

2017 BASE YEAR EMISSIONS INVENTORY

Appendix B1c

Nonpoint and Marine/Air/Rail Inventory Development Overview (Virginia)

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

Prepared by:

**Virginia Department of Environmental Quality,
on behalf of the
Metropolitan Washington Air Quality Committee**

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Virginia 2017 Emission Estimation Approach Overview

Staff for the Virginia Department of Environmental Quality, VDEQ, compiled preliminary 2017 annual and ozone season daily emission inventories from the most currently available data because a comprehensive inventory of 2017 area and marine/air/rail emissions was not available from the US EPA National Emission Inventory, NEI, data system. Virginia's 2017 area and marine/air/rail inventories are a composite of estimates which include 2017 annual emission estimates developed in-house by VDEQ staff, as well as 2017 annual emissions estimates generated using various EPA emission modeling tools. Where 2017 annual emission estimates were not available, VDEQ staff populated those remaining area source and marine/air/rail categories with 2014 emission estimates derived from the US EPA 2014 NEI V2 Final emission inventory. Appendix B2c-2 contains a field labeled 'Data Set' that describes the data source where the annual emission for each area and marine/air/rail estimate was derived from. Data elements denoted as "2017 VADEQ SIS 30 Sept 2019" were populated with annual emission estimates calculated in-house by VDEQ staff. Emission records populated with emission data derived from various EPA emission modeling tools are denoted by the name of the modeling tool used and the date that the model run was performed. The remaining source categories were back-filled with emission estimates carried forward from the EPA 2014 NEI V2 Final emission inventory and are denoted by the Data Set name "2014NEIV2".

State Developed Annual Emission Estimates

Appendix B2c-1 contains sample calculations illustrating how each in-house developed area source and marine/air/rail annual emission estimate was calculated for Northern Virginia jurisdictions. This appendix contains the activity data, emission factors, control factors, fuel loading factors, apportionment factors, and sample calculations demonstrating how state developed annual area source and marine/air/rail emissions were calculated.

Ozone Season Daily Emissions Estimates for Northern Virginia jurisdictions.

Appendix B2c-2 contains the raw data that VDEQ staff used to develop ozone season daily emissions from Annual emission estimate for all area source and marine/air/rail category. For calculating 2017 ozone season daily emissions, OSD, VDEQ staff followed a methodology similar to what has been used previously in developing daily emission estimates for Northern Virginia jurisdictions. The use of this methodology was originally proposed by the Maryland Department of the Environment. VDEQ adopted the proposed methodology in order that the process of converting annual emissions to ozone season daily emissions for Maryland and Virginia would be consistent for jurisdictions that are part of state implementation plans and maintenance plans prepared by the Metropolitan Washington Council of Governments. This methodology was based on a procedure contained in the document 'Introduction to area source emission inventory development', Volume III, Chapter 1, Revised Final January 2001, developed by the EPA Emission Inventory Improvement Program. A copy of the document can be found on the EPA website at:

https://www.epa.gov/sites/production/files/2015-08/documents/iii01_apr2001.pdf

An example for calculating peak ozone season daily emission estimation is provided in the document in section 4.2.8 'Calculations for Temporal Adjustments', equation 1.4-11 on page 1.4-13 and 1.4.14 of the EIIP document and is shown below.

An example calculation of a peak ozone season daily emission estimate where the peak ozone season is the 3 months of summer, is shown in Equation 1.4-11:

Example:

Annual Emissions = 1.3 tons of VOCs

SAF = 0.28 (28 percent)

Peak Ozone Season = 0.25 (25 percent or 3 months)

Operating Schedule = 6 days per week, 52 weeks per year

Typical Ozone Season Daily Emissions

= (1.3 tons year)(2,000 lb ton)* ((0.28)/(0.25))/(6 days/week) (52 weeks/year)*

= 9.3 lb VOCs per day (1.4-11)

Information specific to Virginia's application of the methodology cited above is described below:

Ozone Season Daily Emissions (tons/day)

= Annual Emissions (tons) *[SAF] / [Peak Ozone Season] / [Days per Period]

Where:

"The SAF (Seasonal Adjustment Factor) divided by the Peak Ozone Season Value is the fraction of annual emissions emitted over a period of time that is reflected in the Days per Period value" (R. Thunell, MDE, 18 Nov 2019).

Specifically:

SAF = The component of emissions associated with the designated period that occur during the designated season. A value of 1 would indicate that 100% percent of the emissions for the designated period also occur during the designated season.

Peak Ozone Season = The portion of the days associated with Days per Period that also take place during the season. A value of 1 would indicate that 100% of the 'Days per Period' also take place in the designated season.

