State Implementation Plan Revision: Motor Vehicle Emission Budget Revisions Based on the MOVES3 Model

Washington DC-MD-VA 2008 Ozone NAAQS Maintenance Plan

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for the
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on behalf of the
Metropolitan Washington Air Quality Committee

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1. STATE IMPLEMENTATION PLAN (SIP) REVISION OVERVIEW

The District of Columbia, the State of Maryland, and the Commonwealth of Virginia request that the U.S. Environmental Protection Agency (EPA) approve revisions to the original 2008 ozone national ambient air quality standard (NAAQS) maintenance plan dated December 20, 2017, (the 2017 plan) for the Washington DC-MD-VA 2008 Ozone NAAQS Maintenance Area. These revisions include changes to onroad motor vehicle emissions budgets (MVEBs) for volatile organic compounds (VOC) and nitrogen oxides (NO_X) based on the EPA approved MOVES3.0.4 model.

The three jurisdictions are revising the 2017 plan and MVEBs therein, which were approved by EPA (effective May 15, 2019 (84 FR 15108) for Maryland and Virginia, and effective April 15, 2019 (84 FR 33855) for the District of Columbia,) to establish a revised set of MVEBs. The 2017 plan relied upon the MOVES2014a model to generate onroad estimates and projections since MOVES2014a was the most recent, federally approved model for such applications at the time of the development of that plan. The MOVES2014a estimates were also the basis for the MVEBs contained within the plan. EPA published an updated model called MOVES3 effective January 7, 2021 (86 FR 1106), which became mandatory for use in transportation conformity analyses effective January 10, 2023. Accordingly, the National Capital Region Transportation Planning Board (TPB) is switching over to MOVES3 to develop onroad-source emissions estimates and demonstrate transportation conformity in future years. TPB staff recently conducted a preliminary comparative analysis of MOVES2014b compared to MOVES3.0.4, using the same inputs, and got significantly different results. The analysis~~that~~ showed that NOx emissions estimates generated using MOVES3.0.4 were higher than those generated by MOVES2014b[1] for years 2021, 2023, 2025, 2030, 2040, and 2045 by 1%, 4%, 9%, 26%, 52%, and 54% respectively. The same analysis showed VOC emissions generated using MOVES3.0.4 were lower than those generated by MOVES2014b for years 2021, 2023, 2025, 2030, 2040, and 2045 by 17%, 17%, 18%, 14%, 8%, and 7% respectively.[2] It is worth noting that EPA's own findings related to MOVES3 emissions estimates show that regions such as ours, with congested roads and little truck hoteling activity, could see significant increases in estimated NOx that are based simply on changes in the EPA's MOVES model, without changing any of the modeling inputs.[3] It is clear from the comparative analysis that h~~H~~igher NOx estimates generated by MOVES3.0.4 warrant updates under the requirement in the 2008 maintenance plan SIP that "the MVEBs will be re-evaluated if there… [are] changes to USEPA's emissions estimation model that result in significant changes in emissions inventories or to accommodate transportation planning issues when the Constrained Long-Range Plan horizon year is extended beyond 2040." ~~may pose an issue for TPB in demonstrating conformity with the 2008 ozone NAAQS in its upcoming analyses.~~ Following this finding, TPB requested, and state air agencies of the District, Maryland, and Virginia agreed, to submit revised VOC and NO_X MVEBs for the maintenance area developed using MOVES3.0.4. The use of those updated MVEBs based on MOVES3.0.4 will resolve this issue by providing an "apples to apples" comparison of the MVEBs and the conformity inventories, since the same mobile emissions model will be used both to set budgets and estimate future emissions.

[1] MOVES2014b produces similar emissions estimates as MOVES2014a.
[2] Dusan Vuksan to Metropolitan Washington Air Quality Technical Committee Technical Advisory Committee, "MOVES3 Model Sensitivity Testing" Memorandum, September 12, 2022.
[3] USEPA, "Overview of EPA's MOtor Vehicle Emission Simulator (MOVES3)." (pages 27-28) Assessment and Standards Division Office of Transportation and Air Quality, March 2021.

