510	2302002100	Conveyorized Charbroiling	0.15316		0.04586	1.01069	POP	0.15480		0.04636				0.15480	0.00000	0.04636	
24510	2302002200	Under-fired Charbroiling	0.41689		0.12744	1.01069	POP	0.42135		0.12881				0.42135	0.00000	0.12881	

State County FIPs Code	SCC (AMS)	Emission Process Description	CO	NOX	VOC	GF 2023	Basis	2023 CO	2023 NOX	2023 VOC	Pollutant Controlled	Control Factor (CF)	Control Program	Reductions	2023 Controlled CO Inv	2023 Controlled NOx Inv	2023 Controlled VOC Inv
24510	2302003000	Deep Fat Frying			0.02415	1.01069	POP			0.02441					0.00000	0.00000	0.02441
24510	2302003100	Flat Griddle Frying	0.03292		0.01594	1.01069	POP	0.03327		0.01611					0.03327	0.00000	0.01611
24510	2302003200	Clamshell Griddle Frying			0.00090	1.01069	POP			0.00091					0.00000	0.00000	0.00091
24510	2302050000	Emissions from bakeries.			0.09919	1.01069	POP			0.10025					0.00000	0.00000	0.10025
24510	2302070001	Emissions from small breweries			0.00177	1.01069	POP			0.00179					0.00000	0.00000	0.00179
24510	2302070005	Emissions from small wineries			0.00015	1.01069	POP			0.00015					0.00000	0.00000	0.00015
24510	2401001000	Emissions from ALL SOLVENT TYPES architectural surface coatings.			1.88886	1.01069	POP			1.90905					0.00000	0.00000	1.90905
24510	2401005000	Emissions from automobile refinishing.			0.44031	1.06063	EMP			0.46701					0.00000	0.00000	0.46701
24510	2401008000	Emissions from traffic paints.			0.00134	1.01069	POP			0.00136					0.00000	0.00000	0.00136
24510	2401015000	Industrial surface coatings of finished wood product manufacturing.			0.00370	1.06063	EMP			0.00393					0.00000	0.00000	0.00393
24510	2401020000	Emissions from surface coatings of wood furniture and fixtures.			0.11589	1.06063	EMP			0.12292					0.00000	0.00000	0.12292
24510	2401025000	Emissions from surface coatings of metal furniture & fixtures.			0.36818	1.06063	EMP			0.39051					0.00000	0.00000	0.39051
24510	2401040000	Emissions from surface coatings of metal cans.			0.21647	1.06063	EMP			0.22959					0.00000	0.00000	0.22959
24510	2401070000	Emissions from surface coatings of Motor Vehicle.			0.00344	1.06063	EMP			0.00365					0.00000	0.00000	0.00365
24510	2401080000	Emissions from surface coatings of marine.			0.04074	1.06063	EMP			0.04321					0.00000	0.00000	0.04321
24510	2401085000	Emissions from surface coatings of Railroads.			0.07471	1.06063	EMP			0.07924					0.00000	0.00000	0.07924
24510	2401090000	Emissions from surface coatings - misc. manufacturing.			0.15300	1.06063	EMP			0.16228					0.00000	0.00000	0.16228
24510	2401100000	Emissions from surface			0.68903	1.06063	EMP			0.73081					0.00000	0.00000	0.73081

State County FIPs Code	SCC (AMS)	Emission Process Description	CO	NOX	VOC	GF 2023	Basis	2023 CO	2023 NOX	2023 VOC	Pollutant Controlled	Control Factor (CF)	Control Program	Reductions	2023 Controlled CO Inv	2023 Controlled NOx Inv	2023 Controlled VOC Inv
		coatings for industrial maintenance.															
24510	2401200000	Emissions from surface coatings - other categories.			0.68903	1.06063	EMP			0.73081					0.00000	0.00000	0.73081
24510	2415000000	Emissions from Cleaning Products: Industrial and Institutional Cleaning.			0.86670	1.06063	EMP			0.91925					0.00000	0.00000	0.91925
24510	2420000000	Dry Cleaners			0.38917	1.01069	POP			0.39333					0.00000	0.00000	0.39333
24510	2425000000	Emissions from Screen & Plateless printing			0.06638	1.01069	POP			0.06709					0.00000	0.00000	0.06709
24510	2425010000	Emissions from Offset Lithography printing			0.28889	1.01069	POP			0.29198					0.00000	0.00000	0.29198
24510	2425020000	Emissions from Letterpress printing			0.12293	1.01069	POP			0.12425					0.00000	0.00000	0.12425
24510	2425030000	Emissions from Rotogravure printing			0.13719	1.01069	POP			0.13866					0.00000	0.00000	0.13866
24510	2425040000	Emissions from Flexography printing			0.15711	1.01069	POP			0.15879					0.00000	0.00000	0.15879
24510	2440000000	Emissions from industrial adhesives.			0.36930	1.01069	POP			0.37324					0.00000	0.00000	0.37324
24510	2460100000	Commercial & Consumer Products - Personal Care Products			1.28294	1.01069	POP			1.29665	VOC	15.00%	C&C Products PH III & IV	0.19450	0.00000	0.00000	1.10215
24510	2460200000	Commercial & Consumer Products - Household Products			0.38555	1.01069	POP			0.38967	VOC	15.00%	C&C Products PH III & IV	0.05845	0.00000	0.00000	0.33122
24510	2460400000	Commercial & Consumer Products - Automotive Aftermarket Products			0.70047	1.01069	POP			0.70795	VOC	15.00%	C&C Products PH III & IV	0.10619	0.00000	0.00000	0.60176
24510	2460500000	Commercial & Consumer Products - Coatings and Related Products			0.58894	1.01069	POP			0.59523	VOC	15.00%	C&C Products PH III & IV	0.08928	0.00000	0.00000	0.50595
24510	2460600000	Commercial & Consumer Products - Adhesives and Sealants			0.31248	1.01069	POP			0.31582	VOC	15.00%	C&C Products PH III & IV	0.04737	0.00000	0.00000	0.26845

State County FIPs Code	SCC (AMS)	Emission Process Description	CO	NOX	VOC	GF 2023	Basis	2023 CO	2023 NOX	2023 VOC	Pollutant Controlled	Control Factor (CF)	Control Program	Reductions	2023 Controlled CO Inv	2023 Controlled NOx Inv	2023 Controlled VOC Inv
24510	2460800000	Commercial & Consumer Products - FIFRA - Regulated Products			1.03083	1.01069	POP			1.04185	VOC	15.00%	C&C Products PH III & IV	0.15628	0.00000	0.00000	0.88557
24510	2460900000	Commercial & Consumer Products - Miscellaneous Products			0.04253	1.01069	POP			0.04299	VOC	15.00%	C&C Products PH III & IV	0.00645	0.00000	0.00000	0.03654
24510	2461020000	Misc. Asphalt Application			0.11458	1.01069	POP			0.11580					0.00000	0.00000	0.11580
24510	2461021000	Cutback Asphalt Application			0.05240	1.01069	POP			0.05296					0.00000	0.00000	0.05296
24510	2461022000	Emissions from emulsified asphalt.			0.08740	1.01069	POP			0.08833					0.00000	0.00000	0.08833
24510	2461023000	Emissions from Asphalt Roofing.			0.15148	1.01069	POP			0.15310					0.00000	0.00000	0.15310
24510	2501011011	Portable Fuel Containers: Residential - Permeation			0.00658	1.01069	POP			0.00665					0.00000	0.00000	0.00665
24510	2501011012	Portable Fuel Containers: Residential - Evaporation (including Diurnal)			0.05683	1.01069	POP			0.05744					0.00000	0.00000	0.05744
24510	2501011013	Portable Fuel Containers: Residential - Transport			0.00312	1.01069	POP			0.00315					0.00000	0.00000	0.00315
24510	2501012011	Portable Fuel Containers: Commercial - Permeation			0.00188	1.01069	POP			0.00190					0.00000	0.00000	0.00190
24510	2501012012	Portable Fuel Containers: Commercial - Evaporation (Including Diurnal)			0.02471	1.01069	POP			0.02497					0.00000	0.00000	0.02497
24510	2501012013	Portable Fuel Containers: Commercial - Transport			0.37496	1.01069	POP			0.37897					0.00000	0.00000	0.37897
24510	2501060051	Gasoline Marketing - Tank Truck Unloading -			0.16469	1.04918	VMT			0.17279					0.00000	0.00000	0.17279

State County FIPs Code	SCC (AMS)	Emission Process Description	CO	NOX	VOC	GF 2023	Basis	2023 CO	2023 NOX	2023 VOC	Pollutant Controlled	Control Factor (CF)	Control Program	Reductions	2023 Controlled CO Inv	2023 Controlled NOx Inv	2023 Controlled VOC Inv
		Submerged Filling															
24510	2501060053	Gasoline Marketing - Tank Truck Unloading - Balanced Submerged Filling			0.06843	1.04918	VMT			0.07180					0.00000	0.00000	0.07180
24510	2501060201	Emissions from underground tank breathing.			0.25067	1.04918	VMT			0.26300					0.00000	0.00000	0.26300
24510	2501080050	AvGas Stage I Aircraft Refueling.			0.00035	1.06063	EMP			0.00037					0.00000	0.00000	0.00037
24510	2501080100	AvGas Stage II Aircraft Refueling.			0.00019	1.06063	EMP			0.00020					0.00000	0.00000	0.00020
24510	2505020030	Emissions from crude oil marine vessel unloading.			0.00008	1.06063	EMP			0.00009					0.00000	0.00000	0.00009
24510	2505020060	Emissions from residual oil marine vessel unloading.			0.00000	1.06063	EMP			0.00000					0.00000	0.00000	0.00000
24510	2505020090	Emissions from distillate oil marine vessel unloading.			0.00002	1.06063	EMP			0.00002					0.00000	0.00000	0.00002
24510	2505020120	Emissions from gasoline marine vessel unloading.			0.07230	1.06063	EMP			0.07668					0.00000	0.00000	0.07668
24510	2505020150	Emissions from jet naphtha marine vessel unloading.			0.00016	1.06063	EMP			0.00017					0.00000	0.00000	0.00017
24510	2505020180	Emissions from kerosene marine vessel unloading.			0.00006	1.06063	EMP			0.00006					0.00000	0.00000	0.00006
24510	2505030120	Emissions from tank trucks in transit.			0.01837	1.04918	VMT			0.01928					0.00000	0.00000	0.01928
24510	2601020000	Emissions from on-site incineration.		0.10417	0.00109	1.00000	NG		0.10417	0.00109					0.00000	0.10417	0.00109
24510	2620030000	Emissions from solid waste landfills.			0.07003	1.01069	POP			0.07078					0.00000	0.00000	0.07078
24510	2630020000	Emissions from POTWs.			0.02956	1.02651	HSE			0.03034					0.00000	0.00000	0.03034
24510	2660000000	Emissions from soil/groundwater remediation of LUST sites.			0.04373	1.00000	NG			0.04373					0.00000	0.00000	0.04373

State County FIPs Code	SCC (AMS)	Emission Process Description	CO	NOX	VOC	GF 2023	Basis	2023 CO	2023 NOX	2023 VOC	Pollutant Controlled	Control Factor (CF)	Control Program	Reductions	2023 Controlled CO Inv	2023 Controlled NOx Inv	2023 Controlled VOC Inv
24510	2810050000	Emissions from motor vehicle fires.	0.02196	0.00070	0.00562	1.01069	POP	0.02220	0.00071	0.00568					0.02220	0.00071	0.00568
24510	2810060100	Human Cremation	0.00158	0.00052		1.01069	POP	0.00160	0.00052						0.00160	0.00053	0.00000
24510	2810060200	Animal Cremation	0.00020	0.00007		1.00000	NG	0.00020	0.00007						0.00020	0.00007	0.00000
24510	2830000000	Emissions from catastrophic/accidenta l releases/oil spills.			0.00224	1.00000	NG			0.00224					0.00000	0.00000	0.00224
24510 Total			2.68876	2.66508	13.8671 1			2.80414	2.78457	14.2407 9				0.65852	2.80414	2.78457	13.5822 6
Grand Total			26.9543 8	10.9309 5	72.2326 6			28.0101 2	11.5459 8	75.1390 2				3.00204	28.0101 2	11.5459 8	72.1369 7



Maryland
Department of
the Environment

Wes Moore, Governor
Aruna Miller, Lt. Governor

Serena McIlwain, Secretary
Suzanne E. Dorsey, Deputy Secretary

APPENDIX A-5

Baltimore Moderate Nonattainment Area MOVES3 - Onroad Source Emission Inventory

**Prepared for:
U.S. Environmental Protection Agency**

**Prepared by:
Maryland Department of the Environment**



**Baltimore, MD Ozone Moderate Nonattainment Area
MOVES3 Onroad Source Emission Inventory**

© Maryland Department of the Environment
Air and Radiation Administration
1800 Washington Boulevard, Suite 730
Baltimore, Maryland 21230
Phone 410.537.3240 • Fax 410.631.3202

Baltimore Region Ozone Emissions Summary Using MOVES3 [MOVESDB20220105]
July Weekday

Analysis Year	VMT	Emissions (Tons/Day)	
		VOC	NOx
2017 (Base Year)	78,929,008	22.01	51.15
2023	83,094,737	17.12	32.09
	Tons / Day Reduced	4.89	19.06
	Percent Reduction	22.2%	37.3%

Note:

2017 Run: Using 2017 SHA-Base Input Assumptions with existing emission standards/ controlled measures in MOVES3

2023 Run: Using 2020 SHA-Base Input Assumptions with existing emission standards/ controlled measures in MOVES3

Baltimore Bump-up Ozone SIP Input Checklist for 2017 & 2023 Base Inventories Using MOVES3 Model (06-23-2011)

Data Item	2017 Base Year Inventory Inputs Assumptions (2017 SHA-PPSuite Based Process with MOVES3)	2023 Base Year Inventory Inputs Assumptions (2020 SHA-PPSuite Based Process with MOVES3)
Traffic Data		
Highway Network	2017 SHA Universal Highway Database	2020 SHA Universal Highway Database
Seasonal/Daily Adjustments	2017 SHA Traffic Trends Report	2020 SHA Traffic Trends Report
County HPMS VMT Adjustments	2017 HPMS Adjustments	2020 HPMS Adjustments
Mapfile	Use MOVES2014a national defaults VMT distributions for Maryland to disaggregate light duty vehicles/buses/trucks to MOVES13 source types (Consistent with 2017 NEI)	Use MOVES3 national defaults VMT distributions for Maryland to disaggregate light duty vehicles/buses/trucks to MOVES13 source types
Hourly Patterns	2016 SHA Traffic Trends Report	Modified BMC hourly distributions to be used for MDE SIP hourly patterns
Vehicle Mixes	<ol style="list-style-type: none"> 2017 Vehicle Classification by Functional Class 2017 TMS & hourly distribution from SHA traffic count data 	<ol style="list-style-type: none"> 2020 Vehicle Classification by Functional Class 2020 TMS & hourly distribution from SHA traffic count data Truck percentage assumption consistent with BMC travel modeling
VMT Growth Forecast	2017 HPMS VMT adjusted to July Weekday	2000-2019 HPMS trend growth, applying to 2019 HPMS Base Year
Vehicle Population Growth Forecast	Not forecasted for 2017	<ol style="list-style-type: none"> Source Type 11, 21, 31, 32, 41, 42, 43 & 54: max of population, household and VMT growth Source Type 51: max of population, household, employment and VMT growth Trucks (source type 52, 53 ,61 & 62): Estimated by using MD VMT and MOVES3 national default VMT and population ratios

MOVES Inputs		
Month VMT Fractions	Calculated based on 2017 seasonal adjustment factors	Calculated based on 2020 seasonal adjustment factors
Day VMT Fractions	Calculated based on 2017 seasonal adjustment factors	Calculated based on 2020 seasonal adjustment factors
Hourly VMT Fractions	Calculated by PPSUITE	Calculated by PPSUITE
Average Speed Distribution	Calculated by PPSUITE	Calculated by PPSUITE
Source Type Population	<p>1. Non-trucks: Use 2017 Inputs provided by MDE</p> <p>2. Trucks (source type 52, 53 ,61 & 62): Estimated by using MD VMT and MOVES2014 national default VMT and population ratios</p>	<p>1. Source Type 11, 21, 31, 32, 41, 42, 43, 51 & 54: Apply VPOP growth to 2020 base year inputs (2020 base year inputs provided by MDE)</p> <p>2. Trucks (source type 52, 53 ,61 & 62): Estimated by using MD VMT and MOVES3 national default VMT and population ratios</p>
Vehicle Age Distribution	<p>Provided by MDE (Consistent with 2017 NEI):</p> <p>1) All source types except 61 and 62: developed by MSCP from VIN-decoded registration database.</p> <p>2) Source types 61 & 62: Use MOVES2014 national default age distribution inputs</p>	<p>Provided by MDE (Consistent with 2020 NEI):</p> <p>1) 2020 Jul 01 MVA vehicle registration database, VIN-decoded by ESP.</p> <p>2) Source types 61 & 62: Use MOVES3 national default age distribution inputs</p>
Fuel Supply	MOVES3 Default	MOVES3 inputs provided by MDE
Fuel Formulation	MOVES3 Default	MOVES3 inputs provided by MDE
Fuel Usage Fraction	MOVES3 Default	MOVES3 inputs provided by MDE
Temperatures/Humidity	2017 inputs provided by MDE	2020 inputs provided by MDE
I/M Parameters	Existing IM Programs provided by MDE (2017 IM Programs)	VEIP Reinvention Program provided by MDE (2020 IM Programs)
Early NLEV / CALLEV	Early NLEV and CALEV program databases developed with MOVES3	Early NLEV and CALEV program databases developed with MOVES3
AVFT	Provided by MDE for MOVES3 (2017 LD EV Sales%)	Provided by MDE for MOVES3 (2020 LD EV Sales%)
Federal Fuel & Emissions Standards	Controlled Measures included in MOVES3	Controlled Measures included in MOVES3

NOTE: Input assumptions different from 2020 NEI



Maryland
Department of
the Environment

Wes Moore, Governor
Aruna Miller, Lt. Governor

Serena McIlwain, Secretary
Suzanne E. Dorsey, Deputy Secretary

APPENDIX A-6

Baltimore Moderate Nonattainment Area MOVES3 - Nonroad Source Emission Inventory

**Prepared for:
U.S. Environmental Protection Agency**

**Prepared by:
Maryland Department of the Environment**



**Baltimore, MD Ozone Moderate Nonattainment Area
MOVES3 Nonroad Source Emission Inventory**

© Maryland Department of the Environment
Air and Radiation Administration
1800 Washington Boulevard, Suite 730
Baltimore, Maryland 21230
Phone 410.537.3240 • Fax 410.631.3202

2017 MOVES-NR Data

yearID	County Name	Tier 2 Description	scc	Tier 3 Description	SCC Level Four	VOC	NOX	CO
2017	Anne Arundel	Non-Road Diesel	2270001060	Recreational	Specialty Vehicles/Carts	0.001965	0.008254	0.007526
2017	Anne Arundel	Non-Road Diesel	2270002003	Construction	Pavers	0.000521	0.008163	0.003005
2017	Anne Arundel	Non-Road Diesel	2270002006	Construction	Tampers/Rammers	0.000006	0.000032	0.000022
2017	Anne Arundel	Non-Road Diesel	2270002009	Construction	Plate Compactors	0.000078	0.000488	0.000305
2017	Anne Arundel	Non-Road Diesel	2270002015	Construction	Rollers	0.001623	0.023592	0.009539
2017	Anne Arundel	Non-Road Diesel	2270002018	Construction	Scrapers	0.001350	0.025744	0.011112
2017	Anne Arundel	Non-Road Diesel	2270002021	Construction	Paving Equipment	0.000160	0.001801	0.000804
2017	Anne Arundel	Non-Road Diesel	2270002024	Construction	Surfacing Equipment	0.000147	0.002111	0.000993
2017	Anne Arundel	Non-Road Diesel	2270002027	Construction	Signal Boards/Light Plants	0.000475	0.004592	0.001870
2017	Anne Arundel	Non-Road Diesel	2270002030	Construction	Trenchers	0.001441	0.017483	0.009095
2017	Anne Arundel	Non-Road Diesel	2270002033	Construction	Bore/Drill Rigs	0.002667	0.035118	0.010673
2017	Anne Arundel	Non-Road Diesel	2270002036	Construction	Excavators	0.003241	0.065288	0.020579
2017	Anne Arundel	Non-Road Diesel	2270002039	Construction	Concrete/Industrial Saws	0.000104	0.001133	0.000634
2017	Anne Arundel	Non-Road Diesel	2270002042	Construction	Cement and Mortar Mixers	0.000148	0.001353	0.000592
2017	Anne Arundel	Non-Road Diesel	2270002045	Construction	Cranes	0.001686	0.028875	0.006879
2017	Anne Arundel	Non-Road Diesel	2270002048	Construction	Graders	0.000863	0.014942	0.004882
2017	Anne Arundel	Non-Road Diesel	2270002051	Construction	Off-highway Trucks	0.003114	0.077054	0.017281
2017	Anne Arundel	Non-Road Diesel	2270002054	Construction	Crushing/Processing Equipment	0.000378	0.006626	0.001788
2017	Anne Arundel	Non-Road Diesel	2270002057	Construction	Rough Terrain Forklifts	0.002982	0.037046	0.019392
2017	Anne Arundel	Non-Road Diesel	2270002060	Construction	Rubber Tire Loaders	0.008118	0.133563	0.049212
2017	Anne Arundel	Non-Road Diesel	2270002066	Construction	Tractors/Loaders/Backhoes	0.033245	0.163235	0.141725
2017	Anne Arundel	Non-Road Diesel	2270002069	Construction	Crawler Tractor/Dozers	0.004988	0.092453	0.033533
2017	Anne Arundel	Non-Road Diesel	2270002072	Construction	Skid Steer Loaders	0.032997	0.125369	0.144269
2017	Anne Arundel	Non-Road Diesel	2270002075	Construction	Off-highway Tractors	0.000905	0.016582	0.005987
2017	Anne Arundel	Non-Road Diesel	2270002078	Construction	Dumpers/Tenders	0.000117	0.000409	0.000468
2017	Anne Arundel	Non-Road Diesel	2270002081	Construction	Other Construction Equipment	0.001393	0.023327	0.010063
2017	Anne Arundel	Non-Road Diesel	2270003010	Industrial	Aerial Lifts	0.001339	0.005454	0.005560
2017	Anne Arundel	Non-Road Diesel	2270003020	Industrial	Forklifts	0.001326	0.031516	0.012443
2017	Anne Arundel	Non-Road Diesel	2270003030	Industrial	Sweepers/Scrubbers	0.000954	0.016027	0.005135
2017	Anne Arundel	Non-Road Diesel	2270003040	Industrial	Other General Industrial Equipment	0.001404	0.020024	0.006334
2017	Anne Arundel	Non-Road Diesel	2270003050	Industrial	Other Material Handling Equipment	0.000232	0.001347	0.000883
2017	Anne Arundel	Non-Road Diesel	2270003060	Industrial	AC/Refrigeration	0.007292	0.125561	0.035785
2017	Anne Arundel	Non-Road Diesel	2270003070	Industrial	Terminal Tractors	0.000789	0.014701	0.005549
2017	Anne Arundel	Non-Road Diesel	2270004031	Lawn & Garden	Leafblowers/Vacuums (Commercial)	0.000003	0.000019	0.000011
2017	Anne Arundel	Non-Road Diesel	2270004036	Lawn & Garden	Snowblowers (Commercial)	0.000000	0.000000	0.000000
2017	Anne Arundel	Non-Road Diesel	2270004046	Lawn & Garden	Front Mowers (Commercial)	0.010275	0.096565	0.041464
2017	Anne Arundel	Non-Road Diesel	2270004056	Lawn & Garden	Lawn and Garden Tractors (Commercial)	0.002138	0.019050	0.008735