Days per Period = Number of operating days in the designated period.

The following pages demonstrate 4 examples of how VDEQ calculated OSD emission using the EPA EIIP methodology.

Example 1:

Given:

SCC = 2102004002, Industrial Distillate Combustion

FIPS 51059, Fairfax County Virginia

Annual Emissions = 4.80151251988292 tons VOC per year

SAF = 0.25 because 25% of annual emission take place during the designated 'season'

Peak Ozone Season = 0.25 because the 'season' represents 25% of the 'Days per Period'

Days per Period = 312 because the source operates 312 days

Length of Season = 3 months (0.25 years)

Length of Period = 1 year

Ozone Season Daily Emissions (tons/day)

= Annual Emissions (tons VOC/year) * [SAF] / [Peak Ozone Season] / [Days per Period]

= 4.8015 tons VOC/year * [0.25] / [0.25] / [312 days/year]

= 0.0159 tons/day

Example 2:

Given:

SCC = 2302002200, Under-fired Charbroiling Commercial Cooking

FIPS 51059, Fairfax County Virginia

Annual Emissions = 46.3874 tons VOC per year

SAF = 0.3333 because 33.33% of annual emission take place during the designated 'season'

Peak Ozone Season = 0.25 because the 'season' represents 25% of the 'Days per Period'

Days per Period = 365 because the source operates 365 days

Length of Season = 3 months (0.25 years)

Length of Period = 1 year

Ozone Season Daily Emissions (tons/day)

= Annual Emissions (tons VOC/year) * [SAF] / [Peak Ozone Season] / [Days per Period]

= 46.3874 tons VOC/year * [0.3333] / [0.25] / [365 days/year]

= 0.1695 tons VOC / day

Example 3:

Given:

SCC = 2461022000, Emulsified Asphalt Paving

FIPS 51059, Fairfax County Virginia

Annual Emissions = 471.8353 tons VOC per year

SAF = 0.3893 because 38.93% of annual emission take place during the designated 'season'

Peak Ozone Season = 0.25 because the 'season' represents 25% of the 'Days per Period'

Days per Period = 260 because the source operates 260 days (5 days/week, 52 weeks/year)

Length of Season = 3 months (0.25 years)

Length of Period = 1 year

Ozone Season Daily Emissions (tons/day)

$$\begin{aligned} &= \text{Annual Emissions (tons VOC/year)} * [\text{SAF}] / [\text{Peak Ozone Season}] / [\text{Days per Period}] \\ &= 471.8353 \text{ tons VOC/year} * [0.3893] / [0.25] / [260 \text{ days/year}] \\ &= 2.8258 \text{ tons VOC / day} \end{aligned}$$

Example 4:

Given:

SCC = 2104006000, Residential Natural Gas Combustion

FIPS 51059, Fairfax County Virginia

Annual Emissions = 45.1947 tons VOC per year

SAF = 0.0000665589 because 0.00665589% of annual emission take place during July, which is a month with 31 days

Peak Ozone Season = 1.00 because all 31 days in July take place in the peak ozone season

Days per Period = 31 because the source operates 31 days in the month of July

Length of Season = 1 month

Length of Period = 1 month

Ozone Season Daily Emissions (tons/day)

$$\begin{aligned} &= \text{Annual Emissions (tons VOC/year)} * [\text{SAF}] / [\text{Peak Ozone Season}] / [\text{Days per Period}] \\ &= 45.1947 \text{ tons VOC/year} * [0.0000665589] / [1.00] / [31 \text{ days/year}] \\ &= 9.704\text{E-}05 \text{ tons VOC/day} \end{aligned}$$

Annual and Ozone Season Emission Summaries:

Northern Virginia Nonpoint Emissions				
AREA	Pollutant	Sector	Annual emissions (tons/year)	Ozone Season Daily (tons/day)
51013 Arlington, VA	CO	Nonpoint	602.4019	1.1215
51059 Fairfax County VA	CO	Nonpoint	5155.0027	7.4240
51107 Loudoun County, VA	CO	Nonpoint	7057.3299	14.3770
51153 Prince William County, VA	CO	Nonpoint	4981.2235	7.9373
51510 Alexandria City, VA	CO	Nonpoint	430.5280	0.8919
51600 Fairfax City, VA	CO	Nonpoint	181.0831	0.3400
51610 Falls Church City, VA	CO	Nonpoint	68.2052	0.1468
51683 Manassas City, VA	CO	Nonpoint	266.9730	0.6106
51685 Manassas Park City, VA	CO	Nonpoint	81.7612	0.1834
Total	CO	Nonpoint	18824.5085	33.0325