2. REQUIREMENTS FOR REVISING MAINTENANCE PLANS

EPA's "Policy Guidance on the Use of MOVES3 for State Implementation Plan Development, Transportation Conformity, General Conformity, and Other Purposes," describes requirements for SIP revisions.[4] It states that "if a state revises an existing SIP with MOVES3, it must show that the SIP continues to meet applicable requirements with the new level of motor vehicle emissions calculated by the new model." (pp. 8 - 9). This policy guidance further describes the applicable requirements as follows:

> Use of latest planning assumptions: When SIPs are revised with MOVES3, the motor vehicle emissions inventories for base year, milestone year and attainment/maintenance year will need to be recalculated with the latest available planning assumptions.
> ...
> In addition, states will need to consider and evaluate whether growth and control strategy assumptions for non-motor vehicle sources (i.e., stationary, area, and nonroad mobile sources) are still accurate at the time that the MOVES3 SIP revision is developed to ensure the revised emissions inventories are consistent with the relevant applicable requirement (e.g., RFP, attainment, or maintenance) ... If these assumptions have not changed, the state can explain this and re-submit the original SIP with the revised motor vehicle emissions inventories and budgets to meet the remaining requirements as discussed below. ... Otherwise, the emissions categories in the SIP that have changed should be brought up to date to ensure that the emissions inventory is accurate, current, and consistent with the relevant statutory requirements. ... (pp. 9 -10)

Maintenance demonstration: For maintenance demonstrations,

> Areas may be able to revise their motor vehicle emissions inventories and budgets using MOVES3 without revising the entire SIP or completing additional modeling. This could be the case if:
>
> (1) the SIP meets applicable requirements when the previous motor vehicle emissions inventories are replaced with MOVES3 inventories; and
>
> (2) the state can document that the growth and control strategy assumptions for non-motor vehicle sources continue to be valid and any minor updates do not change the overall conclusions of the SIP. (p. 10)

The policy guidance specifies that if both criteria are met, the state or states can simply re-submit the original maintenance plan with the revised motor vehicle emissions inventories, using MOVES3. However, if either criterion is not met, the emissions categories in the maintenance plan that have changed must be brought up to date.

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[4] Office of Transportation and Air Quality, "Policy Guidance on the Use of MOVES3 for State Implementation Plan Development, Transportation Conformity, General Conformity, and Other Purposes" (Washington, D.C.: U.S. Environmental Protection Agency, November 2020), https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P1010LXH.pdf.

MOVES3.0.4 incorporates new regulations, features, and data. Hence, it produces very different onroad and nonroad emissions outputs compared to MOVES2014a. For this reason, one of the criteria listed above is not met for nonroad model source emissions. Therefore, this SIP revision includes information addressing the recommendations described in the following MOVES3 policy guidance:

- Demonstration that the 2008 ozone NAAQS maintenance plan continues to meet applicable requirements with the revised motor vehicle emissions inventories, as calculated by the most recently approved MOVES3.0.4 model, and recalculation of the interim year and maintenance year MVEBs with the latest planning assumptions, including documentation of the updated assumptions;

- Review of the point, nonpoint (area), and marine, airport, and railroad (MAR) source emissions inventories for the interim year and maintenance year to determine if growth and control strategy assumptions have changed and, if so, development of an analysis to determine if these changes affect the conclusion of the maintenance plan that air quality will remain compliant with the 2008 ozone NAAQS; and

- Assessment to confirm that excess emissions exist and the quantification of these excess emissions for use in the safety margin applied to the MVEBs.