2017 MOVES-NR Data

yearID	County Name	Tier 2 Description	scc	Tier 3 Description	SCC Level Four	VOC	NOX	CO
2017	Anne Arundel	Non-Road Diesel	2270004066	Lawn & Garden	Chippers/Stump Grinders (Commercial)	0.013119	0.154500	0.055537
2017	Anne Arundel	Non-Road Diesel	2270004071	Lawn & Garden	Turf Equipment (Commercial)	0.000723	0.010436	0.003462
2017	Anne Arundel	Non-Road Diesel	2270004076	Lawn & Garden	Other Lawn and Garden Equipment (Commercial)	0.000052	0.000458	0.000215
2017	Anne Arundel	Non-Road Diesel	2270005010	Farm	2-Wheel Tractors	0.000000	0.000001	0.000001
2017	Anne Arundel	Non-Road Diesel	2270005015	Farm	Agricultural Tractors	0.002861	0.031691	0.015921
2017	Anne Arundel	Non-Road Diesel	2270005020	Farm	Combines	0.000405	0.004526	0.001906
2017	Anne Arundel	Non-Road Diesel	2270005025	Farm	Balers	0.000004	0.000022	0.000015
2017	Anne Arundel	Non-Road Diesel	2270005030	Farm	Agricultural Mowers	0.000001	0.000004	0.000003
2017	Anne Arundel	Non-Road Diesel	2270005035	Farm	Sprayers	0.000048	0.000348	0.000190
2017	Anne Arundel	Non-Road Diesel	2270005040	Farm	Tillers : 6 HP	0.000000	0.000001	0.000001
2017	Anne Arundel	Non-Road Diesel	2270005045	Farm	Swathers	0.000040	0.000323	0.000199
2017	Anne Arundel	Non-Road Diesel	2270005055	Farm	Other Agricultural Equipment	0.000079	0.000759	0.000392
2017	Anne Arundel	Non-Road Diesel	2270005060	Farm	Irrigation Sets	0.000028	0.000369	0.000128
2017	Anne Arundel	Non-Road Diesel	2270006005	Light Commercial	Generator Sets	0.009972	0.092377	0.039762
2017	Anne Arundel	Non-Road Diesel	2270006010	Light Commercial	Pumps	0.002352	0.022040	0.009686
2017	Anne Arundel	Non-Road Diesel	2270006015	Light Commercial	Air Compressors	0.003169	0.041744	0.017001
2017	Anne Arundel	Non-Road Diesel	2270006025	Light Commercial	Welders	0.006738	0.028087	0.029423
2017	Anne Arundel	Non-Road Diesel	2270006030	Light Commercial	Pressure Washers	0.000364	0.003140	0.001270
2017	Anne Arundel	Non-Road Diesel	2270006035	Light Commercial	Hydro-power Units	0.000148	0.001853	0.000744
2017	Anne Arundel	Non-Road Diesel	2270007015	Logging	Forest Eqp - Feller/Bunch/Skidder	0.000213	0.003577	0.001533
2017	Anne Arundel	Non-Road Diesel	2282020005	Recreational Marine Vessels	Inboard/Sterndrive	0.012340	0.236689	0.046682
2017	Anne Arundel	Non-Road Diesel	2282020010	Recreational Marine Vessels	Outboard	0.000104	0.000552	0.000327
2017	Anne Arundel	Non-Road Diesel	2285002015	Railway Maintenance	Railway Maintenance	0.000431	0.002619	0.001776
2017	Anne Arundel	Non-Road Gasoline	2260001010	Recreational	Motorcycles: Off-road	0.258763	0.002764	0.262958
2017	Anne Arundel	Non-Road Gasoline	2260001030	Recreational	All Terrain Vehicles	0.066323	0.001406	0.140144
2017	Anne Arundel	Non-Road Gasoline	2260001060	Recreational	Specialty Vehicles/Carts	0.008355	0.002286	0.257543
2017	Anne Arundel	Non-Road Gasoline	2260002006	Construction	Tampers/Rammers	0.012647	0.000318	0.052592
2017	Anne Arundel	Non-Road Gasoline	2260002009	Construction	Plate Compactors	0.000443	0.000021	0.001980
2017	Anne Arundel	Non-Road Gasoline	2260002021	Construction	Paving Equipment	0.000529	0.000025	0.002390
2017	Anne Arundel	Non-Road Gasoline	2260002027	Construction	Signal Boards/Light Plants	0.000004	0.000000	0.000017
2017	Anne Arundel	Non-Road Gasoline	2260002039	Construction	Concrete/Industrial Saws	0.032407	0.000835	0.137739
2017	Anne Arundel	Non-Road Gasoline	2260002054	Construction	Crushing/Processing Equipment	0.000108	0.000005	0.000489
2017	Anne Arundel	Non-Road Gasoline	2260003030	Industrial	Sweepers/Scrubbers	0.000379	0.000016	0.001579
2017	Anne Arundel	Non-Road Gasoline	2260003040	Industrial	Other General Industrial Equipment	0.000028	0.000001	0.000121
2017	Anne Arundel	Non-Road Gasoline	2260004015	Lawn & Garden	Rotary Tillers < 6 HP (Residential)	0.003832	0.000166	0.014311
2017	Anne Arundel	Non-Road Gasoline	2260004016	Lawn & Garden	Rotary Tillers < 6 HP (Commercial)	0.032923	0.001563	0.136482
2017	Anne Arundel	Non-Road Gasoline	2260004020	Lawn & Garden	Chain Saws < 6 HP (Residential)	0.046556	0.001384	0.123933

2017 MOVES-NR Data

yearID	County Name	Tier 2 Description	scc	Tier 3 Description	SCC Level Four	VOC	NOX	CO
2017	Anne Arundel	Non-Road Gasoline	2260004021	Lawn & Garden	Chain Saws < 6 HP (Commercial)	0.420385	0.009387	1.495749
2017	Anne Arundel	Non-Road Gasoline	2260004025	Lawn & Garden	Trimmers/Edgers/Brush Cutters (Residential)	0.076110	0.003101	0.253844
2017	Anne Arundel	Non-Road Gasoline	2260004026	Lawn & Garden	Trimmers/Edgers/Brush Cutters (Commercial)	0.335357	0.013165	1.306094
2017	Anne Arundel	Non-Road Gasoline	2260004030	Lawn & Garden	Leafblowers/Vacuums (Residential)	0.045957	0.001982	0.173290
2017	Anne Arundel	Non-Road Gasoline	2260004031	Lawn & Garden	Leafblowers/Vacuums (Commercial)	0.335177	0.012205	1.455423
2017	Anne Arundel	Non-Road Gasoline	2260004035	Lawn & Garden	Snowblowers (Residential)	0.002771	0.000000	0.000000
2017	Anne Arundel	Non-Road Gasoline	2260004036	Lawn & Garden	Snowblowers (Commercial)	0.000793	0.000000	0.000000
2017	Anne Arundel	Non-Road Gasoline	2260004071	Lawn & Garden	Turf Equipment (Commercial)	0.000125	0.000007	0.000602
2017	Anne Arundel	Non-Road Gasoline	2260005035	Farm	Sprayers	0.000025	0.000001	0.000103
2017	Anne Arundel	Non-Road Gasoline	2260006005	Light Commercial	Generator Sets	0.004482	0.000171	0.015745
2017	Anne Arundel	Non-Road Gasoline	2260006010	Light Commercial	Pumps	0.031587	0.001168	0.102223
2017	Anne Arundel	Non-Road Gasoline	2260006015	Light Commercial	Air Compressors	0.000011	0.000000	0.000039
2017	Anne Arundel	Non-Road Gasoline	2260006035	Light Commercial	Hydro-power Units	0.000194	0.000007	0.000683
2017	Anne Arundel	Non-Road Gasoline	2260007005	Logging	Chain Saws : 6 HP	0.002466	0.000055	0.009594
2017	Anne Arundel	Non-Road Gasoline	2265001010	Recreational	Motorcycles: Off-road	0.011358	0.001642	0.104377
2017	Anne Arundel	Non-Road Gasoline	2265001030	Recreational	All Terrain Vehicles	0.116425	0.012039	1.208643
2017	Anne Arundel	Non-Road Gasoline	2265001050	Recreational	Golf Carts	0.019955	0.006541	0.995207
2017	Anne Arundel	Non-Road Gasoline	2265001060	Recreational	Specialty Vehicles/Carts	0.010538	0.003296	0.302975
2017	Anne Arundel	Non-Road Gasoline	2265002003	Construction	Pavers	0.000565	0.000259	0.028035
2017	Anne Arundel	Non-Road Gasoline	2265002006	Construction	Tampers/Rammers	0.000005	0.000002	0.000249
2017	Anne Arundel	Non-Road Gasoline	2265002009	Construction	Plate Compactors	0.001414	0.000404	0.048486
2017	Anne Arundel	Non-Road Gasoline	2265002015	Construction	Rollers	0.000965	0.000388	0.050293
2017	Anne Arundel	Non-Road Gasoline	2265002021	Construction	Paving Equipment	0.002569	0.000821	0.106723
2017	Anne Arundel	Non-Road Gasoline	2265002024	Construction	Surfacing Equipment	0.001014	0.000329	0.045600
2017	Anne Arundel	Non-Road Gasoline	2265002027	Construction	Signal Boards/Light Plants	0.000051	0.000017	0.002232
2017	Anne Arundel	Non-Road Gasoline	2265002030	Construction	Trenchers	0.001832	0.000819	0.082104
2017	Anne Arundel	Non-Road Gasoline	2265002033	Construction	Bore/Drill Rigs	0.000992	0.000641	0.026355
2017	Anne Arundel	Non-Road Gasoline	2265002039	Construction	Concrete/Industrial Saws	0.003925	0.001429	0.204306
2017	Anne Arundel	Non-Road Gasoline	2265002042	Construction	Cement and Mortar Mixers	0.003099	0.000741	0.095339
2017	Anne Arundel	Non-Road Gasoline	2265002045	Construction	Cranes	0.000160	0.000232	0.004394
2017	Anne Arundel	Non-Road Gasoline	2265002054	Construction	Crushing/Processing Equipment	0.000274	0.000117	0.012615
2017	Anne Arundel	Non-Road Gasoline	2265002057	Construction	Rough Terrain Forklifts	0.000115	0.000203	0.003053
2017	Anne Arundel	Non-Road Gasoline	2265002060	Construction	Rubber Tire Loaders	0.000100	0.000228	0.002892
2017	Anne Arundel	Non-Road Gasoline	2265002066	Construction	Tractors/Loaders/Backhoes	0.001242	0.000455	0.068695
2017	Anne Arundel	Non-Road Gasoline	2265002072	Construction	Skid Steer Loaders	0.000917	0.000950	0.034209
2017	Anne Arundel	Non-Road Gasoline	2265002078	Construction	Dumpers/Tenders	0.000569	0.000151	0.016640
2017	Anne Arundel	Non-Road Gasoline	2265002081	Construction	Other Construction Equipment	0.000285	0.000460	0.006666

2017 MOVES-NR Data

yearID	County Name	Tier 2 Description	scc	Tier 3 Description	SCC Level Four	VOC	NOX	CO
2017	Anne Arundel	Non-Road Gasoline	2265003010	Industrial	Aerial Lifts	0.002918	0.003122	0.101452
2017	Anne Arundel	Non-Road Gasoline	2265003020	Industrial	Forklifts	0.002132	0.005145	0.062548
2017	Anne Arundel	Non-Road Gasoline	2265003030	Industrial	Sweepers/Scrubbers	0.001755	0.001044	0.075557
2017	Anne Arundel	Non-Road Gasoline	2265003040	Industrial	Other General Industrial Equipment	0.007320	0.002126	0.234031
2017	Anne Arundel	Non-Road Gasoline	2265003050	Industrial	Other Material Handling Equipment	0.000189	0.000172	0.007559
2017	Anne Arundel	Non-Road Gasoline	2265003060	Industrial	AC\Refrigeration	0.000224	0.000073	0.011537
2017	Anne Arundel	Non-Road Gasoline	2265003070	Industrial	Terminal Tractors	0.000143	0.000380	0.004332
2017	Anne Arundel	Non-Road Gasoline	2265004010	Lawn & Garden	Lawn Mowers (Residential)	0.182140	0.022312	2.142457
2017	Anne Arundel	Non-Road Gasoline	2265004011	Lawn & Garden	Lawn Mowers (Commercial)	0.172921	0.028806	2.820331
2017	Anne Arundel	Non-Road Gasoline	2265004015	Lawn & Garden	Rotary Tillers < 6 HP (Residential)	0.016337	0.001919	0.184269
2017	Anne Arundel	Non-Road Gasoline	2265004016	Lawn & Garden	Rotary Tillers < 6 HP (Commercial)	0.120463	0.017251	1.682513
2017	Anne Arundel	Non-Road Gasoline	2265004025	Lawn & Garden	Trimmers/Edgers/Brush Cutters (Residential)	0.001171	0.000118	0.011480
2017	Anne Arundel	Non-Road Gasoline	2265004026	Lawn & Garden	Trimmers/Edgers/Brush Cutters (Commercial)	0.004648	0.000662	0.081647
2017	Anne Arundel	Non-Road Gasoline	2265004030	Lawn & Garden	Leafblowers/Vacuums (Residential)	0.001483	0.000224	0.021897
2017	Anne Arundel	Non-Road Gasoline	2265004031	Lawn & Garden	Leafblowers/Vacuums (Commercial)	0.109340	0.030490	3.528111
2017	Anne Arundel	Non-Road Gasoline	2265004035	Lawn & Garden	Snowblowers (Residential)	0.006443	0.000000	0.000000
2017	Anne Arundel	Non-Road Gasoline	2265004036	Lawn & Garden	Snowblowers (Commercial)	0.001879	0.000000	0.000000
2017	Anne Arundel	Non-Road Gasoline	2265004040	Lawn & Garden	Rear Engine Riding Mowers (Residential)	0.023262	0.004654	0.663429
2017	Anne Arundel	Non-Road Gasoline	2265004041	Lawn & Garden	Rear Engine Riding Mowers (Commercial)	0.011983	0.003602	0.566291
2017	Anne Arundel	Non-Road Gasoline	2265004046	Lawn & Garden	Front Mowers (Commercial)	0.017974	0.005591	0.670906
2017	Anne Arundel	Non-Road Gasoline	2265004051	Lawn & Garden	Shredders < 6 HP (Commercial)	0.014062	0.002017	0.194867
2017	Anne Arundel	Non-Road Gasoline	2265004055	Lawn & Garden	Lawn and Garden Tractors (Residential)	0.252305	0.062243	8.888323
2017	Anne Arundel	Non-Road Gasoline	2265004056	Lawn & Garden	Lawn and Garden Tractors (Commercial)	0.155384	0.048950	7.699658
2017	Anne Arundel	Non-Road Gasoline	2265004066	Lawn & Garden	Chippers/Stump Grinders (Commercial)	0.016396	0.008302	0.797126
2017	Anne Arundel	Non-Road Gasoline	2265004071	Lawn & Garden	Turf Equipment (Commercial)	0.452843	0.156975	21.367460
2017	Anne Arundel	Non-Road Gasoline	2265004075	Lawn & Garden	Other Lawn and Garden Equipment (Residential)	0.012142	0.002561	0.267628
2017	Anne Arundel	Non-Road Gasoline	2265004076	Lawn & Garden	Other Lawn and Garden Equipment (Commercial)	0.028642	0.006180	0.646551
2017	Anne Arundel	Non-Road Gasoline	2265005010	Farm	2-Wheel Tractors	0.000006	0.000002	0.000360
2017	Anne Arundel	Non-Road Gasoline	2265005015	Farm	Agricultural Tractors	0.000008	0.000010	0.000392
2017	Anne Arundel	Non-Road Gasoline	2265005020	Farm	Combines	0.000000	0.000000	0.000007
2017	Anne Arundel	Non-Road Gasoline	2265005025	Farm	Balers	0.000034	0.000044	0.000607
2017	Anne Arundel	Non-Road Gasoline	2265005030	Farm	Agricultural Mowers	0.000006	0.000002	0.000297
2017	Anne Arundel	Non-Road Gasoline	2265005035	Farm	Sprayers	0.000094	0.000059	0.002758
2017	Anne Arundel	Non-Road Gasoline	2265005040	Farm	Tillers : 6 HP	0.000452	0.000079	0.012434
2017	Anne Arundel	Non-Road Gasoline	2265005045	Farm	Swathers	0.000049	0.000069	0.000961
2017	Anne Arundel	Non-Road Gasoline	2265005055	Farm	Other Agricultural Equipment	0.000059	0.000079	0.001595
2017	Anne Arundel	Non-Road Gasoline	2265005060	Farm	Irrigation Sets	0.000008	0.000015	0.000242

2017 MOVES-NR Data

yearID	County Name	Tier 2 Description	scc	Tier 3 Description	SCC Level Four	VOC	NOX	CO
2017	Anne Arundel	Non-Road Gasoline	2265006005	Light Commercial	Generator Sets	0.115805	0.030154	3.968708
2017	Anne Arundel	Non-Road Gasoline	2265006010	Light Commercial	Pumps	0.024983	0.007854	0.778205
2017	Anne Arundel	Non-Road Gasoline	2265006015	Light Commercial	Air Compressors	0.010271	0.003902	0.371470
2017	Anne Arundel	Non-Road Gasoline	2265006025	Light Commercial	Welders	0.023359	0.007944	1.019434
2017	Anne Arundel	Non-Road Gasoline	2265006030	Light Commercial	Pressure Washers	0.048367	0.012016	1.565218
2017	Anne Arundel	Non-Road Gasoline	2265006035	Light Commercial	Hydro-power Units	0.001682	0.000558	0.079722
2017	Anne Arundel	Non-Road Gasoline	2265007010	Logging	Shredders : 6 HP	0.000607	0.000175	0.017253
2017	Anne Arundel	Non-Road Gasoline	2265007015	Logging	Forest Eqp - Feller/Bunch/Skidder	0.000004	0.000001	0.000126
2017	Anne Arundel	Non-Road Gasoline	2282005010	Recreational Marine Vessels	Outboard	1.487923	0.232066	4.254649
2017	Anne Arundel	Non-Road Gasoline	2282005015	Recreational Marine Vessels	Personal Water Craft	0.268732	0.103512	2.035473
2017	Anne Arundel	Non-Road Gasoline	2282010005	Recreational Marine Vessels	Inboard/Sterndrive	0.204794	0.245313	3.121451
2017	Anne Arundel	Non-Road Gasoline	2285004015	Railway Maintenance	Railway Maintenance	0.000106	0.000034	0.004699
2017	Anne Arundel	Other	2267001060	Liquified Petroleum Gas	Specialty Vehicles/Carts	0.000153	0.000696	0.003342
2017	Anne Arundel	Other	2267002003	Liquified Petroleum Gas	Pavers	0.000018	0.000086	0.000540
2017	Anne Arundel	Other	2267002015	Liquified Petroleum Gas	Rollers	0.000009	0.000064	0.000404
2017	Anne Arundel	Other	2267002021	Liquified Petroleum Gas	Paving Equipment	0.000014	0.000061	0.000348
2017	Anne Arundel	Other	2267002024	Liquified Petroleum Gas	Surfacing Equipment	0.000003	0.000013	0.000082
2017	Anne Arundel	Other	2267002030	Liquified Petroleum Gas	Trenchers	0.000057	0.000274	0.001735
2017	Anne Arundel	Other	2267002033	Liquified Petroleum Gas	Bore/Drill Rigs	0.000109	0.000480	0.002267
2017	Anne Arundel	Other	2267002039	Liquified Petroleum Gas	Concrete/Industrial Saws	0.000012	0.000094	0.000518
2017	Anne Arundel	Other	2267002045	Liquified Petroleum Gas	Cranes	0.000055	0.000238	0.001382
2017	Anne Arundel	Other	2267002054	Liquified Petroleum Gas	Crushing/Processing Equipment	0.000008	0.000036	0.000215
2017	Anne Arundel	Other	2267002057	Liquified Petroleum Gas	Rough Terrain Forklifts	0.000045	0.000209	0.001331
2017	Anne Arundel	Other	2267002060	Liquified Petroleum Gas	Rubber Tire Loaders	0.000037	0.000223	0.001473
2017	Anne Arundel	Other	2267002066	Liquified Petroleum Gas	Tractors/Loaders/Backhoes	0.000003	0.000018	0.000117
2017	Anne Arundel	Other	2267002072	Liquified Petroleum Gas	Skid Steer Loaders	0.000193	0.000847	0.004677
2017	Anne Arundel	Other	2267002081	Liquified Petroleum Gas	Other Construction Equipment	0.000108	0.000463	0.002510
2017	Anne Arundel	Other	2267003010	Liquified Petroleum Gas	Aerial Lifts	0.000602	0.002805	0.015398
2017	Anne Arundel	Other	2267003020	Liquified Petroleum Gas	Forklifts	0.011959	0.080781	0.488053
2017	Anne Arundel	Other	2267003030	Liquified Petroleum Gas	Sweepers/Scrubbers	0.000071	0.000534	0.003009
2017	Anne Arundel	Other	2267003040	Liquified Petroleum Gas	Other General Industrial Equipment	0.000024	0.000173	0.001020
2017	Anne Arundel	Other	2267003050	Liquified Petroleum Gas	Other Material Handling Equipment	0.000025	0.000120	0.000743
2017	Anne Arundel	Other	2267003070	Liquified Petroleum Gas	Terminal Tractors	0.000036	0.000300	0.001550
2017	Anne Arundel	Other	2267004066	Liquified Petroleum Gas	Chippers/Stump Grinders (Commercial)	0.000468	0.003256	0.019707
2017	Anne Arundel	Other	2267005055	Liquified Petroleum Gas	Other Agricultural Equipment	0.000000	0.000001	0.000004
2017	Anne Arundel	Other	2267005060	Liquified Petroleum Gas	Irrigation Sets	0.000000	0.000000	0.000001
2017	Anne Arundel	Other	2267006005	Liquified Petroleum Gas	Generator Sets	0.002665	0.015721	0.055663