Northern Virginia Nonpoint Emissions				
AREA	Pollutant	Sector	Annual emissions (tons/year)	Ozone Season Daily (tons/day)
51013 Arlington, VA	NOx	Nonpoint	447.0415	0.8779
51059 Fairfax County VA	NOx	Nonpoint	2274.2001	4.7444
51107 Loudoun County, VA	NOx	Nonpoint	951.3809	2.1917
51153 Prince William County, VA	NOx	Nonpoint	745.0583	1.6585
51510 Alexandria City, VA	NOx	Nonpoint	318.4554	0.6537
51600 Fairfax City, VA	NOx	Nonpoint	101.0888	0.2110
51610 Falls Church City, VA	NOx	Nonpoint	39.2549	0.0886
51683 Manassas City, VA	NOx	Nonpoint	121.9791	0.3236
51685 Manassas Park City, VA	NOx	Nonpoint	41.6821	0.1103
Total	NOx	Nonpoint	5040.1412	10.8596

Northern Virginia Nonpoint emissions				
AREA	Pollutant	Sector	Annual emissions (tons/year)	Ozone Season Daily (tons/day)
51013 Arlington, VA	VOC	Nonpoint	1545.9679	4.8967
51059 Fairfax County VA	VOC	Nonpoint	8321.3993	26.0162
51107 Loudoun County, VA	VOC	Nonpoint	3542.0356	10.4827
51153 Prince William County, VA	VOC	Nonpoint	3851.4441	11.4625
51510 Alexandria City, VA	VOC	Nonpoint	1066.4048	3.3456
51600 Fairfax City, VA	VOC	Nonpoint	314.9670	1.0218
51610 Falls Church City, VA	VOC	Nonpoint	133.4866	0.4288
51683 Manassas City, VA	VOC	Nonpoint	384.8287	1.1788
51685 Manassas Park City, VA	VOC	Nonpoint	274.1506	0.9291
Total	VOC	Nonpoint	19434.6847	59.7623

Northern Virginia Marine/Air/Rail emissions				
AREA	Pollutant	Sector	Annual emissions (tons/year)	Ozone Season Daily (tons/day)
51013 Arlington, VA	CO	Marine/Air/Rail	1995.3526	5.4667
51059 Fairfax County VA	CO	Marine/Air/Rail	56.1557	0.1539
51107 Loudoun County, VA	CO	Marine/Air/Rail	2586.9394	7.0875
51153 Prince William County, VA	CO	Marine/Air/Rail	44.3445	0.1215
51510 Alexandria City, VA	CO	Marine/Air/Rail	24.2678	0.0665
51600 Fairfax City, VA	CO	Marine/Air/Rail	0.0000	0.0000
51610 Falls Church City, VA	CO	Marine/Air/Rail	0.0000	0.0000
51683 Manassas City, VA	CO	Marine/Air/Rail	234.4921	0.6424
51685 Manassas Park City, VA	CO	Marine/Air/Rail	0.7843	0.0021
Total	CO	Marine/Air/Rail	4942.3365	13.5406

Northern Virginia Marine/Air/Rail emissions				
AREA	Pollutant	Sector	Annual emissions (tons/year)	Ozone Season Daily (tons/day)
51013 Arlington, VA	NOx	Marine/Air/Rail	1253.3253	3.4338
51059 Fairfax County VA	NOx	Marine/Air/Rail	230.6779	0.6320
51107 Loudoun County, VA	NOx	Marine/Air/Rail	1605.3392	4.3982
51153 Prince William County, VA	NOx	Marine/Air/Rail	182.8397	0.5009
51510 Alexandria City, VA	NOx	Marine/Air/Rail	98.3961	0.2696
51600 Fairfax City, VA	NOx	Marine/Air/Rail	0.0000	0.0000
51610 Falls Church City, VA	NOx	Marine/Air/Rail	0.0000	0.0000
51683 Manassas City, VA	NOx	Marine/Air/Rail	24.2531	0.0664
51685 Manassas Park City, VA	NOx	Marine/Air/Rail	1.4975	0.0041
Total	NOx	Marine/Air/Rail	3396.3288	9.3050