3. REVISIONS TO THE MAINTENANCE DEMONSTRATION

This submittal revises the maintenance demonstration included in the 2017 plan and provides updated estimates of VOCs and NOx for the 2025 and 2030 plan projection years. The maintenance demonstration must show that emissions of VOC and NOx do not increase in future years beyond the actual estimated emissions in the attainment year, in this case 2014. The continued downward trend in projected emissions from within the maintenance area ensures the area will maintain compliance with the 2008 ozone NAAQS. The following sections describe the revisions to the interim year and the outyear inventories, which reflect changes in the onroad and nonroad mobile sectors.

3.1. Reasons for Retaining the Attainment Year 2014 Inventory

As described in detail in Section 3.3 of this document, MOVES3.0.4 nonroad model emissions are much lower compared to MOVES2014a nonroad model emissions for 2025 and 2030. However, as shown in Table 3-6 and 3-7 in that section, even with the estimated lower 2014 MOVES3.0.4 nonroad model emissions, total VOC and NOx emissions from all four sectors (point, nonpoint, nonroad, and onroad) remain higher in 2014 compared to total emissions in 2025 and 2030. Therefore, there is no need to update the 2014 nonroad model emissions.

The emission estimates from all other sectors continue to be valid and need no further updating.

For these reasons, there are no benefits to updating the 2014 attainment year inventories as doing so is resource intensive and does not provide any environmental benefits.

Table 3-1 provides the 2014 attainment year inventory summary from the 2017 plan in units of ozone season tons per day (tpd). The onroad and nonroad model inventories provided in

As described in detail in Section 3.3 of this document, MOVES3.0.4 nonroad model emissions are much lower compared to MOVES2014a nonroad model emissions for 2025 and 2030. However, as shown in Table 3-6 and 3-7 in that section, even with the estimated lower 2014 MOVES3.0.4 nonroad model emissions, total VOC and NOx emissions from all four sectors (point, nonpoint, nonroad, and onroad) remain higher in 2014 compared to total emissions in 2025 and 2030. Therefore, there is no need to update the 2014 nonroad model emissions.

The emission estimates from all other sectors continue to be valid and need no further updating.

For these reasons, there are no benefits to updating the 2014 attainment year inventories as doing so is resource intensive and does not provide any environmental benefits.

Table 3-1 include estimates created using MOVES2014a. MOVES3.0.4 is the latest EPA approved model for generating onroad and nonroad mobile emissions inventories.

As described in Section 1 of this document, the TPB analysis showed that MOVES3.0.4 onroad NOx emissions were only 1% higher compared to MOVES2014b for 2021 while it produced increasingly higher onroad NOx emissions in 2025 and beyond. With this trend in the difference in onroad NOx emissions between the two models, it is quite reasonable to assume that the difference in NOx emissions will be almost negligible in 2014. For this reason, the maintenance area is updating only 2025 and 2030 onroad emissions while retaining the attainment year 2014 onroad emissions developed using MOVES2014a.

As described in detail in Section 3.3 of this document, MOVES3.0.4 nonroad model emissions are much lower compared to MOVES2014a nonroad model emissions for 2025 and 2030. However, as shown in Table 3-6 and 3-7 in that section, even with the estimated lower 2014 MOVES3.0.4 nonroad model emissions, total VOC and NOx emissions from all four sectors (point, nonpoint, nonroad, and onroad) remain higher in 2014 compared to total emissions in 2025 and 2030. Therefore, there is no need to update the 2014 nonroad model emissions.

The emission estimates from all other sectors continue to be valid and need no further updating.

For these reasons, there are no benefits to updating the 2014 attainment year inventories as doing so is resource intensive and does not provide any environmental benefits.