2017 MOVES-NR Data

yearID	County Name	Tier 2 Description	scc	Tier 3 Description	SCC Level Four	VOC	NOX	CO
2017	Anne Arundel	Other	2267006010	Liquified Petroleum Gas	Pumps	0.000314	0.001933	0.008014
2017	Anne Arundel	Other	2267006015	Liquified Petroleum Gas	Air Compressors	0.000163	0.001144	0.006312
2017	Anne Arundel	Other	2267006025	Liquified Petroleum Gas	Welders	0.000271	0.001476	0.009229
2017	Anne Arundel	Other	2267006030	Liquified Petroleum Gas	Pressure Washers	0.000009	0.000043	0.000248
2017	Anne Arundel	Other	2267006035	Liquified Petroleum Gas	Hydro-power Units	0.000002	0.000016	0.000085
2017	Anne Arundel	Other	2268002081	Compressed Natural Gas	Other Construction Equipment	0.000016	0.000020	0.000107
2017	Anne Arundel	Other	2268003020	Compressed Natural Gas	Forklifts	0.003446	0.006501	0.037932
2017	Anne Arundel	Other	2268003030	Compressed Natural Gas	Sweepers/Scrubbers	0.000003	0.000005	0.000031
2017	Anne Arundel	Other	2268003040	Compressed Natural Gas	Other General Industrial Equipment	0.000001	0.000003	0.000016
2017	Anne Arundel	Other	2268003060	Compressed Natural Gas	AC\Refrigeration	0.000012	0.000023	0.000126
2017	Anne Arundel	Other	2268003070	Compressed Natural Gas	Terminal Tractors	0.000013	0.000030	0.000147
2017	Anne Arundel	Other	2268005055	Compressed Natural Gas	Other Agricultural Equipment	0.000002	0.000002	0.000009
2017	Anne Arundel	Other	2268005060	Compressed Natural Gas	Irrigation Sets	0.000012	0.000024	0.000144
2017	Anne Arundel	Other	2268006005	Compressed Natural Gas	Generator Sets	0.003754	0.006219	0.021461
2017	Anne Arundel	Other	2268006010	Compressed Natural Gas	Pumps	0.000114	0.000192	0.000755
2017	Anne Arundel	Other	2268006015	Compressed Natural Gas	Air Compressors	0.000059	0.000115	0.000622
2017	Anne Arundel	Other	2268006020	Compressed Natural Gas	Gas Compressors	0.001154	0.002395	0.012474
2017	Anne Arundel	Other	2285006015	Liquified Petroleum Gas	Railway Maintenance	0.000001	0.000003	0.000020
2017	Anne Arundel	Non-Road Diesel	2270008005	Airport Service	Airport Ground Support Equipment	0.008241	0.127553	0.056556
2017	Anne Arundel	Non-Road Gasoline	2265008005	Airport Service	Airport Ground Support Equipment	0.002064	0.001597	0.076750
2017	Anne Arundel	Other	2267008005	Liquified Petroleum Gas	Airport Ground Support Equipment	0.000140	0.001024	0.006127
Anne Arundel Total						5.921073	3.281830	81.067335
2017	Baltimore	Non-Road Diesel	2270001060	Recreational	Specialty Vehicles/Carts	0.000983	0.004127	0.003763
2017	Baltimore	Non-Road Diesel	2270002003	Construction	Pavers	0.001208	0.018909	0.006960
2017	Baltimore	Non-Road Diesel	2270002006	Construction	Tampers/Rammers	0.000013	0.000073	0.000051
2017	Baltimore	Non-Road Diesel	2270002009	Construction	Plate Compactors	0.000182	0.001131	0.000706
2017	Baltimore	Non-Road Diesel	2270002015	Construction	Rollers	0.003759	0.054646	0.022096
2017	Baltimore	Non-Road Diesel	2270002018	Construction	Scrapers	0.003128	0.059630	0.025739
2017	Baltimore	Non-Road Diesel	2270002021	Construction	Paving Equipment	0.000370	0.004172	0.001861
2017	Baltimore	Non-Road Diesel	2270002024	Construction	Surfacing Equipment	0.000341	0.004891	0.002299
2017	Baltimore	Non-Road Diesel	2270002027	Construction	Signal Boards/Light Plants	0.001101	0.010637	0.004331
2017	Baltimore	Non-Road Diesel	2270002030	Construction	Trenchers	0.003337	0.040495	0.021066
2017	Baltimore	Non-Road Diesel	2270002033	Construction	Bore/Drill Rigs	0.006177	0.081344	0.024722
2017	Baltimore	Non-Road Diesel	2270002036	Construction	Excavators	0.007507	0.151228	0.047668
2017	Baltimore	Non-Road Diesel	2270002039	Construction	Concrete/Industrial Saws	0.000240	0.002624	0.001469
2017	Baltimore	Non-Road Diesel	2270002042	Construction	Cement and Mortar Mixers	0.000343	0.003133	0.001372
2017	Baltimore	Non-Road Diesel	2270002045	Construction	Cranes	0.003904	0.066883	0.015934

2017 MOVES-NR Data

yearID	County Name	Tier 2 Description	scc	Tier 3 Description	SCC Level Four	VOC	NOX	CO
2017	Baltimore	Non-Road Diesel	2270002048	Construction	Graders	0.001999	0.034610	0.011308
2017	Baltimore	Non-Road Diesel	2270002051	Construction	Off-highway Trucks	0.007213	0.178481	0.040028
2017	Baltimore	Non-Road Diesel	2270002054	Construction	Crushing/Processing Equipment	0.000875	0.015347	0.004142
2017	Baltimore	Non-Road Diesel	2270002057	Construction	Rough Terrain Forklifts	0.006908	0.085809	0.044918
2017	Baltimore	Non-Road Diesel	2270002060	Construction	Rubber Tire Loaders	0.018804	0.309375	0.113990
2017	Baltimore	Non-Road Diesel	2270002066	Construction	Tractors/Loaders/Backhoes	0.077005	0.378105	0.328281
2017	Baltimore	Non-Road Diesel	2270002069	Construction	Crawler Tractor/Dozers	0.011554	0.214150	0.077674
2017	Baltimore	Non-Road Diesel	2270002072	Construction	Skid Steer Loaders	0.076431	0.290395	0.334173
2017	Baltimore	Non-Road Diesel	2270002075	Construction	Off-highway Tractors	0.002097	0.038410	0.013868
2017	Baltimore	Non-Road Diesel	2270002078	Construction	Dumpers/Tenders	0.000270	0.000947	0.001084
2017	Baltimore	Non-Road Diesel	2270002081	Construction	Other Construction Equipment	0.003226	0.054032	0.023310
2017	Baltimore	Non-Road Diesel	2270003010	Industrial	Aerial Lifts	0.002450	0.009982	0.010174
2017	Baltimore	Non-Road Diesel	2270003020	Industrial	Forklifts	0.002428	0.057677	0.022772
2017	Baltimore	Non-Road Diesel	2270003030	Industrial	Sweepers/Scrubbers	0.001746	0.029331	0.009398
2017	Baltimore	Non-Road Diesel	2270003040	Industrial	Other General Industrial Equipment	0.002570	0.036645	0.011591
2017	Baltimore	Non-Road Diesel	2270003050	Industrial	Other Material Handling Equipment	0.000424	0.002465	0.001617
2017	Baltimore	Non-Road Diesel	2270003060	Industrial	AC/Refrigeration	0.011163	0.192219	0.054782
2017	Baltimore	Non-Road Diesel	2270003070	Industrial	Terminal Tractors	0.001445	0.026905	0.010155
2017	Baltimore	Non-Road Diesel	2270004031	Lawn & Garden	Leafblowers/Vacuums (Commercial)	0.000004	0.000023	0.000013
2017	Baltimore	Non-Road Diesel	2270004036	Lawn & Garden	Snowblowers (Commercial)	0.000000	0.000000	0.000000
2017	Baltimore	Non-Road Diesel	2270004046	Lawn & Garden	Front Mowers (Commercial)	0.012350	0.116072	0.049840
2017	Baltimore	Non-Road Diesel	2270004056	Lawn & Garden	Lawn and Garden Tractors (Commercial)	0.002570	0.022898	0.010500
2017	Baltimore	Non-Road Diesel	2270004066	Lawn & Garden	Chippers/Stump Grinders (Commercial)	0.015769	0.185709	0.066756
2017	Baltimore	Non-Road Diesel	2270004071	Lawn & Garden	Turf Equipment (Commercial)	0.000869	0.012544	0.004162
2017	Baltimore	Non-Road Diesel	2270004076	Lawn & Garden	Other Lawn and Garden Equipment (Commercial)	0.000062	0.000551	0.000258
2017	Baltimore	Non-Road Diesel	2270005010	Farm	2-Wheel Tractors	0.000000	0.000002	0.000001
2017	Baltimore	Non-Road Diesel	2270005015	Farm	Agricultural Tractors	0.005852	0.064832	0.032571
2017	Baltimore	Non-Road Diesel	2270005020	Farm	Combines	0.000828	0.009258	0.003899
2017	Baltimore	Non-Road Diesel	2270005025	Farm	Balers	0.000007	0.000044	0.000031
2017	Baltimore	Non-Road Diesel	2270005030	Farm	Agricultural Mowers	0.000001	0.000008	0.000006
2017	Baltimore	Non-Road Diesel	2270005035	Farm	Sprayers	0.000098	0.000713	0.000388
2017	Baltimore	Non-Road Diesel	2270005040	Farm	Tillers : 6 HP	0.000000	0.000002	0.000001
2017	Baltimore	Non-Road Diesel	2270005045	Farm	Swathers	0.000083	0.000661	0.000408
2017	Baltimore	Non-Road Diesel	2270005055	Farm	Other Agricultural Equipment	0.000162	0.001552	0.000803
2017	Baltimore	Non-Road Diesel	2270005060	Farm	Irrigation Sets	0.000058	0.000754	0.000262
2017	Baltimore	Non-Road Diesel	2270006005	Light Commercial	Generator Sets	0.015253	0.141299	0.060820
2017	Baltimore	Non-Road Diesel	2270006010	Light Commercial	Pumps	0.003598	0.033713	0.014815

2017 MOVES-NR Data

yearID	County Name	Tier 2 Description	scc	Tier 3 Description	SCC Level Four	VOC	NOX	CO
2017	Baltimore	Non-Road Diesel	2270006015	Light Commercial	Air Compressors	0.004848	0.063851	0.026004
2017	Baltimore	Non-Road Diesel	2270006025	Light Commercial	Welders	0.010306	0.042962	0.045005
2017	Baltimore	Non-Road Diesel	2270006030	Light Commercial	Pressure Washers	0.000556	0.004803	0.001943
2017	Baltimore	Non-Road Diesel	2270006035	Light Commercial	Hydro-power Units	0.000226	0.002835	0.001138
2017	Baltimore	Non-Road Diesel	2270007015	Logging	Forest Eqp - Feller/Bunch/Skidder	0.000118	0.001992	0.000854
2017	Baltimore	Non-Road Diesel	2270010010	Industrial	Other Oil Field Equipment	0.000195	0.003112	0.000961
2017	Baltimore	Non-Road Diesel	2282020005	Recreational Marine Vessels	Inboard/Sterndrive	0.007068	0.135565	0.026737
2017	Baltimore	Non-Road Diesel	2282020010	Recreational Marine Vessels	Outboard	0.000080	0.000425	0.000252
2017	Baltimore	Non-Road Diesel	2285002015	Railway Maintenance	Railway Maintenance	0.000833	0.005058	0.003429
2017	Baltimore	Non-Road Gasoline	2260001010	Recreational	Motorcycles: Off-road	0.129312	0.001382	0.131479
2017	Baltimore	Non-Road Gasoline	2260001030	Recreational	All Terrain Vehicles	0.033124	0.000703	0.070072
2017	Baltimore	Non-Road Gasoline	2260001060	Recreational	Specialty Vehicles/Carts	0.004145	0.001143	0.128772
2017	Baltimore	Non-Road Gasoline	2260002006	Construction	Tampers/Rammers	0.029284	0.000736	0.121820
2017	Baltimore	Non-Road Gasoline	2260002009	Construction	Plate Compactors	0.001026	0.000049	0.004586
2017	Baltimore	Non-Road Gasoline	2260002021	Construction	Paving Equipment	0.001224	0.000059	0.005536
2017	Baltimore	Non-Road Gasoline	2260002027	Construction	Signal Boards/Light Plants	0.000010	0.000000	0.000040
2017	Baltimore	Non-Road Gasoline	2260002039	Construction	Concrete/Industrial Saws	0.075054	0.001935	0.319046
2017	Baltimore	Non-Road Gasoline	2260002054	Construction	Crushing/Processing Equipment	0.000250	0.000012	0.001133
2017	Baltimore	Non-Road Gasoline	2260003030	Industrial	Sweepers/Scrubbers	0.000693	0.000030	0.002889
2017	Baltimore	Non-Road Gasoline	2260003040	Industrial	Other General Industrial Equipment	0.000051	0.000002	0.000221
2017	Baltimore	Non-Road Gasoline	2260004015	Lawn & Garden	Rotary Tillers < 6 HP (Residential)	0.006329	0.000274	0.023712
2017	Baltimore	Non-Road Gasoline	2260004016	Lawn & Garden	Rotary Tillers < 6 HP (Commercial)	0.039563	0.001879	0.164052
2017	Baltimore	Non-Road Gasoline	2260004020	Lawn & Garden	Chain Saws < 6 HP (Residential)	0.076794	0.002294	0.205343
2017	Baltimore	Non-Road Gasoline	2260004021	Lawn & Garden	Chain Saws < 6 HP (Commercial)	0.505197	0.011283	1.797899
2017	Baltimore	Non-Road Gasoline	2260004025	Lawn & Garden	Trimmers/Edgers/Brush Cutters (Residential)	0.125746	0.005137	0.420591
2017	Baltimore	Non-Road Gasoline	2260004026	Lawn & Garden	Trimmers/Edgers/Brush Cutters (Commercial)	0.402986	0.015824	1.569928
2017	Baltimore	Non-Road Gasoline	2260004030	Lawn & Garden	Leafblowers/Vacuums (Residential)	0.075696	0.003284	0.287123
2017	Baltimore	Non-Road Gasoline	2260004031	Lawn & Garden	Leafblowers/Vacuums (Commercial)	0.402770	0.014670	1.749424
2017	Baltimore	Non-Road Gasoline	2260004035	Lawn & Garden	Snowblowers (Residential)	0.004439	0.000000	0.000000
2017	Baltimore	Non-Road Gasoline	2260004036	Lawn & Garden	Snowblowers (Commercial)	0.000921	0.000000	0.000000
2017	Baltimore	Non-Road Gasoline	2260004071	Lawn & Garden	Turf Equipment (Commercial)	0.000150	0.000008	0.000724
2017	Baltimore	Non-Road Gasoline	2260005035	Farm	Sprayers	0.000050	0.000003	0.000210
2017	Baltimore	Non-Road Gasoline	2260006005	Light Commercial	Generator Sets	0.006849	0.000262	0.024083
2017	Baltimore	Non-Road Gasoline	2260006010	Light Commercial	Pumps	0.048287	0.001786	0.156359
2017	Baltimore	Non-Road Gasoline	2260006015	Light Commercial	Air Compressors	0.000016	0.000001	0.000060
2017	Baltimore	Non-Road Gasoline	2260006035	Light Commercial	Hydro-power Units	0.000297	0.000011	0.001045
2017	Baltimore	Non-Road Gasoline	2260007005	Logging	Chain Saws : 6 HP	0.001373	0.000031	0.005342

2017 MOVES-NR Data

yearID	County Name	Tier 2 Description	scc	Tier 3 Description	SCC Level Four	VOC	NOX	CO
2017	Baltimore	Non-Road Gasoline	2265001010	Recreational	Motorcycles: Off-road	0.005643	0.000827	0.052016
2017	Baltimore	Non-Road Gasoline	2265001030	Recreational	All Terrain Vehicles	0.057864	0.006066	0.602320
2017	Baltimore	Non-Road Gasoline	2265001050	Recreational	Golf Carts	0.042042	0.013916	2.094036
2017	Baltimore	Non-Road Gasoline	2265001060	Recreational	Specialty Vehicles/Carts	0.005211	0.001661	0.150986
2017	Baltimore	Non-Road Gasoline	2265002003	Construction	Pavers	0.001305	0.000603	0.064723
2017	Baltimore	Non-Road Gasoline	2265002006	Construction	Tampers/Rammers	0.000012	0.000004	0.000575
2017	Baltimore	Non-Road Gasoline	2265002009	Construction	Plate Compactors	0.003264	0.000944	0.111937
2017	Baltimore	Non-Road Gasoline	2265002015	Construction	Rollers	0.002229	0.000905	0.116110
2017	Baltimore	Non-Road Gasoline	2265002021	Construction	Paving Equipment	0.005913	0.001917	0.246386
2017	Baltimore	Non-Road Gasoline	2265002024	Construction	Surfacing Equipment	0.002341	0.000767	0.105274
2017	Baltimore	Non-Road Gasoline	2265002027	Construction	Signal Boards/Light Plants	0.000118	0.000040	0.005152
2017	Baltimore	Non-Road Gasoline	2265002030	Construction	Trenchers	0.004229	0.001912	0.189549
2017	Baltimore	Non-Road Gasoline	2265002033	Construction	Bore/Drill Rigs	0.002280	0.001496	0.060845
2017	Baltimore	Non-Road Gasoline	2265002039	Construction	Concrete/Industrial Saws	0.009069	0.003336	0.471670
2017	Baltimore	Non-Road Gasoline	2265002042	Construction	Cement and Mortar Mixers	0.007093	0.001729	0.220105
2017	Baltimore	Non-Road Gasoline	2265002045	Construction	Cranes	0.000369	0.000542	0.010145
2017	Baltimore	Non-Road Gasoline	2265002054	Construction	Crushing/Processing Equipment	0.000633	0.000272	0.029123
2017	Baltimore	Non-Road Gasoline	2265002057	Construction	Rough Terrain Forklifts	0.000265	0.000473	0.007049
2017	Baltimore	Non-Road Gasoline	2265002060	Construction	Rubber Tire Loaders	0.000231	0.000533	0.006677
2017	Baltimore	Non-Road Gasoline	2265002066	Construction	Tractors/Loaders/Backhoes	0.002868	0.001063	0.158593
2017	Baltimore	Non-Road Gasoline	2265002072	Construction	Skid Steer Loaders	0.002113	0.002217	0.078978
2017	Baltimore	Non-Road Gasoline	2265002078	Construction	Dumpers/Tenders	0.001301	0.000353	0.038415
2017	Baltimore	Non-Road Gasoline	2265002081	Construction	Other Construction Equipment	0.000658	0.001073	0.015389
2017	Baltimore	Non-Road Gasoline	2265003010	Industrial	Aerial Lifts	0.005309	0.005758	0.185050
2017	Baltimore	Non-Road Gasoline	2265003020	Industrial	Forklifts	0.003887	0.009488	0.114089
2017	Baltimore	Non-Road Gasoline	2265003030	Industrial	Sweepers/Scrubbers	0.003200	0.001925	0.137817
2017	Baltimore	Non-Road Gasoline	2265003040	Industrial	Other General Industrial Equipment	0.013353	0.003920	0.426878
2017	Baltimore	Non-Road Gasoline	2265003050	Industrial	Other Material Handling Equipment	0.000343	0.000317	0.013787
2017	Baltimore	Non-Road Gasoline	2265003060	Industrial	AC\Refrigeration	0.000342	0.000113	0.017604
2017	Baltimore	Non-Road Gasoline	2265003070	Industrial	Terminal Tractors	0.000260	0.000701	0.007902
2017	Baltimore	Non-Road Gasoline	2265004010	Lawn & Garden	Lawn Mowers (Residential)	0.299832	0.037256	3.538065
2017	Baltimore	Non-Road Gasoline	2265004011	Lawn & Garden	Lawn Mowers (Commercial)	0.207516	0.034893	3.378821
2017	Baltimore	Non-Road Gasoline	2265004015	Lawn & Garden	Rotary Tillers < 6 HP (Residential)	0.026921	0.003204	0.304302
2017	Baltimore	Non-Road Gasoline	2265004016	Lawn & Garden	Rotary Tillers < 6 HP (Commercial)	0.144615	0.020896	2.015690
2017	Baltimore	Non-Road Gasoline	2265004025	Lawn & Garden	Trimmers/Edgers/Brush Cutters (Residential)	0.001932	0.000196	0.018958
2017	Baltimore	Non-Road Gasoline	2265004026	Lawn & Garden	Trimmers/Edgers/Brush Cutters (Commercial)	0.005580	0.000802	0.097815
2017	Baltimore	Non-Road Gasoline	2265004030	Lawn & Garden	Leafblowers/Vacuums (Residential)	0.002431	0.000375	0.036161