Northern Virginia Marine/Air/Rail emissions				
AREA	Pollutant	Sector	Annual emissions (tons/year)	Ozone Season Daily (tons/day)
51013 Arlington, VA	VOC	Marine/Air/Rail	205.9458	0.5642
51059 Fairfax County VA	VOC	Marine/Air/Rail	12.4675	0.0342
51107 Loudoun County, VA	VOC	Marine/Air/Rail	289.4754	0.7931
51153 Prince William County, VA	VOC	Marine/Air/Rail	9.6885	0.0265
51510 Alexandria City, VA	VOC	Marine/Air/Rail	5.1946	0.0142
51600 Fairfax City, VA	VOC	Marine/Air/Rail	0.0000	0.0000
51610 Falls Church City, VA	VOC	Marine/Air/Rail	0.0000	0.0000
51683 Manassas City, VA	VOC	Marine/Air/Rail	11.3712	0.0312
51685 Manassas Park City, VA	VOC	Marine/Air/Rail	0.1197	0.0003
Total	VOC	Marine/Air/Rail	534.2628	1.4637

Northern Virginia Nonpoint + Marine/Air/Rail Emissions				
AREA	Pollutant	Sector	Annual emissions (tons/year)	Ozone Season Daily (tons/day)
51013 Arlington, VA	CO	Nonpoint + M/A/R	2597.7545	6.5882
51059 Fairfax County VA	CO	Nonpoint + M/A/R	5211.1583	7.5779
51107 Loudoun County, VA	CO	Nonpoint + M/A/R	9644.2693	21.4645
51153 Prince William County, VA	CO	Nonpoint + M/A/R	5025.5680	8.0588
51510 Alexandria City, VA	CO	Nonpoint + M/A/R	454.7958	0.9584
51600 Fairfax City, VA	CO	Nonpoint + M/A/R	181.0831	0.3400
51610 Falls Church City, VA	CO	Nonpoint + M/A/R	68.2052	0.1468
51683 Manassas City, VA	CO	Nonpoint + M/A/R	501.4651	1.2530
51685 Manassas Park City, VA	CO	Nonpoint + M/A/R	82.5455	0.1855
Total	CO	Nonpoint + M/A/R	23766.8450	46.5732

Northern Virginia Nonpoint + Marine/Air/Rail emissions				
AREA	Pollutant	Sector	Annual emissions (tons/year)	Ozone Season Daily (tons/day)
51013 Arlington, VA	NOx	Nonpoint + M/A/R	1700.3669	4.3117
51059 Fairfax County VA	NOx	Nonpoint + M/A/R	2504.8780	5.3763
51107 Loudoun County, VA	NOx	Nonpoint + M/A/R	2556.7201	6.5899
51153 Prince William County, VA	NOx	Nonpoint + M/A/R	927.8980	2.1595
51510 Alexandria City, VA	NOx	Nonpoint + M/A/R	416.8515	0.9233
51600 Fairfax City, VA	NOx	Nonpoint + M/A/R	101.0888	0.2110
51610 Falls Church City, VA	NOx	Nonpoint + M/A/R	39.2549	0.0886
51683 Manassas City, VA	NOx	Nonpoint + M/A/R	146.2322	0.3900
51685 Manassas Park City, VA	NOx	Nonpoint + M/A/R	43.1796	0.1144
Total	NOx	Nonpoint + M/A/R	8436.4700	20.1646

Northern Virginia Nonpoint + Marine/Air/Rail emissions				
AREA	Pollutant	Sector	Annual emissions (tons/year)	Ozone Season Daily (tons/day)
51013 Arlington, VA	VOC	Nonpoint + M/A/R	1751.9137	5.4609
51059 Fairfax County VA	VOC	Nonpoint + M/A/R	8333.8668	26.0504
51107 Loudoun County, VA	VOC	Nonpoint + M/A/R	3831.5111	11.2758
51153 Prince William County, VA	VOC	Nonpoint + M/A/R	3861.1326	11.4891
51510 Alexandria City, VA	VOC	Nonpoint + M/A/R	1071.5994	3.3599
51600 Fairfax City, VA	VOC	Nonpoint + M/A/R	314.9670	1.0218
51610 Falls Church City, VA	VOC	Nonpoint + M/A/R	133.4866	0.4288
51683 Manassas City, VA	VOC	Nonpoint + M/A/R	396.1999	1.2099
51685 Manassas Park City, VA	VOC	Nonpoint + M/A/R	274.2703	0.9295
Total	VOC	Nonpoint + M/A/R	19968.9475	61.2260

Additional information about Virginia's 2017 Northern Virginia Emission Inventory can be found in the following appendixes:

Appendix B2c-1.pdf contains CY2017 Virginia DEQ Developed Area Annual Emission Emissions Sample Calculations

Appendix B2c-2.pdf contains Ozone Season Daily emission calculations for all Virginia Area and M/A/R source categories