Table 3-1: 2014 Attainment Year Inventory, Emissions in tpd

Geographic Region	Pollutant	Point	Nonpoint	Nonroad	Onroad	Total

The District	VOC	0.45	18.76	2.75	4.87	26.83
The District	NO_X	1.22	0.05	12.39	9.28	22.94
Maryland	VOC	6.51	59.16	24.78	31.20	121.65
Maryland	NO_X	62.18	7.07	25.61	70.87	165.73
Virginia	VOC	1.99	61.38	22.32	25.18	110.87
Virginia	NO_X	15.83	2.50	33.20	56.68	108.20
Washington DC-MD-VA 2008 Ozone NAAQS Maintenance Area	VOC	8.95	139.29	49.85	61.25	259.34
Washington DC-MD-VA 2008 Ozone NAAQS Maintenance Area	NO_X	79.22	9.62	71.20	136.84	296.88

3.2. Retaining the 2025 Interim Year and the 2030 Outyear Projection Inventories for Point and Nonpoint Sources

Review of the information submitted in the 2017 plan shows that revisions to the point and nonpoint source emissions inventories are not necessary. This conclusion is based on analyses of more current emissions inventory data as well as the latest growth rates for economic indicators. The following sections provide more detail on how these conclusions were reached.

3.2.1 Analysis of Point Source Emission Growth and Control Assumptions

Each jurisdiction reviewed their point source emission inventories, growth assumptions, and control assumptions. Each jurisdiction also reviewed emissions inventory data from more current actual inventories. The point source emissions estimates for 2014, 2025, and 2030 do not need updating from the original maintenance plan. These analyses and conclusions are detailed in the sections below.

3.2.1.1. District of Columbia

The District provided point source emissions inventories in units of tpd for the 2017 plan. The point source emissions inventory for the attainment year 2014 for VOC and NOx was based on the 2014 National Emissions Inventory (NEI). This inventory was used as the basis for the projection year inventories of 2025 (the interim year inventory) and 2030 (the outyear/maintenance year inventory) and was assumed not to grow.

Table 3-2 summarizes the 2014, 2025, and 2030 emission estimates for the District's point sources as well as the reported VOC and NO_X emissions for 2020 and 2021 Title V Sources that were submitted as point sources in 2014 and thus included in the 2014 analysis.

Table 3-2: District of Columbia Point Source Inventory

Data Description	NO_X, tpd	VOC, tpd
2014 attainment year emissions	1.22	0.45
2025 projected interim year emissions	1.22	0.45
2030 projected outyear emissions	1.22	0.45
2020 actual reported emissions	1.02	0.24
2021 actual reported emissions	1.03	0.24

The data in Table 3-2 show that the 2020 and 2021 emission estimates are below the 2014 attainment year emission estimates used in the maintenance plan. Additionally, emission projections for 2025 and 2030 are above the actual estimates for 2020 and 2021 and are therefore very likely conservative. Based on these data, the point source inventories for the District used in the 2017 plan were conservative in nature, and updates are not necessary to ensure continued maintenance of the 2008 ozone NAAQS for the District's portion of the plan.

3.2.1.2. Virginia

Virginia provided emission inventory for point sources located in Northern Virginia for the 2017 plan. The attainment year 2014 emissions inventory for VOC and NOx is partially based on the 2014 NEI and partially based on 2014 Community Emissions Data Systems (CEDS) data.

The 2014 inventory was used as the basis for the projection year inventories of 2025 (the interim year inventory) and 2030 (the outyear inventory).

Virginia provided two spreadsheets identifying point source emission estimates in units of tpd and by jurisdiction and by Source Classification Code (SCC). The first spreadsheet, "VA_Point_EGU_BY2014_2025_2030_Average-OS-Tons-Per-Day_08-31-2017_updated.xlsx," provided data for the electric generating units (EGUs) at the only EGU in the Northern Virginia area that operated in 2014, Possum Point Power Station. The ERTAC EGU Tool CONUS2.6 reference case outputs were used to estimate this facility's projected emissions in 2025 and 2030.