2017 MOVES-NR Data

yearID	County Name	Tier 2 Description	scc	Tier 3 Description	SCC Level Four	VOC	NOX	CO
2017	Baltimore	Non-Road Gasoline	2265004031	Lawn & Garden	Leafblowers/Vacuums (Commercial)	0.131174	0.036934	4.226759
2017	Baltimore	Non-Road Gasoline	2265004035	Lawn & Garden	Snowblowers (Residential)	0.010320	0.000000	0.000000
2017	Baltimore	Non-Road Gasoline	2265004036	Lawn & Garden	Snowblowers (Commercial)	0.002184	0.000000	0.000000
2017	Baltimore	Non-Road Gasoline	2265004040	Lawn & Garden	Rear Engine Riding Mowers (Residential)	0.038058	0.007772	1.095591
2017	Baltimore	Non-Road Gasoline	2265004041	Lawn & Garden	Rear Engine Riding Mowers (Commercial)	0.014358	0.004363	0.678429
2017	Baltimore	Non-Road Gasoline	2265004046	Lawn & Garden	Front Mowers (Commercial)	0.021429	0.006772	0.803760
2017	Baltimore	Non-Road Gasoline	2265004051	Lawn & Garden	Shredders < 6 HP (Commercial)	0.016867	0.002443	0.233455
2017	Baltimore	Non-Road Gasoline	2265004055	Lawn & Garden	Lawn and Garden Tractors (Residential)	0.414109	0.103930	14.678212
2017	Baltimore	Non-Road Gasoline	2265004056	Lawn & Garden	Lawn and Garden Tractors (Commercial)	0.186233	0.059294	9.224359
2017	Baltimore	Non-Road Gasoline	2265004066	Lawn & Garden	Chippers/Stump Grinders (Commercial)	0.019624	0.010056	0.954976
2017	Baltimore	Non-Road Gasoline	2265004071	Lawn & Garden	Turf Equipment (Commercial)	0.542451	0.190147	25.598716
2017	Baltimore	Non-Road Gasoline	2265004075	Lawn & Garden	Other Lawn and Garden Equipment (Residential)	0.019876	0.004276	0.441963
2017	Baltimore	Non-Road Gasoline	2265004076	Lawn & Garden	Other Lawn and Garden Equipment (Commercial)	0.033984	0.007486	0.774583
2017	Baltimore	Non-Road Gasoline	2265005010	Farm	2-Wheel Tractors	0.000013	0.000005	0.000734
2017	Baltimore	Non-Road Gasoline	2265005015	Farm	Agricultural Tractors	0.000017	0.000021	0.000799
2017	Baltimore	Non-Road Gasoline	2265005020	Farm	Combines	0.000001	0.000001	0.000014
2017	Baltimore	Non-Road Gasoline	2265005025	Farm	Balers	0.000069	0.000090	0.001238
2017	Baltimore	Non-Road Gasoline	2265005030	Farm	Agricultural Mowers	0.000012	0.000004	0.000606
2017	Baltimore	Non-Road Gasoline	2265005035	Farm	Sprayers	0.000191	0.000122	0.005624
2017	Baltimore	Non-Road Gasoline	2265005040	Farm	Tillers : 6 HP	0.000920	0.000162	0.025352
2017	Baltimore	Non-Road Gasoline	2265005045	Farm	Swathers	0.000099	0.000143	0.001960
2017	Baltimore	Non-Road Gasoline	2265005055	Farm	Other Agricultural Equipment	0.000120	0.000162	0.003253
2017	Baltimore	Non-Road Gasoline	2265005060	Farm	Irrigation Sets	0.000016	0.000030	0.000494
2017	Baltimore	Non-Road Gasoline	2265006005	Light Commercial	Generator Sets	0.175364	0.046480	6.050395
2017	Baltimore	Non-Road Gasoline	2265006010	Light Commercial	Pumps	0.038045	0.012106	1.186394
2017	Baltimore	Non-Road Gasoline	2265006015	Light Commercial	Air Compressors	0.015655	0.006014	0.566314
2017	Baltimore	Non-Road Gasoline	2265006025	Light Commercial	Welders	0.035621	0.012245	1.554152
2017	Baltimore	Non-Road Gasoline	2265006030	Light Commercial	Pressure Washers	0.073548	0.018521	2.386216
2017	Baltimore	Non-Road Gasoline	2265006035	Light Commercial	Hydro-power Units	0.002563	0.000860	0.121538
2017	Baltimore	Non-Road Gasoline	2265007010	Logging	Shredders : 6 HP	0.000335	0.000098	0.009574
2017	Baltimore	Non-Road Gasoline	2265007015	Logging	Forest Eqp - Feller/Bunch/Skidder	0.000002	0.000001	0.000070
2017	Baltimore	Non-Road Gasoline	2265010010	Industrial	Other Oil Field Equipment	0.000181	0.000066	0.009722
2017	Baltimore	Non-Road Gasoline	2282005010	Recreational Marine Vessels	Outboard	1.138518	0.178654	3.275404
2017	Baltimore	Non-Road Gasoline	2282005015	Recreational Marine Vessels	Personal Water Craft	0.206548	0.079687	1.566990
2017	Baltimore	Non-Road Gasoline	2282010005	Recreational Marine Vessels	Inboard/Sterndrive	0.115468	0.141593	1.781908
2017	Baltimore	Non-Road Gasoline	2285004015	Railway Maintenance	Railway Maintenance	0.000203	0.000067	0.009044
2017	Baltimore	Other	2267001060	Liquified Petroleum Gas	Specialty Vehicles/Carts	0.000076	0.000348	0.001671

2017 MOVES-NR Data

yearID	County Name	Tier 2 Description	scc	Tier 3 Description	SCC Level Four	VOC	NOX	CO
2017	Baltimore	Other	2267002003	Liquified Petroleum Gas	Pavers	0.000041	0.000199	0.001250
2017	Baltimore	Other	2267002015	Liquified Petroleum Gas	Rollers	0.000022	0.000149	0.000936
2017	Baltimore	Other	2267002021	Liquified Petroleum Gas	Paving Equipment	0.000033	0.000142	0.000805
2017	Baltimore	Other	2267002024	Liquified Petroleum Gas	Surfacing Equipment	0.000006	0.000030	0.000189
2017	Baltimore	Other	2267002030	Liquified Petroleum Gas	Trenchers	0.000132	0.000635	0.004018
2017	Baltimore	Other	2267002033	Liquified Petroleum Gas	Bore/Drill Rigs	0.000252	0.001113	0.005250
2017	Baltimore	Other	2267002039	Liquified Petroleum Gas	Concrete/Industrial Saws	0.000027	0.000218	0.001200
2017	Baltimore	Other	2267002045	Liquified Petroleum Gas	Cranes	0.000127	0.000551	0.003201
2017	Baltimore	Other	2267002054	Liquified Petroleum Gas	Crushing/Processing Equipment	0.000019	0.000083	0.000497
2017	Baltimore	Other	2267002057	Liquified Petroleum Gas	Rough Terrain Forklifts	0.000104	0.000484	0.003084
2017	Baltimore	Other	2267002060	Liquified Petroleum Gas	Rubber Tire Loaders	0.000086	0.000516	0.003411
2017	Baltimore	Other	2267002066	Liquified Petroleum Gas	Tractors/Loaders/Backhoes	0.000006	0.000043	0.000271
2017	Baltimore	Other	2267002072	Liquified Petroleum Gas	Skid Steer Loaders	0.000448	0.001962	0.010833
2017	Baltimore	Other	2267002081	Liquified Petroleum Gas	Other Construction Equipment	0.000250	0.001073	0.005815
2017	Baltimore	Other	2267003010	Liquified Petroleum Gas	Aerial Lifts	0.001101	0.005134	0.028179
2017	Baltimore	Other	2267003020	Liquified Petroleum Gas	Forklifts	0.021885	0.147835	0.893176
2017	Baltimore	Other	2267003030	Liquified Petroleum Gas	Sweepers/Scrubbers	0.000130	0.000978	0.005507
2017	Baltimore	Other	2267003040	Liquified Petroleum Gas	Other General Industrial Equipment	0.000044	0.000317	0.001866
2017	Baltimore	Other	2267003050	Liquified Petroleum Gas	Other Material Handling Equipment	0.000047	0.000220	0.001360
2017	Baltimore	Other	2267003070	Liquified Petroleum Gas	Terminal Tractors	0.000065	0.000549	0.002836
2017	Baltimore	Other	2267004066	Liquified Petroleum Gas	Chippers/Stump Grinders (Commercial)	0.000563	0.003913	0.023688
2017	Baltimore	Other	2267005055	Liquified Petroleum Gas	Other Agricultural Equipment	0.000000	0.000002	0.000007
2017	Baltimore	Other	2267005060	Liquified Petroleum Gas	Irrigation Sets	0.000000	0.000000	0.000003
2017	Baltimore	Other	2267006005	Liquified Petroleum Gas	Generator Sets	0.004076	0.024046	0.085142
2017	Baltimore	Other	2267006010	Liquified Petroleum Gas	Pumps	0.000480	0.002956	0.012257
2017	Baltimore	Other	2267006015	Liquified Petroleum Gas	Air Compressors	0.000250	0.001749	0.009655
2017	Baltimore	Other	2267006025	Liquified Petroleum Gas	Welders	0.000414	0.002258	0.014116
2017	Baltimore	Other	2267006030	Liquified Petroleum Gas	Pressure Washers	0.000014	0.000066	0.000380
2017	Baltimore	Other	2267006035	Liquified Petroleum Gas	Hydro-power Units	0.000003	0.000024	0.000131
2017	Baltimore	Other	2268002081	Compressed Natural Gas	Other Construction Equipment	0.000038	0.000046	0.000247
2017	Baltimore	Other	2268003020	Compressed Natural Gas	Forklifts	0.006307	0.011897	0.069419
2017	Baltimore	Other	2268003030	Compressed Natural Gas	Sweepers/Scrubbers	0.000005	0.000010	0.000057
2017	Baltimore	Other	2268003040	Compressed Natural Gas	Other General Industrial Equipment	0.000003	0.000005	0.000030
2017	Baltimore	Other	2268003060	Compressed Natural Gas	AC/Refrigeration	0.000019	0.000036	0.000194
2017	Baltimore	Other	2268003070	Compressed Natural Gas	Terminal Tractors	0.000024	0.000055	0.000269
2017	Baltimore	Other	2268005055	Compressed Natural Gas	Other Agricultural Equipment	0.000003	0.000004	0.000018
2017	Baltimore	Other	2268005060	Compressed Natural Gas	Irrigation Sets	0.000025	0.000050	0.000295

2017 MOVES-NR Data

yearID	County Name	Tier 2 Description	scc	Tier 3 Description	SCC Level Four	VOC	NOX	CO
2017	Baltimore	Other	2268006005	Compressed Natural Gas	Generator Sets	0.005742	0.009512	0.032827
2017	Baltimore	Other	2268006010	Compressed Natural Gas	Pumps	0.000174	0.000294	0.001154
2017	Baltimore	Other	2268006015	Compressed Natural Gas	Air Compressors	0.000090	0.000176	0.000952
2017	Baltimore	Other	2268006020	Compressed Natural Gas	Gas Compressors	0.001765	0.003663	0.019081
2017	Baltimore	Other	2268010010	Compressed Natural Gas	Other Oil Field Equipment	0.000023	0.000051	0.000259
2017	Baltimore	Other	2285006015	Liquified Petroleum Gas	Railway Maintenance	0.000001	0.000005	0.000038
2017	Baltimore	Non-Road Diesel	2270008005	Airport Service	Airport Ground Support Equipment	0.000006	0.000092	0.000041
2017	Baltimore	Non-Road Gasoline	2265008005	Airport Service	Airport Ground Support Equipment	0.000001	0.000001	0.000055
2017	Baltimore	Other	2267008005	Liquified Petroleum Gas	Airport Ground Support Equipment	0.000000	0.000001	0.000004
Baltimore Total						6.486301	4.689428	102.479906
2017	Baltimore City	Non-Road Diesel	2270003010	Industrial	Aerial Lifts	0.001859	0.007573	0.007720
2017	Baltimore City	Non-Road Diesel	2270003020	Industrial	Forklifts	0.001842	0.043761	0.017277
2017	Baltimore City	Non-Road Diesel	2270003030	Industrial	Sweepers/Scrubbers	0.001324	0.022254	0.007130
2017	Baltimore City	Non-Road Diesel	2270003040	Industrial	Other General Industrial Equipment	0.001950	0.027803	0.008794
2017	Baltimore City	Non-Road Diesel	2270003050	Industrial	Other Material Handling Equipment	0.000322	0.001870	0.001227
2017	Baltimore City	Non-Road Diesel	2270003060	Industrial	AC\Refrigeration	0.009239	0.159087	0.045340
2017	Baltimore City	Non-Road Diesel	2270003070	Industrial	Terminal Tractors	0.001096	0.020413	0.007704
2017	Baltimore City	Non-Road Diesel	2270004031	Lawn & Garden	Leafblowers/Vacuums (Commercial)	0.000000	0.000003	0.000002
2017	Baltimore City	Non-Road Diesel	2270004036	Lawn & Garden	Snowblowers (Commercial)	0.000000	0.000000	0.000000
2017	Baltimore City	Non-Road Diesel	2270004046	Lawn & Garden	Front Mowers (Commercial)	0.001552	0.014590	0.006265
2017	Baltimore City	Non-Road Diesel	2270004056	Lawn & Garden	Lawn and Garden Tractors (Commercial)	0.000323	0.002878	0.001320
2017	Baltimore City	Non-Road Diesel	2270004066	Lawn & Garden	Chippers/Stump Grinders (Commercial)	0.001982	0.023343	0.008391
2017	Baltimore City	Non-Road Diesel	2270004071	Lawn & Garden	Turf Equipment (Commercial)	0.000109	0.001577	0.000523
2017	Baltimore City	Non-Road Diesel	2270004076	Lawn & Garden	Other Lawn and Garden Equipment (Commercial)	0.000008	0.000069	0.000032
2017	Baltimore City	Non-Road Diesel	2270006005	Light Commercial	Generator Sets	0.009624	0.089153	0.038375
2017	Baltimore City	Non-Road Diesel	2270006010	Light Commercial	Pumps	0.002270	0.021271	0.009348
2017	Baltimore City	Non-Road Diesel	2270006015	Light Commercial	Air Compressors	0.003059	0.040287	0.016407
2017	Baltimore City	Non-Road Diesel	2270006025	Light Commercial	Welders	0.006502	0.027107	0.028396
2017	Baltimore City	Non-Road Diesel	2270006030	Light Commercial	Pressure Washers	0.000351	0.003031	0.001226
2017	Baltimore City	Non-Road Diesel	2270006035	Light Commercial	Hydro-power Units	0.000142	0.001789	0.000718
2017	Baltimore City	Non-Road Diesel	2270010010	Industrial	Other Oil Field Equipment	0.000195	0.003112	0.000961
2017	Baltimore City	Non-Road Diesel	2282020005	Recreational Marine Vessels	Inboard/Sterndrive	0.001757	0.033708	0.006648
2017	Baltimore City	Non-Road Diesel	2282020010	Recreational Marine Vessels	Outboard	0.000026	0.000136	0.000080
2017	Baltimore City	Non-Road Diesel	2285002015	Railway Maintenance	Railway Maintenance	0.000424	0.002577	0.001747
2017	Baltimore City	Non-Road Gasoline	2260003030	Industrial	Sweepers/Scrubbers	0.000526	0.000022	0.002192
2017	Baltimore City	Non-Road Gasoline	2260003040	Industrial	Other General Industrial Equipment	0.000039	0.000002	0.000168
2017	Baltimore City	Non-Road Gasoline	2260004015	Lawn & Garden	Rotary Tillers < 6 HP (Residential)	0.005895	0.000255	0.022033

2017 MOVES-NR Data

yearID	County Name	Tier 2 Description	scc	Tier 3 Description	SCC Level Four	VOC	NOX	CO
2017	Baltimore City	Non-Road Gasoline	2260004016	Lawn & Garden	Rotary Tillers < 6 HP (Commercial)	0.004974	0.000236	0.020620
2017	Baltimore City	Non-Road Gasoline	2260004020	Lawn & Garden	Chain Saws < 6 HP (Residential)	0.071732	0.002131	0.190802
2017	Baltimore City	Non-Road Gasoline	2260004021	Lawn & Garden	Chain Saws < 6 HP (Commercial)	0.063516	0.001418	0.225985
2017	Baltimore City	Non-Road Gasoline	2260004025	Lawn & Garden	Trimmers/Edgers/Brush Cutters (Residential)	0.117085	0.004773	0.390808
2017	Baltimore City	Non-Road Gasoline	2260004026	Lawn & Garden	Trimmers/Edgers/Brush Cutters (Commercial)	0.050667	0.001989	0.197331
2017	Baltimore City	Non-Road Gasoline	2260004030	Lawn & Garden	Leafblowers/Vacuums (Residential)	0.070547	0.003051	0.266791
2017	Baltimore City	Non-Road Gasoline	2260004031	Lawn & Garden	Leafblowers/Vacuums (Commercial)	0.050638	0.001844	0.219893
2017	Baltimore City	Non-Road Gasoline	2260004035	Lawn & Garden	Snowblowers (Residential)	0.004216	0.000000	0.000000
2017	Baltimore City	Non-Road Gasoline	2260004036	Lawn & Garden	Snowblowers (Commercial)	0.000118	0.000000	0.000000
2017	Baltimore City	Non-Road Gasoline	2260004071	Lawn & Garden	Turf Equipment (Commercial)	0.000019	0.000001	0.000091
2017	Baltimore City	Non-Road Gasoline	2260006005	Light Commercial	Generator Sets	0.004324	0.000165	0.015195
2017	Baltimore City	Non-Road Gasoline	2260006010	Light Commercial	Pumps	0.030478	0.001127	0.098655
2017	Baltimore City	Non-Road Gasoline	2260006015	Light Commercial	Air Compressors	0.000010	0.000000	0.000038
2017	Baltimore City	Non-Road Gasoline	2260006035	Light Commercial	Hydro-power Units	0.000187	0.000007	0.000659
2017	Baltimore City	Non-Road Gasoline	2265001050	Recreational	Golf Carts	0.011083	0.003627	0.553372
2017	Baltimore City	Non-Road Gasoline	2265003010	Industrial	Aerial Lifts	0.004037	0.004327	0.140990
2017	Baltimore City	Non-Road Gasoline	2265003020	Industrial	Forklifts	0.002959	0.007129	0.086925
2017	Baltimore City	Non-Road Gasoline	2265003030	Industrial	Sweepers/Scrubbers	0.002435	0.001446	0.105003
2017	Baltimore City	Non-Road Gasoline	2265003040	Industrial	Other General Industrial Equipment	0.010158	0.002946	0.325239
2017	Baltimore City	Non-Road Gasoline	2265003050	Industrial	Other Material Handling Equipment	0.000261	0.000238	0.010504
2017	Baltimore City	Non-Road Gasoline	2265003060	Industrial	AC\Refrigeration	0.000283	0.000092	0.014630
2017	Baltimore City	Non-Road Gasoline	2265003070	Industrial	Terminal Tractors	0.000198	0.000527	0.006021
2017	Baltimore City	Non-Road Gasoline	2265004010	Lawn & Garden	Lawn Mowers (Residential)	0.279995	0.034282	3.301307
2017	Baltimore City	Non-Road Gasoline	2265004011	Lawn & Garden	Lawn Mowers (Commercial)	0.026130	0.004343	0.426479
2017	Baltimore City	Non-Road Gasoline	2265004015	Lawn & Garden	Rotary Tillers < 6 HP (Residential)	0.025128	0.002948	0.283939
2017	Baltimore City	Non-Road Gasoline	2265004016	Lawn & Garden	Rotary Tillers < 6 HP (Commercial)	0.018204	0.002601	0.254423
2017	Baltimore City	Non-Road Gasoline	2265004025	Lawn & Garden	Trimmers/Edgers/Brush Cutters (Residential)	0.001803	0.000181	0.017690
2017	Baltimore City	Non-Road Gasoline	2265004026	Lawn & Garden	Trimmers/Edgers/Brush Cutters (Commercial)	0.000702	0.000100	0.012346
2017	Baltimore City	Non-Road Gasoline	2265004030	Lawn & Garden	Leafblowers/Vacuums (Residential)	0.002273	0.000345	0.033742
2017	Baltimore City	Non-Road Gasoline	2265004031	Lawn & Garden	Leafblowers/Vacuums (Commercial)	0.016525	0.004597	0.533508
2017	Baltimore City	Non-Road Gasoline	2265004035	Lawn & Garden	Snowblowers (Residential)	0.009791	0.000000	0.000000
2017	Baltimore City	Non-Road Gasoline	2265004036	Lawn & Garden	Snowblowers (Commercial)	0.000281	0.000000	0.000000
2017	Baltimore City	Non-Road Gasoline	2265004040	Lawn & Garden	Rear Engine Riding Mowers (Residential)	0.035637	0.007151	1.022277
2017	Baltimore City	Non-Road Gasoline	2265004041	Lawn & Garden	Rear Engine Riding Mowers (Commercial)	0.001810	0.000543	0.085632
2017	Baltimore City	Non-Road Gasoline	2265004046	Lawn & Garden	Front Mowers (Commercial)	0.002715	0.000843	0.101452
2017	Baltimore City	Non-Road Gasoline	2265004051	Lawn & Garden	Shredders < 6 HP (Commercial)	0.002124	0.000304	0.029467
2017	Baltimore City	Non-Road Gasoline	2265004055	Lawn & Garden	Lawn and Garden Tractors (Residential)	0.387277	0.095634	13.695988

2017 MOVES-NR Data

yearID	County Name	Tier 2 Description	scc	Tier 3 Description	SCC Level Four	VOC	NOX	CO
2017	Baltimore City	Non-Road Gasoline	2265004056	Lawn & Garden	Lawn and Garden Tractors (Commercial)	0.023483	0.007381	1.164311
2017	Baltimore City	Non-Road Gasoline	2265004066	Lawn & Garden	Chippers/Stump Grinders (Commercial)	0.002477	0.001252	0.120538
2017	Baltimore City	Non-Road Gasoline	2265004071	Lawn & Garden	Turf Equipment (Commercial)	0.068417	0.023669	3.231102
2017	Baltimore City	Non-Road Gasoline	2265004075	Lawn & Garden	Other Lawn and Garden Equipment (Residential)	0.018608	0.003935	0.412388
2017	Baltimore City	Non-Road Gasoline	2265004076	Lawn & Garden	Other Lawn and Garden Equipment (Commercial)	0.004306	0.000932	0.097769
2017	Baltimore City	Non-Road Gasoline	2265006005	Light Commercial	Generator Sets	0.111352	0.029043	3.833512
2017	Baltimore City	Non-Road Gasoline	2265006010	Light Commercial	Pumps	0.024076	0.007564	0.751695
2017	Baltimore City	Non-Road Gasoline	2265006015	Light Commercial	Air Compressors	0.009905	0.003758	0.358815
2017	Baltimore City	Non-Road Gasoline	2265006025	Light Commercial	Welders	0.022537	0.007651	0.984706
2017	Baltimore City	Non-Road Gasoline	2265006030	Light Commercial	Pressure Washers	0.046584	0.011573	1.511899
2017	Baltimore City	Non-Road Gasoline	2265006035	Light Commercial	Hydro-power Units	0.001621	0.000538	0.077006
2017	Baltimore City	Non-Road Gasoline	2265010010	Industrial	Other Oil Field Equipment	0.000181	0.000065	0.009763
2017	Baltimore City	Non-Road Gasoline	2282005010	Recreational Marine Vessels	Outboard	0.366191	0.057095	1.046779
2017	Baltimore City	Non-Road Gasoline	2282005015	Recreational Marine Vessels	Personal Water Craft	0.066130	0.025467	0.500791
2017	Baltimore City	Non-Road Gasoline	2282010005	Recreational Marine Vessels	Inboard/Sterndrive	0.029149	0.034866	0.444926
2017	Baltimore City	Non-Road Gasoline	2285004015	Railway Maintenance	Railway Maintenance	0.000104	0.000034	0.004627
2017	Baltimore City	Other	2267003010	Liquified Petroleum Gas	Aerial Lifts	0.000835	0.003895	0.021380
2017	Baltimore City	Other	2267003020	Liquified Petroleum Gas	Forklifts	0.016605	0.112166	0.677673
2017	Baltimore City	Other	2267003030	Liquified Petroleum Gas	Sweepers/Scrubbers	0.000099	0.000742	0.004178
2017	Baltimore City	Other	2267003040	Liquified Petroleum Gas	Other General Industrial Equipment	0.000033	0.000241	0.001416
2017	Baltimore City	Other	2267003050	Liquified Petroleum Gas	Other Material Handling Equipment	0.000035	0.000167	0.001032
2017	Baltimore City	Other	2267003070	Liquified Petroleum Gas	Terminal Tractors	0.000050	0.000417	0.002152
2017	Baltimore City	Other	2267004066	Liquified Petroleum Gas	Chippers/Stump Grinders (Commercial)	0.000071	0.000492	0.002977
2017	Baltimore City	Other	2267006005	Liquified Petroleum Gas	Generator Sets	0.002572	0.015172	0.053720
2017	Baltimore City	Other	2267006010	Liquified Petroleum Gas	Pumps	0.000303	0.001865	0.007734
2017	Baltimore City	Other	2267006015	Liquified Petroleum Gas	Air Compressors	0.000158	0.001104	0.006092
2017	Baltimore City	Other	2267006025	Liquified Petroleum Gas	Welders	0.000261	0.001424	0.008907
2017	Baltimore City	Other	2267006030	Liquified Petroleum Gas	Pressure Washers	0.000009	0.000042	0.000240
2017	Baltimore City	Other	2267006035	Liquified Petroleum Gas	Hydro-power Units	0.000002	0.000015	0.000083
2017	Baltimore City	Other	2268003020	Compressed Natural Gas	Forklifts	0.004785	0.009027	0.052670
2017	Baltimore City	Other	2268003030	Compressed Natural Gas	Sweepers/Scrubbers	0.000004	0.000007	0.000043
2017	Baltimore City	Other	2268003040	Compressed Natural Gas	Other General Industrial Equipment	0.000002	0.000004	0.000022
2017	Baltimore City	Other	2268003060	Compressed Natural Gas	AC\Refrigeration	0.000016	0.000030	0.000160
2017	Baltimore City	Other	2268003070	Compressed Natural Gas	Terminal Tractors	0.000018	0.000041	0.000204
2017	Baltimore City	Other	2268006005	Compressed Natural Gas	Generator Sets	0.003623	0.006002	0.020712
2017	Baltimore City	Other	2268006010	Compressed Natural Gas	Pumps	0.000110	0.000186	0.000728
2017	Baltimore City	Other	2268006015	Compressed Natural Gas	Air Compressors	0.000057	0.000111	0.000601