The spreadsheet entitled, "VA_NonEGU Growth Files.xlsx (Revised)(No Airports)_08-31-2017_updates.xlsx," includes data for all non-EGU point sources in the Northern Virginia area. For all non-EGU point sources except data centers, Virginia used a "no growth" scenario in the 2017 plan, assuming that future-year point-source emissions would be equivalent to the 2014 emissions estimates. Emissions from data centers in Northern Virginia were grown based on the estimated employment growth rate derived from the Council of Governments (COG) Cooperative Forecasts for each county in which each data center is located.

Table 3-3 summarizes the 2014, 2025, and 2030 emission estimates for point sources found in the above two spreadsheets. This table also provides the reported VOC and NO_X emissions for 2019, 2020, and 2021 for sources required to provide emission statements. The 2021 point source inventory is the latest CEDS data currently available. Ozone season NO_X and VOC emissions must be reported under the emissions statement program as per Virginia regulation, 9 VAC5-20-160B, for sources with a potential to emit of at least 25 tpy of either NO_X or VOC in the Northern Virginia area, and these data are included in Virginia's Comprehensive Environmental Data System.

Table 3-3: Virginia Point Source Inventory

Data Description	NO_X, tpd	VOC, tpd
2014 attainment year emissions	15.83	1.99
2025 projected interim year emissions	11.78	1.90
2030 projected outyear emissions	12.11	1.94

Data Description	NO_X, tpd	VOC, tpd
2019 actual reported emissions	13.00	1.60
2020 actual reported emissions	11.21	1.37
2021 actual reported emissions	7.93	1.29

The data in Table 3-3 show that the 2021 emission estimates are well beneath the attainment year 2014 emission estimates used in the 2017 plan. Additionally, emission projections for 2025 and 2030 are above the actual estimates for 2021 and are therefore very likely conservative. Lastly, the data in Table 3-3 show that there is generally a downward trend in actual emissions estimates from 2014, 2019, 2020, and 2021. Based on these data, the point source inventories used in the 2017 plan were conservative in nature, and updates are not necessary to ensure continued maintenance of the 2008 ozone NAAQS for the Northern Virginia portion of the plan.

3.2.1.3. Maryland

Maryland provided point source emissions for the Maryland jurisdictions located in the maintenance area. The attainment year 2014 emissions inventory is based on the 2014 NEI and partially based on the 2014 Clean Air Markets Division (CAMD) data. The 2014 inventory was used as the basis for the projection year inventories of 2025 (the interim year inventory) and 2030 (the outyear inventory).

Note that only the total emissions from all source sectors are used to demonstrate how the area will remain in compliance with the 2008 ozone NAAQS.

Table 3-4 summarizes the attainment year 2014 point source emissions and corresponding 2025 and 2030 future year emission estimates from the maintenance plan.

For all point sources, Maryland used a "no negative growth" scenario in the 2017 plan, assuming that future-year point-source emissions would be equivalent to the 2014 emissions estimates, at worst. Emissions from EGU point sources were grown based on the Annual Energy Outlook electricity projections. Emissions from non-EGU point sources were grown based on Maryland Department of Labor, Licensing and Regulation industry projections.

Table 3-4: Maryland Point Source Inventory, tpd

Data Description	NO_X, tpd	VOC, tpd
2014 Attainment year emissions	47.81	5.27
2025 Projected interim year emissions	53.04	6.48
2030 Projected outyear emissions	55.18	7.02
2017 Actual reported emissions	49.72	2.52
2020 Actual reported emissions	48.18	2.71

Table 3-4 provides the total actual reported VOC and NO_X emissions for 2017 and 2020 for point sources located in the Maryland portion of the maintenance area.

The key element of a maintenance plan is a demonstration of how the area will remain in compliance with the 8-hour ozone NAAQS for the 10-year period following the effective date of designation. The typical method that areas have used in the past to demonstrate that an area will maintain the standard is to identify the level of ozone precursor emissions in the area which is sufficient to attain the NAAQS (attainment year 2014 inventory) and to show that future emissions of ozone precursors will not exceed the attainment levels. The comparison of emissions inventories includes ozone precursors from all source categories, not only point sources.