2017 MOVES-NR Data

yearID	County Name	Tier 2 Description	scc	Tier 3 Description	SCC Level Four	VOC	NOX	CO
2017	Baltimore City	Other	2268006020	Compressed Natural Gas	Gas Compressors	0.001114	0.002311	0.012039
2017	Baltimore City	Other	2268010010	Compressed Natural Gas	Other Oil Field Equipment	0.000023	0.000051	0.000259
2017	Baltimore City	Other	2285006015	Liquified Petroleum Gas	Railway Maintenance	0.000001	0.000003	0.000019
Baltimore City Total						2.188644	1.108956	38.333498
Carroll Total						1.575592	0.966487	25.904336
Harford Total						2.717361	1.602205	30.557946
2017	Howard	Non-Road Diesel	2270001060	Recreational	Specialty Vehicles/Carts	0.000328	0.001376	0.001254
2017	Howard	Non-Road Diesel	2270002003	Construction	Pavers	0.000232	0.003628	0.001335
2017	Howard	Non-Road Diesel	2270002006	Construction	Tampers/Rammers	0.000002	0.000014	0.000010
2017	Howard	Non-Road Diesel	2270002009	Construction	Plate Compactors	0.000035	0.000217	0.000135
2017	Howard	Non-Road Diesel	2270002015	Construction	Rollers	0.000721	0.010485	0.004240
2017	Howard	Non-Road Diesel	2270002018	Construction	Scrapers	0.000600	0.011442	0.004939
2017	Howard	Non-Road Diesel	2270002021	Construction	Paving Equipment	0.000071	0.000801	0.000357
2017	Howard	Non-Road Diesel	2270002024	Construction	Surfacing Equipment	0.000065	0.000938	0.000441
2017	Howard	Non-Road Diesel	2270002027	Construction	Signal Boards/Light Plants	0.000211	0.002041	0.000831
2017	Howard	Non-Road Diesel	2270002030	Construction	Trenchers	0.000640	0.007770	0.004042
2017	Howard	Non-Road Diesel	2270002033	Construction	Bore/Drill Rigs	0.001185	0.015608	0.004744
2017	Howard	Non-Road Diesel	2270002036	Construction	Excavators	0.001440	0.029018	0.009146
2017	Howard	Non-Road Diesel	2270002039	Construction	Concrete/Industrial Saws	0.000046	0.000504	0.000282
2017	Howard	Non-Road Diesel	2270002042	Construction	Cement and Mortar Mixers	0.000066	0.000601	0.000263
2017	Howard	Non-Road Diesel	2270002045	Construction	Cranes	0.000749	0.012833	0.003058
2017	Howard	Non-Road Diesel	2270002048	Construction	Graders	0.000383	0.006641	0.002170
2017	Howard	Non-Road Diesel	2270002051	Construction	Off-highway Trucks	0.001384	0.034247	0.007681
2017	Howard	Non-Road Diesel	2270002054	Construction	Crushing/Processing Equipment	0.000168	0.002945	0.000795
2017	Howard	Non-Road Diesel	2270002057	Construction	Rough Terrain Forklifts	0.001325	0.016465	0.008619
2017	Howard	Non-Road Diesel	2270002060	Construction	Rubber Tire Loaders	0.003608	0.059363	0.021872
2017	Howard	Non-Road Diesel	2270002066	Construction	Tractors/Loaders/Backhoes	0.014776	0.072551	0.062990
2017	Howard	Non-Road Diesel	2270002069	Construction	Crawler Tractor/Dozers	0.002217	0.041091	0.014904
2017	Howard	Non-Road Diesel	2270002072	Construction	Skid Steer Loaders	0.014666	0.055721	0.064121
2017	Howard	Non-Road Diesel	2270002075	Construction	Off-highway Tractors	0.000402	0.007370	0.002661
2017	Howard	Non-Road Diesel	2270002078	Construction	Dumpers/Tenders	0.000052	0.000182	0.000208
2017	Howard	Non-Road Diesel	2270002081	Construction	Other Construction Equipment	0.000619	0.010368	0.004473
2017	Howard	Non-Road Diesel	2270003010	Industrial	Aerial Lifts	0.000749	0.003051	0.003110
2017	Howard	Non-Road Diesel	2270003020	Industrial	Forklifts	0.000742	0.017631	0.006961
2017	Howard	Non-Road Diesel	2270003030	Industrial	Sweepers/Scrubbers	0.000534	0.008966	0.002873
2017	Howard	Non-Road Diesel	2270003040	Industrial	Other General Industrial Equipment	0.000786	0.011202	0.003543
2017	Howard	Non-Road Diesel	2270003050	Industrial	Other Material Handling Equipment	0.000130	0.000754	0.000494

2017 MOVES-NR Data

yearID	County Name	Tier 2 Description	scc	Tier 3 Description	SCC Level Four	VOC	NOX	CO
2017	Howard	Non-Road Diesel	2270003060	Industrial	AC/Refrigeration	0.003775	0.064997	0.018524
2017	Howard	Non-Road Diesel	2270003070	Industrial	Terminal Tractors	0.000442	0.008224	0.003104
2017	Howard	Non-Road Diesel	2270004031	Lawn & Garden	Leafblowers/Vacuums (Commercial)	0.000003	0.000016	0.000009
2017	Howard	Non-Road Diesel	2270004036	Lawn & Garden	Snowblowers (Commercial)	0.000000	0.000000	0.000000
2017	Howard	Non-Road Diesel	2270004046	Lawn & Garden	Front Mowers (Commercial)	0.008354	0.078510	0.033711
2017	Howard	Non-Road Diesel	2270004056	Lawn & Garden	Lawn and Garden Tractors (Commercial)	0.001739	0.015488	0.007102
2017	Howard	Non-Road Diesel	2270004066	Lawn & Garden	Chippers/Stump Grinders (Commercial)	0.010666	0.125612	0.045153
2017	Howard	Non-Road Diesel	2270004071	Lawn & Garden	Turf Equipment (Commercial)	0.000588	0.008485	0.002815
2017	Howard	Non-Road Diesel	2270004076	Lawn & Garden	Other Lawn and Garden Equipment (Commercial)	0.000042	0.000373	0.000174
2017	Howard	Non-Road Diesel	2270005010	Farm	2-Wheel Tractors	0.000000	0.000001	0.000001
2017	Howard	Non-Road Diesel	2270005015	Farm	Agricultural Tractors	0.003135	0.034729	0.017448
2017	Howard	Non-Road Diesel	2270005020	Farm	Combines	0.000444	0.004959	0.002088
2017	Howard	Non-Road Diesel	2270005025	Farm	Balers	0.000004	0.000024	0.000016
2017	Howard	Non-Road Diesel	2270005030	Farm	Agricultural Mowers	0.000001	0.000004	0.000003
2017	Howard	Non-Road Diesel	2270005035	Farm	Sprayers	0.000053	0.000382	0.000208
2017	Howard	Non-Road Diesel	2270005040	Farm	Tillers : 6 HP	0.000000	0.000001	0.000001
2017	Howard	Non-Road Diesel	2270005045	Farm	Swathers	0.000044	0.000354	0.000218
2017	Howard	Non-Road Diesel	2270005055	Farm	Other Agricultural Equipment	0.000087	0.000831	0.000430
2017	Howard	Non-Road Diesel	2270005060	Farm	Irrigation Sets	0.000031	0.000404	0.000141
2017	Howard	Non-Road Diesel	2270006005	Light Commercial	Generator Sets	0.009049	0.083826	0.036082
2017	Howard	Non-Road Diesel	2270006010	Light Commercial	Pumps	0.002135	0.020000	0.008789
2017	Howard	Non-Road Diesel	2270006015	Light Commercial	Air Compressors	0.002876	0.037880	0.015427
2017	Howard	Non-Road Diesel	2270006025	Light Commercial	Welders	0.006114	0.025487	0.026699
2017	Howard	Non-Road Diesel	2270006030	Light Commercial	Pressure Washers	0.000330	0.002850	0.001153
2017	Howard	Non-Road Diesel	2270006035	Light Commercial	Hydro-power Units	0.000134	0.001682	0.000675
2017	Howard	Non-Road Diesel	2270007015	Logging	Forest Eq - Feller/Bunch/Skidder	0.000061	0.001022	0.000438
2017	Howard	Non-Road Diesel	2270010010	Industrial	Other Oil Field Equipment	0.000071	0.001132	0.000350
2017	Howard	Non-Road Diesel	2282020005	Recreational Marine Vessels	Inboard/Sterndrive	0.000153	0.002931	0.000578
2017	Howard	Non-Road Diesel	2282020010	Recreational Marine Vessels	Outboard	0.000003	0.000018	0.000010
2017	Howard	Non-Road Diesel	2285002015	Railway Maintenance	Railway Maintenance	0.000547	0.003324	0.002254
2017	Howard	Non-Road Gasoline	2260001010	Recreational	Motorcycles: Off-road	0.043116	0.000461	0.043826
2017	Howard	Non-Road Gasoline	2260001030	Recreational	All Terrain Vehicles	0.011049	0.000234	0.023357
2017	Howard	Non-Road Gasoline	2260001060	Recreational	Specialty Vehicles/Carts	0.001390	0.000381	0.042924
2017	Howard	Non-Road Gasoline	2260002006	Construction	Tampers/Rammers	0.005621	0.000141	0.023375
2017	Howard	Non-Road Gasoline	2260002009	Construction	Plate Compactors	0.000197	0.000009	0.000880
2017	Howard	Non-Road Gasoline	2260002021	Construction	Paving Equipment	0.000235	0.000011	0.001062
2017	Howard	Non-Road Gasoline	2260002027	Construction	Signal Boards/Light Plants	0.000002	0.000000	0.000008

2017 MOVES-NR Data

yearID	County Name	Tier 2 Description	scc	Tier 3 Description	SCC Level Four	VOC	NOX	CO
2017	Howard	Non-Road Gasoline	2260002039	Construction	Concrete/Industrial Saws	0.014403	0.000371	0.061219
2017	Howard	Non-Road Gasoline	2260002054	Construction	Crushing/Processing Equipment	0.000048	0.000002	0.000217
2017	Howard	Non-Road Gasoline	2260003030	Industrial	Sweepers/Scrubbers	0.000212	0.000009	0.000883
2017	Howard	Non-Road Gasoline	2260003040	Industrial	Other General Industrial Equipment	0.000016	0.000001	0.000068
2017	Howard	Non-Road Gasoline	2260004015	Lawn & Garden	Rotary Tillers < 6 HP (Residential)	0.001922	0.000083	0.007187
2017	Howard	Non-Road Gasoline	2260004016	Lawn & Garden	Rotary Tillers < 6 HP (Commercial)	0.026763	0.001271	0.110963
2017	Howard	Non-Road Gasoline	2260004020	Lawn & Garden	Chain Saws < 6 HP (Residential)	0.023305	0.000695	0.062235
2017	Howard	Non-Road Gasoline	2260004021	Lawn & Garden	Chain Saws < 6 HP (Commercial)	0.341731	0.007632	1.216077
2017	Howard	Non-Road Gasoline	2260004025	Lawn & Garden	Trimmers/Edgers/Brush Cutters (Residential)	0.038178	0.001557	0.127472
2017	Howard	Non-Road Gasoline	2260004026	Lawn & Garden	Trimmers/Edgers/Brush Cutters (Commercial)	0.272610	0.010703	1.061882
2017	Howard	Non-Road Gasoline	2260004030	Lawn & Garden	Leafblowers/Vacuums (Residential)	0.023048	0.000995	0.087021
2017	Howard	Non-Road Gasoline	2260004031	Lawn & Garden	Leafblowers/Vacuums (Commercial)	0.272470	0.009923	1.183292
2017	Howard	Non-Road Gasoline	2260004035	Lawn & Garden	Snowblowers (Residential)	0.001376	0.000000	0.000000
2017	Howard	Non-Road Gasoline	2260004036	Lawn & Garden	Snowblowers (Commercial)	0.000637	0.000000	0.000000
2017	Howard	Non-Road Gasoline	2260004071	Lawn & Garden	Turf Equipment (Commercial)	0.000101	0.000005	0.000490
2017	Howard	Non-Road Gasoline	2260005035	Farm	Sprayers	0.000027	0.000001	0.000112
2017	Howard	Non-Road Gasoline	2260006005	Light Commercial	Generator Sets	0.004066	0.000155	0.014287
2017	Howard	Non-Road Gasoline	2260006010	Light Commercial	Pumps	0.028658	0.001060	0.092760
2017	Howard	Non-Road Gasoline	2260006015	Light Commercial	Air Compressors	0.000010	0.000000	0.000036
2017	Howard	Non-Road Gasoline	2260006035	Light Commercial	Hydro-power Units	0.000176	0.000006	0.000620
2017	Howard	Non-Road Gasoline	2260007005	Logging	Chain Saws : 6 HP	0.000704	0.000016	0.002741
2017	Howard	Non-Road Gasoline	2265001010	Recreational	Motorcycles: Off-road	0.001887	0.000275	0.017352
2017	Howard	Non-Road Gasoline	2265001030	Recreational	All Terrain Vehicles	0.019355	0.002019	0.200924
2017	Howard	Non-Road Gasoline	2265001050	Recreational	Golf Carts	0.015505	0.005118	0.772067
2017	Howard	Non-Road Gasoline	2265001060	Recreational	Specialty Vehicles/Carts	0.001744	0.000553	0.050366
2017	Howard	Non-Road Gasoline	2265002003	Construction	Pavers	0.000251	0.000116	0.012428
2017	Howard	Non-Road Gasoline	2265002006	Construction	Tampers/Rammers	0.000002	0.000001	0.000110
2017	Howard	Non-Road Gasoline	2265002009	Construction	Plate Compactors	0.000628	0.000181	0.021495
2017	Howard	Non-Road Gasoline	2265002015	Construction	Rollers	0.000429	0.000173	0.022296
2017	Howard	Non-Road Gasoline	2265002021	Construction	Paving Equipment	0.001140	0.000367	0.047312
2017	Howard	Non-Road Gasoline	2265002024	Construction	Surfacing Equipment	0.000450	0.000147	0.020215
2017	Howard	Non-Road Gasoline	2265002027	Construction	Signal Boards/Light Plants	0.000023	0.000008	0.000989
2017	Howard	Non-Road Gasoline	2265002030	Construction	Trenchers	0.000813	0.000366	0.036398
2017	Howard	Non-Road Gasoline	2265002033	Construction	Bore/Drill Rigs	0.000440	0.000286	0.011684
2017	Howard	Non-Road Gasoline	2265002039	Construction	Concrete/Industrial Saws	0.001743	0.000639	0.090572
2017	Howard	Non-Road Gasoline	2265002042	Construction	Cement and Mortar Mixers	0.001373	0.000331	0.042265
2017	Howard	Non-Road Gasoline	2265002045	Construction	Cranes	0.000071	0.000104	0.001948

2017 MOVES-NR Data

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2017	Howard	Non-Road Gasoline	2265002054	Construction	Crushing/Processing Equipment	0.000122	0.000052	0.005592
2017	Howard	Non-Road Gasoline	2265002057	Construction	Rough Terrain Forklifts	0.000051	0.000091	0.001354
2017	Howard	Non-Road Gasoline	2265002060	Construction	Rubber Tire Loaders	0.000045	0.000102	0.001282
2017	Howard	Non-Road Gasoline	2265002066	Construction	Tractors/Loaders/Backhoes	0.000551	0.000204	0.030454
2017	Howard	Non-Road Gasoline	2265002072	Construction	Skid Steer Loaders	0.000407	0.000425	0.015166
2017	Howard	Non-Road Gasoline	2265002078	Construction	Dumpers/Tenders	0.000252	0.000068	0.007377
2017	Howard	Non-Road Gasoline	2265002081	Construction	Other Construction Equipment	0.000127	0.000206	0.002955
2017	Howard	Non-Road Gasoline	2265003010	Industrial	Aerial Lifts	0.001631	0.001757	0.056608
2017	Howard	Non-Road Gasoline	2265003020	Industrial	Forklifts	0.001190	0.002895	0.034901
2017	Howard	Non-Road Gasoline	2265003030	Industrial	Sweepers/Scrubbers	0.000980	0.000587	0.042159
2017	Howard	Non-Road Gasoline	2265003040	Industrial	Other General Industrial Equipment	0.004089	0.001196	0.130585
2017	Howard	Non-Road Gasoline	2265003050	Industrial	Other Material Handling Equipment	0.000105	0.000097	0.004218
2017	Howard	Non-Road Gasoline	2265003060	Industrial	AC\Refrigeration	0.000116	0.000038	0.005957
2017	Howard	Non-Road Gasoline	2265003070	Industrial	Terminal Tractors	0.000080	0.000214	0.002417
2017	Howard	Non-Road Gasoline	2265004010	Lawn & Garden	Lawn Mowers (Residential)	0.091218	0.011272	1.073119
2017	Howard	Non-Road Gasoline	2265004011	Lawn & Garden	Lawn Mowers (Commercial)	0.140441	0.023560	2.287111
2017	Howard	Non-Road Gasoline	2265004015	Lawn & Garden	Rotary Tillers < 6 HP (Residential)	0.008184	0.000969	0.092297
2017	Howard	Non-Road Gasoline	2265004016	Lawn & Garden	Rotary Tillers < 6 HP (Commercial)	0.097852	0.014109	1.364413
2017	Howard	Non-Road Gasoline	2265004025	Lawn & Garden	Trimmers/Edgers/Brush Cutters (Residential)	0.000587	0.000059	0.005750
2017	Howard	Non-Road Gasoline	2265004026	Lawn & Garden	Trimmers/Edgers/Brush Cutters (Commercial)	0.003776	0.000541	0.066211
2017	Howard	Non-Road Gasoline	2265004030	Lawn & Garden	Leafblowers/Vacuums (Residential)	0.000742	0.000113	0.010968
2017	Howard	Non-Road Gasoline	2265004031	Lawn & Garden	Leafblowers/Vacuums (Commercial)	0.088774	0.024938	2.861078
2017	Howard	Non-Road Gasoline	2265004035	Lawn & Garden	Snowblowers (Residential)	0.003203	0.000000	0.000000
2017	Howard	Non-Road Gasoline	2265004036	Lawn & Garden	Snowblowers (Commercial)	0.001512	0.000000	0.000000
2017	Howard	Non-Road Gasoline	2265004040	Lawn & Garden	Rear Engine Riding Mowers (Residential)	0.011637	0.002351	0.332300
2017	Howard	Non-Road Gasoline	2265004041	Lawn & Garden	Rear Engine Riding Mowers (Commercial)	0.009725	0.002946	0.459226
2017	Howard	Non-Road Gasoline	2265004046	Lawn & Garden	Front Mowers (Commercial)	0.014545	0.004573	0.544062
2017	Howard	Non-Road Gasoline	2265004051	Lawn & Garden	Shredders < 6 HP (Commercial)	0.011419	0.001650	0.158025
2017	Howard	Non-Road Gasoline	2265004055	Lawn & Garden	Lawn and Garden Tractors (Residential)	0.126278	0.031444	4.452001
2017	Howard	Non-Road Gasoline	2265004056	Lawn & Garden	Lawn and Garden Tractors (Commercial)	0.126093	0.040036	6.243945
2017	Howard	Non-Road Gasoline	2265004066	Lawn & Garden	Chippers/Stump Grinders (Commercial)	0.013298	0.006790	0.646419
2017	Howard	Non-Road Gasoline	2265004071	Lawn & Garden	Turf Equipment (Commercial)	0.367437	0.128389	17.327676
2017	Howard	Non-Road Gasoline	2265004075	Lawn & Garden	Other Lawn and Garden Equipment (Residential)	0.006075	0.001294	0.134050
2017	Howard	Non-Road Gasoline	2265004076	Lawn & Garden	Other Lawn and Garden Equipment (Commercial)	0.023193	0.005055	0.524313
2017	Howard	Non-Road Gasoline	2265005010	Farm	2-Wheel Tractors	0.000007	0.000003	0.000393
2017	Howard	Non-Road Gasoline	2265005015	Farm	Agricultural Tractors	0.000009	0.000011	0.000428
2017	Howard	Non-Road Gasoline	2265005020	Farm	Combines	0.000000	0.000001	0.000007

2017 MOVES-NR Data

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2017	Howard	Non-Road Gasoline	2265005025	Farm	Balers	0.000037	0.000048	0.000664
2017	Howard	Non-Road Gasoline	2265005030	Farm	Agricultural Mowers	0.000006	0.000002	0.000325
2017	Howard	Non-Road Gasoline	2265005035	Farm	Sprayers	0.000103	0.000065	0.003015
2017	Howard	Non-Road Gasoline	2265005040	Farm	Tillers : 6 HP	0.000494	0.000087	0.013591
2017	Howard	Non-Road Gasoline	2265005045	Farm	Swathers	0.000054	0.000076	0.001051
2017	Howard	Non-Road Gasoline	2265005055	Farm	Other Agricultural Equipment	0.000065	0.000087	0.001744
2017	Howard	Non-Road Gasoline	2265005060	Farm	Irrigation Sets	0.000009	0.000016	0.000265
2017	Howard	Non-Road Gasoline	2265006005	Light Commercial	Generator Sets	0.104752	0.027526	3.592111
2017	Howard	Non-Road Gasoline	2265006010	Light Commercial	Pumps	0.022635	0.007169	0.704361
2017	Howard	Non-Road Gasoline	2265006015	Light Commercial	Air Compressors	0.009306	0.003562	0.336221
2017	Howard	Non-Road Gasoline	2265006025	Light Commercial	Welders	0.021164	0.007252	0.922699
2017	Howard	Non-Road Gasoline	2265006030	Light Commercial	Pressure Washers	0.043803	0.010969	1.416694
2017	Howard	Non-Road Gasoline	2265006035	Light Commercial	Hydro-power Units	0.001524	0.000509	0.072157
2017	Howard	Non-Road Gasoline	2265007010	Logging	Shredders : 6 HP	0.000173	0.000050	0.004916
2017	Howard	Non-Road Gasoline	2265007015	Logging	Forest Eqp - Feller/Bunch/Skidder	0.000001	0.000000	0.000036
2017	Howard	Non-Road Gasoline	2265010010	Industrial	Other Oil Field Equipment	0.000066	0.000024	0.003538
2017	Howard	Non-Road Gasoline	2282005010	Recreational Marine Vessels	Outboard	0.047058	0.007367	0.135068
2017	Howard	Non-Road Gasoline	2282005015	Recreational Marine Vessels	Personal Water Craft	0.008522	0.003286	0.064618
2017	Howard	Non-Road Gasoline	2282010005	Recreational Marine Vessels	Inboard/Sterndrive	0.002514	0.003056	0.038557
2017	Howard	Non-Road Gasoline	2285004015	Railway Maintenance	Railway Maintenance	0.000135	0.000044	0.005949
2017	Howard	Other	2267001060	Liquified Petroleum Gas	Specialty Vehicles/Carts	0.000025	0.000116	0.000557
2017	Howard	Other	2267002003	Liquified Petroleum Gas	Pavers	0.000008	0.000038	0.000240
2017	Howard	Other	2267002015	Liquified Petroleum Gas	Rollers	0.000004	0.000029	0.000180
2017	Howard	Other	2267002021	Liquified Petroleum Gas	Paving Equipment	0.000006	0.000027	0.000154
2017	Howard	Other	2267002024	Liquified Petroleum Gas	Surfacing Equipment	0.000001	0.000006	0.000036
2017	Howard	Other	2267002030	Liquified Petroleum Gas	Trenchers	0.000025	0.000122	0.000771
2017	Howard	Other	2267002033	Liquified Petroleum Gas	Bore/Drill Rigs	0.000048	0.000214	0.001007
2017	Howard	Other	2267002039	Liquified Petroleum Gas	Concrete/Industrial Saws	0.000005	0.000042	0.000230
2017	Howard	Other	2267002045	Liquified Petroleum Gas	Cranes	0.000024	0.000106	0.000614
2017	Howard	Other	2267002054	Liquified Petroleum Gas	Crushing/Processing Equipment	0.000004	0.000016	0.000095
2017	Howard	Other	2267002057	Liquified Petroleum Gas	Rough Terrain Forklifts	0.000020	0.000093	0.000592
2017	Howard	Other	2267002060	Liquified Petroleum Gas	Rubber Tire Loaders	0.000016	0.000099	0.000655
2017	Howard	Other	2267002066	Liquified Petroleum Gas	Tractors/Loaders/Backhoes	0.000001	0.000008	0.000052
2017	Howard	Other	2267002072	Liquified Petroleum Gas	Skid Steer Loaders	0.000086	0.000376	0.002079
2017	Howard	Other	2267002081	Liquified Petroleum Gas	Other Construction Equipment	0.000048	0.000206	0.001116
2017	Howard	Other	2267003010	Liquified Petroleum Gas	Aerial Lifts	0.000337	0.001569	0.008614
2017	Howard	Other	2267003020	Liquified Petroleum Gas	Forklifts	0.006690	0.045190	0.273024

2017 MOVES-NR Data

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2017	Howard	Other	2267003030	Liquified Petroleum Gas	Sweepers/Scrubbers	0.000040	0.000299	0.001683
2017	Howard	Other	2267003040	Liquified Petroleum Gas	Other General Industrial Equipment	0.000013	0.000097	0.000570
2017	Howard	Other	2267003050	Liquified Petroleum Gas	Other Material Handling Equipment	0.000014	0.000067	0.000416
2017	Howard	Other	2267003070	Liquified Petroleum Gas	Terminal Tractors	0.000020	0.000168	0.000867
2017	Howard	Other	2267004066	Liquified Petroleum Gas	Chippers/Stump Grinders (Commercial)	0.000381	0.002647	0.016022
2017	Howard	Other	2267005055	Liquified Petroleum Gas	Other Agricultural Equipment	0.000000	0.000001	0.000004
2017	Howard	Other	2267005060	Liquified Petroleum Gas	Irrigation Sets	0.000000	0.000000	0.000001
2017	Howard	Other	2267006005	Liquified Petroleum Gas	Generator Sets	0.002418	0.014265	0.050511
2017	Howard	Other	2267006010	Liquified Petroleum Gas	Pumps	0.000285	0.001754	0.007272
2017	Howard	Other	2267006015	Liquified Petroleum Gas	Air Compressors	0.000148	0.001038	0.005728
2017	Howard	Other	2267006025	Liquified Petroleum Gas	Welders	0.000246	0.001339	0.008375
2017	Howard	Other	2267006030	Liquified Petroleum Gas	Pressure Washers	0.000009	0.000039	0.000225
2017	Howard	Other	2267006035	Liquified Petroleum Gas	Hydro-power Units	0.000002	0.000014	0.000078
2017	Howard	Other	2268002081	Compressed Natural Gas	Other Construction Equipment	0.000007	0.000009	0.000047
2017	Howard	Other	2268003020	Compressed Natural Gas	Forklifts	0.001928	0.003637	0.021220
2017	Howard	Other	2268003030	Compressed Natural Gas	Sweepers/Scrubbers	0.000002	0.000003	0.000018
2017	Howard	Other	2268003040	Compressed Natural Gas	Other General Industrial Equipment	0.000001	0.000002	0.000009
2017	Howard	Other	2268003060	Compressed Natural Gas	AC\Refrigeration	0.000006	0.000012	0.000065
2017	Howard	Other	2268003070	Compressed Natural Gas	Terminal Tractors	0.000007	0.000017	0.000082
2017	Howard	Other	2268005055	Compressed Natural Gas	Other Agricultural Equipment	0.000002	0.000002	0.000010
2017	Howard	Other	2268005060	Compressed Natural Gas	Irrigation Sets	0.000013	0.000027	0.000158
2017	Howard	Other	2268006005	Compressed Natural Gas	Generator Sets	0.003406	0.005643	0.019475
2017	Howard	Other	2268006010	Compressed Natural Gas	Pumps	0.000103	0.000174	0.000685
2017	Howard	Other	2268006015	Compressed Natural Gas	Air Compressors	0.000054	0.000104	0.000565
2017	Howard	Other	2268006020	Compressed Natural Gas	Gas Compressors	0.001047	0.002173	0.011320
2017	Howard	Other	2268010010	Compressed Natural Gas	Other Oil Field Equipment	0.000008	0.000019	0.000094
2017	Howard	Other	2285006015	Liquified Petroleum Gas	Railway Maintenance	0.000001	0.000004	0.000025
Howard Total						2.693413	1.476815	52.657504
Grand Total						21.582384	13.125722	331.000525

2023 MOVES-NR Data

yearID	County Name	Tier 2 Description	scc	Tier 3 Description	SCC Level Four	VOC	NOX	CO
2023	Anne Arundel	Non-Road Diesel	2270001060	Recreational	Specialty Vehicles/Carts	0.001208	0.006196	0.004748
2023	Anne Arundel	Non-Road Diesel	2270002003	Construction	Pavers	0.000187	0.004296	0.001160
2023	Anne Arundel	Non-Road Diesel	2270002006	Construction	Tampers/Rammers	0.000006	0.000031	0.000019
2023	Anne Arundel	Non-Road Diesel	2270002009	Construction	Plate Compactors	0.000080	0.000483	0.000262
2023	Anne Arundel	Non-Road Diesel	2270002015	Construction	Rollers	0.000652	0.013664	0.004092
2023	Anne Arundel	Non-Road Diesel	2270002018	Construction	Scrapers	0.000422	0.007422	0.003060
2023	Anne Arundel	Non-Road Diesel	2270002021	Construction	Paving Equipment	0.000063	0.000892	0.000301
2023	Anne Arundel	Non-Road Diesel	2270002024	Construction	Surfacing Equipment	0.000069	0.001149	0.000444
2023	Anne Arundel	Non-Road Diesel	2270002027	Construction	Signal Boards/Light Plants	0.000371	0.004227	0.001500
2023	Anne Arundel	Non-Road Diesel	2270002030	Construction	Trenchers	0.000519	0.011029	0.003031
2023	Anne Arundel	Non-Road Diesel	2270002033	Construction	Bore/Drill Rigs	0.001548	0.022330	0.006173
2023	Anne Arundel	Non-Road Diesel	2270002036	Construction	Excavators	0.001139	0.024240	0.006171
2023	Anne Arundel	Non-Road Diesel	2270002039	Construction	Concrete/Industrial Saws	0.000042	0.000799	0.000225
2023	Anne Arundel	Non-Road Diesel	2270002042	Construction	Cement and Mortar Mixers	0.000094	0.000910	0.000377
2023	Anne Arundel	Non-Road Diesel	2270002045	Construction	Cranes	0.000555	0.010285	0.002441
2023	Anne Arundel	Non-Road Diesel	2270002048	Construction	Graders	0.000268	0.004513	0.001475
2023	Anne Arundel	Non-Road Diesel	2270002051	Construction	Off-highway Trucks	0.001461	0.061621	0.005400
2023	Anne Arundel	Non-Road Diesel	2270002054	Construction	Crushing/Processing Equipment	0.000131	0.002905	0.000627
2023	Anne Arundel	Non-Road Diesel	2270002057	Construction	Rough Terrain Forklifts	0.000885	0.018662	0.006600
2023	Anne Arundel	Non-Road Diesel	2270002060	Construction	Rubber Tire Loaders	0.002812	0.057489	0.017017
2023	Anne Arundel	Non-Road Diesel	2270002066	Construction	Tractors/Loaders/Backhoes	0.014520	0.080625	0.064097
2023	Anne Arundel	Non-Road Diesel	2270002069	Construction	Crawler Tractor/Dozers	0.001649	0.038252	0.010138
2023	Anne Arundel	Non-Road Diesel	2270002072	Construction	Skid Steer Loaders	0.019237	0.088291	0.088547
2023	Anne Arundel	Non-Road Diesel	2270002075	Construction	Off-highway Tractors	0.000323	0.008666	0.001835
2023	Anne Arundel	Non-Road Diesel	2270002078	Construction	Dumpers/Tenders	0.000063	0.000277	0.000264
2023	Anne Arundel	Non-Road Diesel	2270002081	Construction	Other Construction Equipment	0.000576	0.009901	0.004125
2023	Anne Arundel	Non-Road Diesel	2270003010	Industrial	Aerial Lifts	0.000846	0.004949	0.003783
2023	Anne Arundel	Non-Road Diesel	2270003020	Industrial	Forklifts	0.000480	0.023886	0.002304
2023	Anne Arundel	Non-Road Diesel	2270003030	Industrial	Sweepers/Scrubbers	0.000375	0.009187	0.001974
2023	Anne Arundel	Non-Road Diesel	2270003040	Industrial	Other General Industrial Equipment	0.000569	0.011064	0.002882
2023	Anne Arundel	Non-Road Diesel	2270003050	Industrial	Other Material Handling Equipment	0.000147	0.000971	0.000565
2023	Anne Arundel	Non-Road Diesel	2270003060	Industrial	AC/Refrigeration	0.004741	0.138413	0.018942
2023	Anne Arundel	Non-Road Diesel	2270003070	Industrial	Terminal Tractors	0.000224	0.005291	0.001063
2023	Anne Arundel	Non-Road Diesel	2270004031	Lawn & Garden	Leafblowers/Vacuums (Commercial)	0.000002	0.000016	0.000009
2023	Anne Arundel	Non-Road Diesel	2270004036	Lawn & Garden	Snowblowers (Commercial)	0.000000	0.000000	0.000000
2023	Anne Arundel	Non-Road Diesel	2270004046	Lawn & Garden	Front Mowers (Commercial)	0.006834	0.083123	0.028496
2023	Anne Arundel	Non-Road Diesel	2270004056	Lawn & Garden	Lawn and Garden Tractors (Commercial)	0.001733	0.018206	0.007338

2023 MOVES-NR Data

yearID	County Name	Tier 2 Description	scc	Tier 3 Description	SCC Level Four	VOC	NOX	CO
2023	Anne Arundel	Non-Road Diesel	2270004066	Lawn & Garden	Chippers/Stump Grinders (Commercial)	0.007907	0.105291	0.035134
2023	Anne Arundel	Non-Road Diesel	2270004071	Lawn & Garden	Turf Equipment (Commercial)	0.000363	0.007304	0.001657
2023	Anne Arundel	Non-Road Diesel	2270004076	Lawn & Garden	Other Lawn and Garden Equipment (Commercial)	0.000036	0.000383	0.000156
2023	Anne Arundel	Non-Road Diesel	2270005010	Farm	2-Wheel Tractors	0.000000	0.000001	0.000000
2023	Anne Arundel	Non-Road Diesel	2270005015	Farm	Agricultural Tractors	0.001282	0.017105	0.007335
2023	Anne Arundel	Non-Road Diesel	2270005020	Farm	Combines	0.000189	0.002184	0.000875
2023	Anne Arundel	Non-Road Diesel	2270005025	Farm	Balers	0.000002	0.000013	0.000007
2023	Anne Arundel	Non-Road Diesel	2270005030	Farm	Agricultural Mowers	0.000000	0.000002	0.000001
2023	Anne Arundel	Non-Road Diesel	2270005035	Farm	Sprayers	0.000023	0.000172	0.000088
2023	Anne Arundel	Non-Road Diesel	2270005040	Farm	Tillers : 6 HP	0.000000	0.000000	0.000000
2023	Anne Arundel	Non-Road Diesel	2270005045	Farm	Swathers	0.000019	0.000178	0.000096
2023	Anne Arundel	Non-Road Diesel	2270005055	Farm	Other Agricultural Equipment	0.000034	0.000363	0.000177
2023	Anne Arundel	Non-Road Diesel	2270005060	Farm	Irrigation Sets	0.000011	0.000204	0.000059
2023	Anne Arundel	Non-Road Diesel	2270006005	Light Commercial	Generator Sets	0.006513	0.071420	0.026659
2023	Anne Arundel	Non-Road Diesel	2270006010	Light Commercial	Pumps	0.001558	0.016845	0.006507
2023	Anne Arundel	Non-Road Diesel	2270006015	Light Commercial	Air Compressors	0.001338	0.027451	0.007952
2023	Anne Arundel	Non-Road Diesel	2270006025	Light Commercial	Welders	0.003884	0.023328	0.017961
2023	Anne Arundel	Non-Road Diesel	2270006030	Light Commercial	Pressure Washers	0.000240	0.002371	0.000864
2023	Anne Arundel	Non-Road Diesel	2270006035	Light Commercial	Hydro-power Units	0.000069	0.001298	0.000375
2023	Anne Arundel	Non-Road Diesel	2270007015	Logging	Forest Eqp - Feller/Bunch/Skidder	0.000038	0.000601	0.000199
2023	Anne Arundel	Non-Road Diesel	2282020005	Recreational Marine Vessels	Inboard/Sterndrive	0.013951	0.223120	0.050561
2023	Anne Arundel	Non-Road Diesel	2282020010	Recreational Marine Vessels	Outboard	0.000086	0.000466	0.000279
2023	Anne Arundel	Non-Road Diesel	2285002015	Railway Maintenance	Railway Maintenance	0.000273	0.001824	0.001109
2023	Anne Arundel	Non-Road Gasoline	2260001010	Recreational	Motorcycles: Off-road	0.232075	0.003073	0.262131
2023	Anne Arundel	Non-Road Gasoline	2260001030	Recreational	All Terrain Vehicles	0.024815	0.001596	0.138961
2023	Anne Arundel	Non-Road Gasoline	2260001060	Recreational	Specialty Vehicles/Carts	0.007827	0.002143	0.266208
2023	Anne Arundel	Non-Road Gasoline	2260002006	Construction	Tampers/Rammers	0.014484	0.000362	0.060211
2023	Anne Arundel	Non-Road Gasoline	2260002009	Construction	Plate Compactors	0.000506	0.000024	0.002259
2023	Anne Arundel	Non-Road Gasoline	2260002021	Construction	Paving Equipment	0.000604	0.000029	0.002726
2023	Anne Arundel	Non-Road Gasoline	2260002027	Construction	Signal Boards/Light Plants	0.000005	0.000000	0.000020
2023	Anne Arundel	Non-Road Gasoline	2260002039	Construction	Concrete/Industrial Saws	0.036934	0.000952	0.156982
2023	Anne Arundel	Non-Road Gasoline	2260002054	Construction	Crushing/Processing Equipment	0.000123	0.000006	0.000558
2023	Anne Arundel	Non-Road Gasoline	2260003030	Industrial	Sweepers/Scrubbers	0.000487	0.000021	0.002027
2023	Anne Arundel	Non-Road Gasoline	2260003040	Industrial	Other General Industrial Equipment	0.000036	0.000002	0.000155
2023	Anne Arundel	Non-Road Gasoline	2260004015	Lawn & Garden	Rotary Tillers < 6 HP (Residential)	0.003930	0.000173	0.014970
2023	Anne Arundel	Non-Road Gasoline	2260004016	Lawn & Garden	Rotary Tillers < 6 HP (Commercial)	0.034438	0.001634	0.142764
2023	Anne Arundel	Non-Road Gasoline	2260004020	Lawn & Garden	Chain Saws < 6 HP (Residential)	0.048700	0.001448	0.129642

2023 MOVES-NR Data

yearID	County Name	Tier 2 Description	scc	Tier 3 Description	SCC Level Four	VOC	NOX	CO
2023	Anne Arundel	Non-Road Gasoline	2260004021	Lawn & Garden	Chain Saws < 6 HP (Commercial)	0.439597	0.009816	1.564106
2023	Anne Arundel	Non-Road Gasoline	2260004025	Lawn & Garden	Trimmers/Edgers/Brush Cutters (Residential)	0.079062	0.003243	0.265538
2023	Anne Arundel	Non-Road Gasoline	2260004026	Lawn & Garden	Trimmers/Edgers/Brush Cutters (Commercial)	0.350833	0.013766	1.366230
2023	Anne Arundel	Non-Road Gasoline	2260004030	Lawn & Garden	Leafblowers/Vacuums (Residential)	0.047753	0.002073	0.181273
2023	Anne Arundel	Non-Road Gasoline	2260004031	Lawn & Garden	Leafblowers/Vacuums (Commercial)	0.350635	0.012763	1.522391
2023	Anne Arundel	Non-Road Gasoline	2260004035	Lawn & Garden	Snowblowers (Residential)	0.002600	0.000000	0.000000
2023	Anne Arundel	Non-Road Gasoline	2260004036	Lawn & Garden	Snowblowers (Commercial)	0.000746	0.000000	0.000000
2023	Anne Arundel	Non-Road Gasoline	2260004071	Lawn & Garden	Turf Equipment (Commercial)	0.000131	0.000007	0.000630
2023	Anne Arundel	Non-Road Gasoline	2260005035	Farm	Sprayers	0.000024	0.000001	0.000101
2023	Anne Arundel	Non-Road Gasoline	2260006005	Light Commercial	Generator Sets	0.004970	0.000190	0.017454
2023	Anne Arundel	Non-Road Gasoline	2260006010	Light Commercial	Pumps	0.034836	0.001293	0.112938
2023	Anne Arundel	Non-Road Gasoline	2260006015	Light Commercial	Air Compressors	0.000012	0.000000	0.000043
2023	Anne Arundel	Non-Road Gasoline	2260006035	Light Commercial	Hydro-power Units	0.000215	0.000008	0.000757
2023	Anne Arundel	Non-Road Gasoline	2260007005	Logging	Chain Saws : 6 HP	0.002463	0.000055	0.009582
2023	Anne Arundel	Non-Road Gasoline	2265001010	Recreational	Motorcycles: Off-road	0.010806	0.001666	0.100362
2023	Anne Arundel	Non-Road Gasoline	2265001030	Recreational	All Terrain Vehicles	0.110265	0.011556	1.237256
2023	Anne Arundel	Non-Road Gasoline	2265001050	Recreational	Golf Carts	0.020855	0.006836	1.040101
2023	Anne Arundel	Non-Road Gasoline	2265001060	Recreational	Specialty Vehicles/Carts	0.007774	0.002544	0.267703
2023	Anne Arundel	Non-Road Gasoline	2265002003	Construction	Pavers	0.000614	0.000244	0.031205
2023	Anne Arundel	Non-Road Gasoline	2265002006	Construction	Tampers/Rammers	0.000006	0.000002	0.000283
2023	Anne Arundel	Non-Road Gasoline	2265002009	Construction	Plate Compactors	0.001608	0.000455	0.055261
2023	Anne Arundel	Non-Road Gasoline	2265002015	Construction	Rollers	0.001096	0.000431	0.057160
2023	Anne Arundel	Non-Road Gasoline	2265002021	Construction	Paving Equipment	0.002804	0.000860	0.120625
2023	Anne Arundel	Non-Road Gasoline	2265002024	Construction	Surfacing Equipment	0.001153	0.000368	0.051894
2023	Anne Arundel	Non-Road Gasoline	2265002027	Construction	Signal Boards/Light Plants	0.000058	0.000019	0.002545
2023	Anne Arundel	Non-Road Gasoline	2265002030	Construction	Trenchers	0.001987	0.000765	0.091078
2023	Anne Arundel	Non-Road Gasoline	2265002033	Construction	Bore/Drill Rigs	0.000975	0.000507	0.027050
2023	Anne Arundel	Non-Road Gasoline	2265002039	Construction	Concrete/Industrial Saws	0.004479	0.001628	0.232881
2023	Anne Arundel	Non-Road Gasoline	2265002042	Construction	Cement and Mortar Mixers	0.003032	0.000742	0.105642
2023	Anne Arundel	Non-Road Gasoline	2265002045	Construction	Cranes	0.000079	0.000106	0.002633
2023	Anne Arundel	Non-Road Gasoline	2265002054	Construction	Crushing/Processing Equipment	0.000298	0.000109	0.014029
2023	Anne Arundel	Non-Road Gasoline	2265002057	Construction	Rough Terrain Forklifts	0.000046	0.000095	0.001410
2023	Anne Arundel	Non-Road Gasoline	2265002060	Construction	Rubber Tire Loaders	0.000072	0.000188	0.002136
2023	Anne Arundel	Non-Road Gasoline	2265002066	Construction	Tractors/Loaders/Backhoes	0.001418	0.000517	0.078299
2023	Anne Arundel	Non-Road Gasoline	2265002072	Construction	Skid Steer Loaders	0.000670	0.000514	0.030638
2023	Anne Arundel	Non-Road Gasoline	2265002078	Construction	Dumpers/Tenders	0.000488	0.000131	0.017498
2023	Anne Arundel	Non-Road Gasoline	2265002081	Construction	Other Construction Equipment	0.000108	0.000189	0.002666

2023 MOVES-NR Data

yearID	County Name	Tier 2 Description	scc	Tier 3 Description	SCC Level Four	VOC	NOX	CO
2023	Anne Arundel	Non-Road Gasoline	2265003010	Industrial	Aerial Lifts	0.002439	0.002119	0.102836
2023	Anne Arundel	Non-Road Gasoline	2265003020	Industrial	Forklifts	0.002102	0.005479	0.061979
2023	Anne Arundel	Non-Road Gasoline	2265003030	Industrial	Sweepers/Scrubbers	0.002220	0.001283	0.096092
2023	Anne Arundel	Non-Road Gasoline	2265003040	Industrial	Other General Industrial Equipment	0.009386	0.002705	0.300115
2023	Anne Arundel	Non-Road Gasoline	2265003050	Industrial	Other Material Handling Equipment	0.000177	0.000128	0.008297
2023	Anne Arundel	Non-Road Gasoline	2265003060	Industrial	AC\Refrigeration	0.000286	0.000093	0.014805
2023	Anne Arundel	Non-Road Gasoline	2265003070	Industrial	Terminal Tractors	0.000184	0.000489	0.005575
2023	Anne Arundel	Non-Road Gasoline	2265004010	Lawn & Garden	Lawn Mowers (Residential)	0.160894	0.021245	2.136706
2023	Anne Arundel	Non-Road Gasoline	2265004011	Lawn & Garden	Lawn Mowers (Commercial)	0.180833	0.030126	2.949308
2023	Anne Arundel	Non-Road Gasoline	2265004015	Lawn & Garden	Rotary Tillers < 6 HP (Residential)	0.014685	0.001828	0.183801
2023	Anne Arundel	Non-Road Gasoline	2265004016	Lawn & Garden	Rotary Tillers < 6 HP (Commercial)	0.119351	0.017374	1.737127
2023	Anne Arundel	Non-Road Gasoline	2265004025	Lawn & Garden	Trimmers/Edgers/Brush Cutters (Residential)	0.001178	0.000119	0.011862
2023	Anne Arundel	Non-Road Gasoline	2265004026	Lawn & Garden	Trimmers/Edgers/Brush Cutters (Commercial)	0.004857	0.000690	0.085353
2023	Anne Arundel	Non-Road Gasoline	2265004030	Lawn & Garden	Leafblowers/Vacuums (Residential)	0.001436	0.000226	0.022630
2023	Anne Arundel	Non-Road Gasoline	2265004031	Lawn & Garden	Leafblowers/Vacuums (Commercial)	0.111989	0.028049	3.630258
2023	Anne Arundel	Non-Road Gasoline	2265004035	Lawn & Garden	Snowblowers (Residential)	0.005797	0.000000	0.000000
2023	Anne Arundel	Non-Road Gasoline	2265004036	Lawn & Garden	Snowblowers (Commercial)	0.001695	0.000000	0.000000
2023	Anne Arundel	Non-Road Gasoline	2265004040	Lawn & Garden	Rear Engine Riding Mowers (Residential)	0.021656	0.004263	0.685135
2023	Anne Arundel	Non-Road Gasoline	2265004041	Lawn & Garden	Rear Engine Riding Mowers (Commercial)	0.012447	0.003715	0.591438
2023	Anne Arundel	Non-Road Gasoline	2265004046	Lawn & Garden	Front Mowers (Commercial)	0.015081	0.004477	0.667786
2023	Anne Arundel	Non-Road Gasoline	2265004051	Lawn & Garden	Shredders < 6 HP (Commercial)	0.013592	0.001994	0.199936
2023	Anne Arundel	Non-Road Gasoline	2265004055	Lawn & Garden	Lawn and Garden Tractors (Residential)	0.239173	0.057025	9.184190
2023	Anne Arundel	Non-Road Gasoline	2265004056	Lawn & Garden	Lawn and Garden Tractors (Commercial)	0.161421	0.050483	8.041604
2023	Anne Arundel	Non-Road Gasoline	2265004066	Lawn & Garden	Chippers/Stump Grinders (Commercial)	0.016846	0.008183	0.825198
2023	Anne Arundel	Non-Road Gasoline	2265004071	Lawn & Garden	Turf Equipment (Commercial)	0.472127	0.163334	22.332324
2023	Anne Arundel	Non-Road Gasoline	2265004075	Lawn & Garden	Other Lawn and Garden Equipment (Residential)	0.009941	0.002145	0.262350
2023	Anne Arundel	Non-Road Gasoline	2265004076	Lawn & Garden	Other Lawn and Garden Equipment (Commercial)	0.023426	0.005257	0.636033
2023	Anne Arundel	Non-Road Gasoline	2265005010	Farm	2-Wheel Tractors	0.000006	0.000002	0.000354
2023	Anne Arundel	Non-Road Gasoline	2265005015	Farm	Agricultural Tractors	0.000007	0.000008	0.000351
2023	Anne Arundel	Non-Road Gasoline	2265005020	Farm	Combines	0.000000	0.000000	0.000004
2023	Anne Arundel	Non-Road Gasoline	2265005025	Farm	Balers	0.000018	0.000023	0.000319
2023	Anne Arundel	Non-Road Gasoline	2265005030	Farm	Agricultural Mowers	0.000005	0.000002	0.000287
2023	Anne Arundel	Non-Road Gasoline	2265005035	Farm	Sprayers	0.000066	0.000037	0.002298
2023	Anne Arundel	Non-Road Gasoline	2265005040	Farm	Tillers : 6 HP	0.000274	0.000058	0.009196
2023	Anne Arundel	Non-Road Gasoline	2265005045	Farm	Swathers	0.000025	0.000037	0.000504
2023	Anne Arundel	Non-Road Gasoline	2265005055	Farm	Other Agricultural Equipment	0.000034	0.000043	0.001075
2023	Anne Arundel	Non-Road Gasoline	2265005060	Farm	Irrigation Sets	0.000007	0.000013	0.000217

2023 MOVES-NR Data

yearID	County Name	Tier 2 Description	scc	Tier 3 Description	SCC Level Four	VOC	NOX	CO
2023	Anne Arundel	Non-Road Gasoline	2265006005	Light Commercial	Generator Sets	0.111357	0.028295	4.298264
2023	Anne Arundel	Non-Road Gasoline	2265006010	Light Commercial	Pumps	0.026998	0.007590	0.851328
2023	Anne Arundel	Non-Road Gasoline	2265006015	Light Commercial	Air Compressors	0.011108	0.003797	0.406035
2023	Anne Arundel	Non-Road Gasoline	2265006025	Light Commercial	Welders	0.025447	0.008155	1.119569
2023	Anne Arundel	Non-Road Gasoline	2265006030	Light Commercial	Pressure Washers	0.052136	0.012776	1.726307
2023	Anne Arundel	Non-Road Gasoline	2265006035	Light Commercial	Hydro-power Units	0.001855	0.000610	0.088232
2023	Anne Arundel	Non-Road Gasoline	2265007010	Logging	Shredders : 6 HP	0.000401	0.000100	0.014433
2023	Anne Arundel	Non-Road Gasoline	2265007015	Logging	Forest Eqp - Feller/Bunch/Skidder	0.000004	0.000001	0.000125
2023	Anne Arundel	Non-Road Gasoline	2282005010	Recreational Marine Vessels	Outboard	0.781697	0.244556	4.068191
2023	Anne Arundel	Non-Road Gasoline	2282005015	Recreational Marine Vessels	Personal Water Craft	0.140856	0.115934	2.092224
2023	Anne Arundel	Non-Road Gasoline	2282010005	Recreational Marine Vessels	Inboard/Sterndrive	0.155830	0.174611	2.365056
2023	Anne Arundel	Non-Road Gasoline	2285004015	Railway Maintenance	Railway Maintenance	0.000116	0.000036	0.005294
2023	Anne Arundel	Other	2267001060	Liquified Petroleum Gas	Specialty Vehicles/Carts	0.000101	0.000471	0.002435
2023	Anne Arundel	Other	2267002003	Liquified Petroleum Gas	Pavers	0.000006	0.000043	0.000244
2023	Anne Arundel	Other	2267002015	Liquified Petroleum Gas	Rollers	0.000007	0.000060	0.000312
2023	Anne Arundel	Other	2267002021	Liquified Petroleum Gas	Paving Equipment	0.000006	0.000030	0.000161
2023	Anne Arundel	Other	2267002024	Liquified Petroleum Gas	Surfacing Equipment	0.000001	0.000008	0.000042
2023	Anne Arundel	Other	2267002030	Liquified Petroleum Gas	Trenchers	0.000018	0.000128	0.000747
2023	Anne Arundel	Other	2267002033	Liquified Petroleum Gas	Bore/Drill Rigs	0.000072	0.000314	0.001579
2023	Anne Arundel	Other	2267002039	Liquified Petroleum Gas	Concrete/Industrial Saws	0.000013	0.000104	0.000545
2023	Anne Arundel	Other	2267002045	Liquified Petroleum Gas	Cranes	0.000020	0.000099	0.000551
2023	Anne Arundel	Other	2267002054	Liquified Petroleum Gas	Crushing/Processing Equipment	0.000003	0.000015	0.000083
2023	Anne Arundel	Other	2267002057	Liquified Petroleum Gas	Rough Terrain Forklifts	0.000013	0.000089	0.000524
2023	Anne Arundel	Other	2267002060	Liquified Petroleum Gas	Rubber Tire Loaders	0.000020	0.000172	0.000886
2023	Anne Arundel	Other	2267002066	Liquified Petroleum Gas	Tractors/Loaders/Backhoes	0.000002	0.000018	0.000094
2023	Anne Arundel	Other	2267002072	Liquified Petroleum Gas	Skid Steer Loaders	0.000070	0.000356	0.001953
2023	Anne Arundel	Other	2267002081	Liquified Petroleum Gas	Other Construction Equipment	0.000038	0.000184	0.001021
2023	Anne Arundel	Other	2267003010	Liquified Petroleum Gas	Aerial Lifts	0.000285	0.001592	0.009181
2023	Anne Arundel	Other	2267003020	Liquified Petroleum Gas	Forklifts	0.009694	0.082763	0.424169
2023	Anne Arundel	Other	2267003030	Liquified Petroleum Gas	Sweepers/Scrubbers	0.000074	0.000621	0.003207
2023	Anne Arundel	Other	2267003040	Liquified Petroleum Gas	Other General Industrial Equipment	0.000023	0.000195	0.001002
2023	Anne Arundel	Other	2267003050	Liquified Petroleum Gas	Other Material Handling Equipment	0.000011	0.000069	0.000381
2023	Anne Arundel	Other	2267003070	Liquified Petroleum Gas	Terminal Tractors	0.000046	0.000386	0.001994
2023	Anne Arundel	Other	2267004066	Liquified Petroleum Gas	Chippers/Stump Grinders (Commercial)	0.000337	0.002854	0.014683
2023	Anne Arundel	Other	2267005055	Liquified Petroleum Gas	Other Agricultural Equipment	0.000000	0.000000	0.000002
2023	Anne Arundel	Other	2267005060	Liquified Petroleum Gas	Irrigation Sets	0.000000	0.000000	0.000001
2023	Anne Arundel	Other	2267006005	Liquified Petroleum Gas	Generator Sets	0.001582	0.009663	0.039258

2023 MOVES-NR Data

yearID	County Name	Tier 2 Description	scc	Tier 3 Description	SCC Level Four	VOC	NOX	CO
2023	Anne Arundel	Other	2267006010	Liquified Petroleum Gas	Pumps	0.000155	0.001072	0.005269
2023	Anne Arundel	Other	2267006015	Liquified Petroleum Gas	Air Compressors	0.000090	0.000749	0.004044
2023	Anne Arundel	Other	2267006025	Liquified Petroleum Gas	Welders	0.000121	0.000940	0.005254
2023	Anne Arundel	Other	2267006030	Liquified Petroleum Gas	Pressure Washers	0.000004	0.000023	0.000128
2023	Anne Arundel	Other	2267006035	Liquified Petroleum Gas	Hydro-power Units	0.000001	0.000012	0.000062
2023	Anne Arundel	Other	2268002081	Compressed Natural Gas	Other Construction Equipment	0.000006	0.000008	0.000043
2023	Anne Arundel	Other	2268003020	Compressed Natural Gas	Forklifts	0.002866	0.006735	0.032967
2023	Anne Arundel	Other	2268003030	Compressed Natural Gas	Sweepers/Scrubbers	0.000002	0.000006	0.000028
2023	Anne Arundel	Other	2268003040	Compressed Natural Gas	Other General Industrial Equipment	0.000001	0.000003	0.000015
2023	Anne Arundel	Other	2268003060	Compressed Natural Gas	AC\Refrigeration	0.000011	0.000024	0.000122
2023	Anne Arundel	Other	2268003070	Compressed Natural Gas	Terminal Tractors	0.000017	0.000038	0.000189
2023	Anne Arundel	Other	2268005055	Compressed Natural Gas	Other Agricultural Equipment	0.000001	0.000001	0.000005
2023	Anne Arundel	Other	2268005060	Compressed Natural Gas	Irrigation Sets	0.000009	0.000022	0.000107
2023	Anne Arundel	Other	2268006005	Compressed Natural Gas	Generator Sets	0.002356	0.004001	0.015587
2023	Anne Arundel	Other	2268006010	Compressed Natural Gas	Pumps	0.000055	0.000102	0.000485
2023	Anne Arundel	Other	2268006015	Compressed Natural Gas	Air Compressors	0.000033	0.000075	0.000389
2023	Anne Arundel	Other	2268006020	Compressed Natural Gas	Gas Compressors	0.001278	0.002653	0.013820
2023	Anne Arundel	Other	2285006015	Liquified Petroleum Gas	Railway Maintenance	0.000000	0.000001	0.000009
2023	Anne Arundel	Non-Road Diesel	2270008005	Airport Service	Airport Ground Support Equipment	0.003519	0.060683	0.024572
2023	Anne Arundel	Non-Road Gasoline	2265008005	Airport Service	Airport Ground Support Equipment	0.002327	0.001737	0.087055
2023	Anne Arundel	Other	2267008005	Liquified Petroleum Gas	Airport Ground Support Equipment	0.000124	0.001052	0.005416
Anne Arundel Total						4.931067	2.551024	82.773568
Baltimore Total						5.677390	3.396405	105.277138
Baltimore City Total						1.922059	0.996630	39.606195
Carroll Total						1.471488	0.693975	26.708134
Harford Total						2.104052	1.207004	30.845566
2023	Howard	Non-Road Diesel	2270001060	Recreational	Specialty Vehicles/Carts	0.000201	0.001033	0.000791
2023	Howard	Non-Road Diesel	2270002003	Construction	Pavers	0.000083	0.001909	0.000516
2023	Howard	Non-Road Diesel	2270002006	Construction	Tampers/Rammers	0.000003	0.000014	0.000008
2023	Howard	Non-Road Diesel	2270002009	Construction	Plate Compactors	0.000035	0.000214	0.000116
2023	Howard	Non-Road Diesel	2270002015	Construction	Rollers	0.000290	0.006073	0.001819
2023	Howard	Non-Road Diesel	2270002018	Construction	Scrapers	0.000187	0.003299	0.001360
2023	Howard	Non-Road Diesel	2270002021	Construction	Paving Equipment	0.000028	0.000397	0.000134
2023	Howard	Non-Road Diesel	2270002024	Construction	Surfacing Equipment	0.000031	0.000511	0.000197
2023	Howard	Non-Road Diesel	2270002027	Construction	Signal Boards/Light Plants	0.000165	0.001879	0.000667
2023	Howard	Non-Road Diesel	2270002030	Construction	Trenchers	0.000231	0.004902	0.001347
2023	Howard	Non-Road Diesel	2270002033	Construction	Bore/Drill Rigs	0.000688	0.009925	0.002743

2023 MOVES-NR Data

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2023	Howard	Non-Road Diesel	2270002036	Construction	Excavators	0.000506	0.010774	0.002743
2023	Howard	Non-Road Diesel	2270002039	Construction	Concrete/Industrial Saws	0.000019	0.000355	0.000100
2023	Howard	Non-Road Diesel	2270002042	Construction	Cement and Mortar Mixers	0.000042	0.000405	0.000167
2023	Howard	Non-Road Diesel	2270002045	Construction	Cranes	0.000247	0.004571	0.001085
2023	Howard	Non-Road Diesel	2270002048	Construction	Graders	0.000119	0.002006	0.000655
2023	Howard	Non-Road Diesel	2270002051	Construction	Off-highway Trucks	0.000649	0.027388	0.002400
2023	Howard	Non-Road Diesel	2270002054	Construction	Crushing/Processing Equipment	0.000058	0.001291	0.000279
2023	Howard	Non-Road Diesel	2270002057	Construction	Rough Terrain Forklifts	0.000393	0.008295	0.002933
2023	Howard	Non-Road Diesel	2270002060	Construction	Rubber Tire Loaders	0.001250	0.025551	0.007563
2023	Howard	Non-Road Diesel	2270002066	Construction	Tractors/Loaders/Backhoes	0.006453	0.035834	0.028488
2023	Howard	Non-Road Diesel	2270002069	Construction	Crawler Tractor/Dozers	0.000733	0.017001	0.004506
2023	Howard	Non-Road Diesel	2270002072	Construction	Skid Steer Loaders	0.008550	0.039241	0.039355
2023	Howard	Non-Road Diesel	2270002075	Construction	Off-highway Tractors	0.000144	0.003852	0.000815
2023	Howard	Non-Road Diesel	2270002078	Construction	Dumpers/Tenders	0.000028	0.000123	0.000117
2023	Howard	Non-Road Diesel	2270002081	Construction	Other Construction Equipment	0.000256	0.004401	0.001833
2023	Howard	Non-Road Diesel	2270003010	Industrial	Aerial Lifts	0.000473	0.002769	0.002116
2023	Howard	Non-Road Diesel	2270003020	Industrial	Forklifts	0.000268	0.013362	0.001289
2023	Howard	Non-Road Diesel	2270003030	Industrial	Sweepers/Scrubbers	0.000210	0.005139	0.001104
2023	Howard	Non-Road Diesel	2270003040	Industrial	Other General Industrial Equipment	0.000318	0.006189	0.001612
2023	Howard	Non-Road Diesel	2270003050	Industrial	Other Material Handling Equipment	0.000082	0.000543	0.000316
2023	Howard	Non-Road Diesel	2270003060	Industrial	AC/Refrigeration	0.002454	0.071649	0.009805
2023	Howard	Non-Road Diesel	2270003070	Industrial	Terminal Tractors	0.000125	0.002960	0.000595
2023	Howard	Non-Road Diesel	2270004031	Lawn & Garden	Leafblowers/Vacuums (Commercial)	0.000002	0.000013	0.000007
2023	Howard	Non-Road Diesel	2270004036	Lawn & Garden	Snowblowers (Commercial)	0.000000	0.000000	0.000000
2023	Howard	Non-Road Diesel	2270004046	Lawn & Garden	Front Mowers (Commercial)	0.005556	0.067581	0.023168
2023	Howard	Non-Road Diesel	2270004056	Lawn & Garden	Lawn and Garden Tractors (Commercial)	0.001409	0.014802	0.005966
2023	Howard	Non-Road Diesel	2270004066	Lawn & Garden	Chippers/Stump Grinders (Commercial)	0.006429	0.085604	0.028564
2023	Howard	Non-Road Diesel	2270004071	Lawn & Garden	Turf Equipment (Commercial)	0.000295	0.005939	0.001347
2023	Howard	Non-Road Diesel	2270004076	Lawn & Garden	Other Lawn and Garden Equipment (Commercial)	0.000029	0.000311	0.000127
2023	Howard	Non-Road Diesel	2270005010	Farm	2-Wheel Tractors	0.000000	0.000001	0.000000
2023	Howard	Non-Road Diesel	2270005015	Farm	Agricultural Tractors	0.001405	0.018745	0.008038
2023	Howard	Non-Road Diesel	2270005020	Farm	Combines	0.000208	0.002393	0.000959
2023	Howard	Non-Road Diesel	2270005025	Farm	Balers	0.000002	0.000014	0.000008
2023	Howard	Non-Road Diesel	2270005030	Farm	Agricultural Mowers	0.000000	0.000002	0.000001
2023	Howard	Non-Road Diesel	2270005035	Farm	Sprayers	0.000025	0.000188	0.000097
2023	Howard	Non-Road Diesel	2270005040	Farm	Tillers : 6 HP	0.000000	0.000001	0.000000
2023	Howard	Non-Road Diesel	2270005045	Farm	Swathers	0.000021	0.000195	0.000105

2023 MOVES-NR Data

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2023	Howard	Non-Road Diesel	2270005055	Farm	Other Agricultural Equipment	0.000037	0.000398	0.000194
2023	Howard	Non-Road Diesel	2270005060	Farm	Irrigation Sets	0.000012	0.000224	0.000065
2023	Howard	Non-Road Diesel	2270006005	Light Commercial	Generator Sets	0.005910	0.064809	0.024192
2023	Howard	Non-Road Diesel	2270006010	Light Commercial	Pumps	0.001414	0.015285	0.005905
2023	Howard	Non-Road Diesel	2270006015	Light Commercial	Air Compressors	0.001215	0.024910	0.007216
2023	Howard	Non-Road Diesel	2270006025	Light Commercial	Welders	0.003525	0.021168	0.016299
2023	Howard	Non-Road Diesel	2270006030	Light Commercial	Pressure Washers	0.000218	0.002152	0.000784
2023	Howard	Non-Road Diesel	2270006035	Light Commercial	Hydro-power Units	0.000063	0.001178	0.000340
2023	Howard	Non-Road Diesel	2270007015	Logging	Forest Eq - Feller/Bunch/Skidder	0.000011	0.000172	0.000057
2023	Howard	Non-Road Diesel	2270010010	Industrial	Other Oil Field Equipment	0.000022	0.000411	0.000110
2023	Howard	Non-Road Diesel	2282020005	Recreational Marine Vessels	Inboard/Sterndrive	0.000173	0.002763	0.000626
2023	Howard	Non-Road Diesel	2282020010	Recreational Marine Vessels	Outboard	0.000003	0.000015	0.000009
2023	Howard	Non-Road Diesel	2285002015	Railway Maintenance	Railway Maintenance	0.000346	0.002315	0.001408
2023	Howard	Non-Road Gasoline	2260001010	Recreational	Motorcycles: Off-road	0.038675	0.000512	0.043689
2023	Howard	Non-Road Gasoline	2260001030	Recreational	All Terrain Vehicles	0.004134	0.000266	0.023160
2023	Howard	Non-Road Gasoline	2260001060	Recreational	Specialty Vehicles/Carts	0.001304	0.000357	0.044368
2023	Howard	Non-Road Gasoline	2260002006	Construction	Tampers/Rammers	0.006437	0.000161	0.026761
2023	Howard	Non-Road Gasoline	2260002009	Construction	Plate Compactors	0.000225	0.000011	0.001004
2023	Howard	Non-Road Gasoline	2260002021	Construction	Paving Equipment	0.000268	0.000013	0.001212
2023	Howard	Non-Road Gasoline	2260002027	Construction	Signal Boards/Light Plants	0.000002	0.000000	0.000009
2023	Howard	Non-Road Gasoline	2260002039	Construction	Concrete/Industrial Saws	0.016415	0.000423	0.069771
2023	Howard	Non-Road Gasoline	2260002054	Construction	Crushing/Processing Equipment	0.000055	0.000003	0.000248
2023	Howard	Non-Road Gasoline	2260003030	Industrial	Sweepers/Scrubbers	0.000272	0.000012	0.001134
2023	Howard	Non-Road Gasoline	2260003040	Industrial	Other General Industrial Equipment	0.000020	0.000001	0.000087
2023	Howard	Non-Road Gasoline	2260004015	Lawn & Garden	Rotary Tillers < 6 HP (Residential)	0.001972	0.000087	0.007517
2023	Howard	Non-Road Gasoline	2260004016	Lawn & Garden	Rotary Tillers < 6 HP (Commercial)	0.027994	0.001329	0.116070
2023	Howard	Non-Road Gasoline	2260004020	Lawn & Garden	Chain Saws < 6 HP (Residential)	0.024378	0.000727	0.065102
2023	Howard	Non-Road Gasoline	2260004021	Lawn & Garden	Chain Saws < 6 HP (Commercial)	0.357349	0.007981	1.271653
2023	Howard	Non-Road Gasoline	2260004025	Lawn & Garden	Trimmers/Edgers/Brush Cutters (Residential)	0.039666	0.001629	0.133345
2023	Howard	Non-Road Gasoline	2260004026	Lawn & Garden	Trimmers/Edgers/Brush Cutters (Commercial)	0.285190	0.011192	1.110775
2023	Howard	Non-Road Gasoline	2260004030	Lawn & Garden	Leafblowers/Vacuums (Residential)	0.023952	0.001041	0.091030
2023	Howard	Non-Road Gasoline	2260004031	Lawn & Garden	Leafblowers/Vacuums (Commercial)	0.285035	0.010376	1.237737
2023	Howard	Non-Road Gasoline	2260004035	Lawn & Garden	Snowblowers (Residential)	0.001293	0.000000	0.000000
2023	Howard	Non-Road Gasoline	2260004036	Lawn & Garden	Snowblowers (Commercial)	0.000600	0.000000	0.000000
2023	Howard	Non-Road Gasoline	2260004071	Lawn & Garden	Turf Equipment (Commercial)	0.000106	0.000006	0.000512
2023	Howard	Non-Road Gasoline	2260005035	Farm	Sprayers	0.000027	0.000001	0.000110
2023	Howard	Non-Road Gasoline	2260006005	Light Commercial	Generator Sets	0.004509	0.000172	0.015839

2023 MOVES-NR Data

yearID	County Name	Tier 2 Description	scc	Tier 3 Description	SCC Level Four	VOC	NOX	CO
2023	Howard	Non-Road Gasoline	2260006010	Light Commercial	Pumps	0.031606	0.001174	0.102484
2023	Howard	Non-Road Gasoline	2260006015	Light Commercial	Air Compressors	0.000011	0.000000	0.000039
2023	Howard	Non-Road Gasoline	2260006035	Light Commercial	Hydro-power Units	0.000195	0.000007	0.000687
2023	Howard	Non-Road Gasoline	2260007005	Logging	Chain Saws : 6 HP	0.000704	0.000016	0.002737
2023	Howard	Non-Road Gasoline	2265001010	Recreational	Motorcycles: Off-road	0.001798	0.000279	0.016684
2023	Howard	Non-Road Gasoline	2265001030	Recreational	All Terrain Vehicles	0.018356	0.001938	0.205681
2023	Howard	Non-Road Gasoline	2265001050	Recreational	Golf Carts	0.016204	0.005349	0.806893
2023	Howard	Non-Road Gasoline	2265001060	Recreational	Specialty Vehicles/Carts	0.001289	0.000426	0.044503
2023	Howard	Non-Road Gasoline	2265002003	Construction	Pavers	0.000272	0.000109	0.013834
2023	Howard	Non-Road Gasoline	2265002006	Construction	Tampers/Rammers	0.000003	0.000001	0.000126
2023	Howard	Non-Road Gasoline	2265002009	Construction	Plate Compactors	0.000714	0.000203	0.024498
2023	Howard	Non-Road Gasoline	2265002015	Construction	Rollers	0.000487	0.000193	0.025340
2023	Howard	Non-Road Gasoline	2265002021	Construction	Paving Equipment	0.001245	0.000384	0.053475
2023	Howard	Non-Road Gasoline	2265002024	Construction	Surfacing Equipment	0.000512	0.000164	0.023006
2023	Howard	Non-Road Gasoline	2265002027	Construction	Signal Boards/Light Plants	0.000026	0.000009	0.001128
2023	Howard	Non-Road Gasoline	2265002030	Construction	Trenchers	0.000882	0.000342	0.040376
2023	Howard	Non-Road Gasoline	2265002033	Construction	Bore/Drill Rigs	0.000433	0.000227	0.011992
2023	Howard	Non-Road Gasoline	2265002039	Construction	Concrete/Industrial Saws	0.001989	0.000728	0.103240
2023	Howard	Non-Road Gasoline	2265002042	Construction	Cement and Mortar Mixers	0.001345	0.000332	0.046833
2023	Howard	Non-Road Gasoline	2265002045	Construction	Cranes	0.000035	0.000047	0.001167
2023	Howard	Non-Road Gasoline	2265002054	Construction	Crushing/Processing Equipment	0.000132	0.000049	0.006219
2023	Howard	Non-Road Gasoline	2265002057	Construction	Rough Terrain Forklifts	0.000020	0.000042	0.000625
2023	Howard	Non-Road Gasoline	2265002060	Construction	Rubber Tire Loaders	0.000032	0.000084	0.000947
2023	Howard	Non-Road Gasoline	2265002066	Construction	Tractors/Loaders/Backhoes	0.000630	0.000231	0.034711
2023	Howard	Non-Road Gasoline	2265002072	Construction	Skid Steer Loaders	0.000298	0.000230	0.013582
2023	Howard	Non-Road Gasoline	2265002078	Construction	Dumpers/Tenders	0.000217	0.000059	0.007757
2023	Howard	Non-Road Gasoline	2265002081	Construction	Other Construction Equipment	0.000048	0.000085	0.001182
2023	Howard	Non-Road Gasoline	2265003010	Industrial	Aerial Lifts	0.001363	0.001192	0.057380
2023	Howard	Non-Road Gasoline	2265003020	Industrial	Forklifts	0.001173	0.003083	0.034583
2023	Howard	Non-Road Gasoline	2265003030	Industrial	Sweepers/Scrubbers	0.001240	0.000722	0.053617
2023	Howard	Non-Road Gasoline	2265003040	Industrial	Other General Industrial Equipment	0.005243	0.001522	0.167458
2023	Howard	Non-Road Gasoline	2265003050	Industrial	Other Material Handling Equipment	0.000099	0.000072	0.004630
2023	Howard	Non-Road Gasoline	2265003060	Industrial	AC/Refrigeration	0.000148	0.000048	0.007644
2023	Howard	Non-Road Gasoline	2265003070	Industrial	Terminal Tractors	0.000102	0.000275	0.003111
2023	Howard	Non-Road Gasoline	2265004010	Lawn & Garden	Lawn Mowers (Residential)	0.080636	0.010733	1.070238
2023	Howard	Non-Road Gasoline	2265004011	Lawn & Garden	Lawn Mowers (Commercial)	0.146867	0.024640	2.391703
2023	Howard	Non-Road Gasoline	2265004015	Lawn & Garden	Rotary Tillers < 6 HP (Residential)	0.007361	0.000923	0.092063

2023 MOVES-NR Data

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2023	Howard	Non-Road Gasoline	2265004016	Lawn & Garden	Rotary Tillers < 6 HP (Commercial)	0.096949	0.014210	1.408700
2023	Howard	Non-Road Gasoline	2265004025	Lawn & Garden	Trimmers/Edgers/Brush Cutters (Residential)	0.000590	0.000060	0.005941
2023	Howard	Non-Road Gasoline	2265004026	Lawn & Garden	Trimmers/Edgers/Brush Cutters (Commercial)	0.003945	0.000565	0.069216
2023	Howard	Non-Road Gasoline	2265004030	Lawn & Garden	Leafblowers/Vacuums (Residential)	0.000719	0.000114	0.011335
2023	Howard	Non-Road Gasoline	2265004031	Lawn & Garden	Leafblowers/Vacuums (Commercial)	0.090924	0.022941	2.943908
2023	Howard	Non-Road Gasoline	2265004035	Lawn & Garden	Snowblowers (Residential)	0.002889	0.000000	0.000000
2023	Howard	Non-Road Gasoline	2265004036	Lawn & Garden	Snowblowers (Commercial)	0.001366	0.000000	0.000000
2023	Howard	Non-Road Gasoline	2265004040	Lawn & Garden	Rear Engine Riding Mowers (Residential)	0.010850	0.002154	0.343172
2023	Howard	Non-Road Gasoline	2265004041	Lawn & Garden	Rear Engine Riding Mowers (Commercial)	0.010101	0.003038	0.479619
2023	Howard	Non-Road Gasoline	2265004046	Lawn & Garden	Front Mowers (Commercial)	0.012226	0.003661	0.541532
2023	Howard	Non-Road Gasoline	2265004051	Lawn & Garden	Shredders < 6 HP (Commercial)	0.011038	0.001631	0.162136
2023	Howard	Non-Road Gasoline	2265004055	Lawn & Garden	Lawn and Garden Tractors (Residential)	0.119824	0.028808	4.600196
2023	Howard	Non-Road Gasoline	2265004056	Lawn & Garden	Lawn and Garden Tractors (Commercial)	0.130992	0.041290	6.521239
2023	Howard	Non-Road Gasoline	2265004066	Lawn & Garden	Chippers/Stump Grinders (Commercial)	0.013662	0.006693	0.669184
2023	Howard	Non-Road Gasoline	2265004071	Lawn & Garden	Turf Equipment (Commercial)	0.383086	0.133590	18.110112
2023	Howard	Non-Road Gasoline	2265004075	Lawn & Garden	Other Lawn and Garden Equipment (Residential)	0.004981	0.001084	0.131406
2023	Howard	Non-Road Gasoline	2265004076	Lawn & Garden	Other Lawn and Garden Equipment (Commercial)	0.018998	0.004300	0.515782
2023	Howard	Non-Road Gasoline	2265005010	Farm	2-Wheel Tractors	0.000007	0.000002	0.000386
2023	Howard	Non-Road Gasoline	2265005015	Farm	Agricultural Tractors	0.000008	0.000009	0.000383
2023	Howard	Non-Road Gasoline	2265005020	Farm	Combines	0.000000	0.000000	0.000004
2023	Howard	Non-Road Gasoline	2265005025	Farm	Balers	0.000019	0.000025	0.000348
2023	Howard	Non-Road Gasoline	2265005030	Farm	Agricultural Mowers	0.000006	0.000002	0.000314
2023	Howard	Non-Road Gasoline	2265005035	Farm	Sprayers	0.000072	0.000040	0.002512
2023	Howard	Non-Road Gasoline	2265005040	Farm	Tillers : 6 HP	0.000299	0.000064	0.010051
2023	Howard	Non-Road Gasoline	2265005045	Farm	Swathers	0.000028	0.000040	0.000551
2023	Howard	Non-Road Gasoline	2265005055	Farm	Other Agricultural Equipment	0.000038	0.000047	0.001175
2023	Howard	Non-Road Gasoline	2265005060	Farm	Irrigation Sets	0.000008	0.000015	0.000238
2023	Howard	Non-Road Gasoline	2265006005	Light Commercial	Generator Sets	0.100856	0.025830	3.890395
2023	Howard	Non-Road Gasoline	2265006010	Light Commercial	Pumps	0.024461	0.006929	0.770545
2023	Howard	Non-Road Gasoline	2265006015	Light Commercial	Air Compressors	0.010064	0.003466	0.367505
2023	Howard	Non-Road Gasoline	2265006025	Light Commercial	Welders	0.023055	0.007444	1.013332
2023	Howard	Non-Road Gasoline	2265006030	Light Commercial	Pressure Washers	0.047229	0.011663	1.562496
2023	Howard	Non-Road Gasoline	2265006035	Light Commercial	Hydro-power Units	0.001682	0.000557	0.079860
2023	Howard	Non-Road Gasoline	2265007010	Logging	Shredders : 6 HP	0.000114	0.000029	0.004113
2023	Howard	Non-Road Gasoline	2265007015	Logging	Forest Eqp - Feller/Bunch/Skidder	0.000001	0.000000	0.000036
2023	Howard	Non-Road Gasoline	2265010010	Industrial	Other Oil Field Equipment	0.000073	0.000027	0.003954
2023	Howard	Non-Road Gasoline	2282005010	Recreational Marine Vessels	Outboard	0.024706	0.007764	0.129149

2023 MOVES-NR Data

yearID	County Name	Tier 2 Description	scc	Tier 3 Description	SCC Level Four	VOC	NOX	CO
2023	Howard	Non-Road Gasoline	2282005015	Recreational Marine Vessels	Personal Water Craft	0.004467	0.003680	0.066420
2023	Howard	Non-Road Gasoline	2282010005	Recreational Marine Vessels	Inboard/Sterndrive	0.001914	0.002175	0.029214
2023	Howard	Non-Road Gasoline	2285004015	Railway Maintenance	Railway Maintenance	0.000146	0.000046	0.006702
2023	Howard	Other	2267001060	Liquified Petroleum Gas	Specialty Vehicles/Carts	0.000017	0.000079	0.000406
2023	Howard	Other	2267002003	Liquified Petroleum Gas	Pavers	0.000003	0.000019	0.000108
2023	Howard	Other	2267002015	Liquified Petroleum Gas	Rollers	0.000003	0.000027	0.000139
2023	Howard	Other	2267002021	Liquified Petroleum Gas	Paving Equipment	0.000003	0.000013	0.000071
2023	Howard	Other	2267002024	Liquified Petroleum Gas	Surfacing Equipment	0.000000	0.000003	0.000019
2023	Howard	Other	2267002030	Liquified Petroleum Gas	Trenchers	0.000008	0.000057	0.000332
2023	Howard	Other	2267002033	Liquified Petroleum Gas	Bore/Drill Rigs	0.000032	0.000139	0.000702
2023	Howard	Other	2267002039	Liquified Petroleum Gas	Concrete/Industrial Saws	0.000006	0.000046	0.000242
2023	Howard	Other	2267002045	Liquified Petroleum Gas	Cranes	0.000009	0.000044	0.000245
2023	Howard	Other	2267002054	Liquified Petroleum Gas	Crushing/Processing Equipment	0.000001	0.000007	0.000037
2023	Howard	Other	2267002057	Liquified Petroleum Gas	Rough Terrain Forklifts	0.000006	0.000039	0.000233
2023	Howard	Other	2267002060	Liquified Petroleum Gas	Rubber Tire Loaders	0.000009	0.000077	0.000394
2023	Howard	Other	2267002066	Liquified Petroleum Gas	Tractors/Loaders/Backhoes	0.000001	0.000008	0.000042
2023	Howard	Other	2267002072	Liquified Petroleum Gas	Skid Steer Loaders	0.000031	0.000158	0.000868
2023	Howard	Other	2267002081	Liquified Petroleum Gas	Other Construction Equipment	0.000017	0.000082	0.000454
2023	Howard	Other	2267003010	Liquified Petroleum Gas	Aerial Lifts	0.000159	0.000891	0.005136
2023	Howard	Other	2267003020	Liquified Petroleum Gas	Forklifts	0.005423	0.046299	0.237286
2023	Howard	Other	2267003030	Liquified Petroleum Gas	Sweepers/Scrubbers	0.000041	0.000348	0.001794
2023	Howard	Other	2267003040	Liquified Petroleum Gas	Other General Industrial Equipment	0.000013	0.000109	0.000560
2023	Howard	Other	2267003050	Liquified Petroleum Gas	Other Material Handling Equipment	0.000006	0.000038	0.000213
2023	Howard	Other	2267003070	Liquified Petroleum Gas	Terminal Tractors	0.000026	0.000216	0.001116
2023	Howard	Other	2267004066	Liquified Petroleum Gas	Chippers/Stump Grinders (Commercial)	0.000274	0.002321	0.011938
2023	Howard	Other	2267005055	Liquified Petroleum Gas	Other Agricultural Equipment	0.000000	0.000000	0.000002
2023	Howard	Other	2267005060	Liquified Petroleum Gas	Irrigation Sets	0.000000	0.000000	0.000001
2023	Howard	Other	2267006005	Liquified Petroleum Gas	Generator Sets	0.001435	0.008768	0.035624
2023	Howard	Other	2267006010	Liquified Petroleum Gas	Pumps	0.000141	0.000973	0.004781
2023	Howard	Other	2267006015	Liquified Petroleum Gas	Air Compressors	0.000082	0.000680	0.003670
2023	Howard	Other	2267006025	Liquified Petroleum Gas	Welders	0.000110	0.000853	0.004768
2023	Howard	Other	2267006030	Liquified Petroleum Gas	Pressure Washers	0.000004	0.000021	0.000116
2023	Howard	Other	2267006035	Liquified Petroleum Gas	Hydro-power Units	0.000001	0.000011	0.000056
2023	Howard	Other	2268002081	Compressed Natural Gas	Other Construction Equipment	0.000003	0.000004	0.000019
2023	Howard	Other	2268003020	Compressed Natural Gas	Forklifts	0.001604	0.003768	0.018442
2023	Howard	Other	2268003030	Compressed Natural Gas	Sweepers/Scrubbers	0.000001	0.000003	0.000016
2023	Howard	Other	2268003040	Compressed Natural Gas	Other General Industrial Equipment	0.000001	0.000002	0.000009

2023 MOVES-NR Data

yearID	County Name	Tier 2 Description	scc	Tier 3 Description	SCC Level Four	VOC	NOX	CO
2023	Howard	Other	2268003060	Compressed Natural Gas	AC\Refrigeration	0.000006	0.000013	0.000063
2023	Howard	Other	2268003070	Compressed Natural Gas	Terminal Tractors	0.000009	0.000021	0.000106
2023	Howard	Other	2268005055	Compressed Natural Gas	Other Agricultural Equipment	0.000001	0.000001	0.000005
2023	Howard	Other	2268005060	Compressed Natural Gas	Irrigation Sets	0.000010	0.000024	0.000117
2023	Howard	Other	2268006005	Compressed Natural Gas	Generator Sets	0.002137	0.003631	0.014144
2023	Howard	Other	2268006010	Compressed Natural Gas	Pumps	0.000050	0.000093	0.000440
2023	Howard	Other	2268006015	Compressed Natural Gas	Air Compressors	0.000030	0.000068	0.000353
2023	Howard	Other	2268006020	Compressed Natural Gas	Gas Compressors	0.001160	0.002408	0.012541
2023	Howard	Other	2268010010	Compressed Natural Gas	Other Oil Field Equipment	0.000009	0.000021	0.000105
2023	Howard	Other	2285006015	Liquified Petroleum Gas	Railway Maintenance	0.000000	0.000002	0.000011
Howard Total						2.662513	1.144038	54.789358
Grand Total						18.768569	9.989076	339.999958

MOVES Inputs		
Month VMT Fractions	Calculated based on 2017 seasonal adjustment factors	Calculated based on 2020 seasonal adjustment factors
Day VMT Fractions	Calculated based on 2017 seasonal adjustment factors	Calculated based on 2020 seasonal adjustment factors
Hourly VMT Fractions	Calculated by PPSUITE	Calculated by PPSUITE
Average Speed Distribution	Calculated by PPSUITE	Calculated by PPSUITE
Source Type Population	<p>1. Non-trucks: Use 2017 Inputs provided by MDE</p> <p>2. Trucks (source type 52, 53 ,61 & 62): Estimated by using MD VMT and MOVES2014 national default VMT and population ratios</p>	<p>1. Source Type 11, 21, 31, 32, 41, 42, 43, 51 & 54: Apply VPOP growth to 2020 base year inputs (2020 base year inputs provided by MDE)</p> <p>2. Trucks (source type 52, 53 ,61 & 62): Estimated by using MD VMT and MOVES3 national default VMT and population ratios</p>
Vehicle Age Distribution	<p>Provided by MDE (Consistent with 2017 NEI):</p> <p>1) All source types except 61 and 62: developed by MSCP from VIN-decoded registration database.</p> <p>2) Source types 61 & 62: Use MOVES2014 national default age distribution inputs</p>	<p>Provided by MDE (Consistent with 2020 NEI):</p> <p>1) 2020 Jul 01 MVA vehicle registration database, VIN-decoded by ESP.</p> <p>2) Source types 61 & 62: Use MOVES3 national default age distribution inputs</p>
Fuel Supply	MOVES3 Default	MOVES3 inputs provided by MDE
Fuel Formulation	MOVES3 Default	MOVES3 inputs provided by MDE
Fuel Usage Fraction	MOVES3 Default	MOVES3 inputs provided by MDE
Temperatures/Humidity	2017 inputs provided by MDE	2020 inputs provided by MDE
I/M Parameters	Existing IM Programs provided by MDE (2017 IM Programs)	VEIP Reinvention Program provided by MDE (2020 IM Programs)
Early NLEV / CALLEV	Early NLEV and CALEV program databases developed with MOVES3	Early NLEV and CALEV program databases developed with MOVES3
AVFT	Provided by MDE for MOVES3 (2017 LD EV Sales%)	Provided by MDE for MOVES3 (2020 LD EV Sales%)
Federal Fuel & Emissions Standards	Controlled Measures included in MOVES3	Controlled Measures included in MOVES3

NOTE: Input assumptions different from 2020 NEI