The data in Table 3-4 show that the 2017 and 2020 actual emission estimates are well beneath the 2025 and 2030 projected future year emission estimates used in the maintenance plan. Therefore, when comparing the actual point source emissions to the grown future year point source emissions that demonstrate maintenance of the standard, the actual point source emissions provide a buffer for other source categories such as onroad mobile, nonroad mobile and nonpoint emissions sources. Based on these data, the point source inventories for Maryland used in the 2017 plan were conservative in nature, and updates are not necessary to ensure continued maintenance of the 2008 ozone NAAQS.

3.2.2 Analysis of Nonpoint & MAR Source Emission Growth and Control Assumptions

Growth factors used to project nonpoint and MAR emissions from 2014 to 2025 and 2030 in the 2017 plan were compared with current estimates. Table 3-5 shows relatively minor changes to those growth factors. The new set of growth factors are based on latest estimates from COG's Cooperative Forecasts Round 9.2 and the Constrained Element of the Long-Range Transportation Plan (CE LRTP). The CE LRTP, which was updated in both 2020 and 2022, is also known as Visualize 2045, and is the source for vehicle miles traveled (VMT) estimates and lane-miles estimates.

Table 3-5: Comparison of Growth Factors – Initial Maintenance Plan Vs Current Estimates

Growth Factor Description	Initial Maintenance Plan Factor	Current Factor	Current Factor Source
Employment (2025/2014)	1.14	1.14	COG Cooperative Forecasts 9.2 (Final)
Employment (2030/2014)	1.21	1.21	COG Cooperative Forecasts 9.2 (Final)
Population (2025/2014)	1.12	1.13	COG Cooperative Forecasts 9.2 (Final)
Population (2030/2014)	1.17	1.18	COG Cooperative Forecasts 9.2 (Final)
Household (2025/2014)	1.14	1.13	COG Cooperative Forecasts 9.2 (Final)
Household (2030/2014)	1.19	1.20	COG Cooperative Forecasts 9.2 (Final)
VMT (2025/2014)	1.12	1.12	2020 & 2022 Amendments to Visualize 2045 (CLRP)
VMT (2030/2014)	1.17	1.16	2020 & 2022 Amendments to Visualize 2045 (CLRP)
Lane-Miles (2025/2014)	1.06	1.04	2020 & 2022 Amendments to Visualize 2045 (CLRP)
Lane-Miles (2030/2014)	1.06	1.06	2020 & 2022 Amendments to Visualize 2045 (CLRP)

As seen in Table 3-5, only population growth factors for 2025 and 2030 and the household growth factor for 2030 increased, and only by about 1% based on the latest estimates. The remaining growth factors, such as those for employment, households (for 2025), and VMT or lane-miles, either remain at the same level or decrease between 1% to 2%. Though emission sources using population growth factors contribute about 60% and 26% of total VOC and NOx emissions, respectively, in the initial maintenance plan, a 1% increase in population growth factors, together with some amount of decrease in other growth factors, should ensure that the overall change in

nonpoint and MAR source emissions in 2025 and 2030 would be relatively insignificant. Therefore, the growth and control strategy assumptions for those sources described in the 2017 plan are generally still valid, and any slight change in emissions in future years will not materially change the overall conclusion of the 2017 plan.

The above analysis demonstrates that the emission estimates and projections from nonpoint and MAR sources in the 2017 plan continue to be valid and continue to demonstrate that the area's air quality will remain compliant with the 2008 ozone NAAQS.

3.3. Revisions to the 2025 Interim Year and the 2030 Outyear Projection Inventories for Onroad and Nonroad Mobile Model Sources

Emissions for onroad and nonroad (except for MAR) mobile sources for 2014, 2025 and 2030 were developed using the MOVES2014a model in the 2017 plan. EPA recently released its latest MOVES3.0.4 model, which allows users to model the benefits from new regulations promulgated since MOVES2014a was released and incorporates the latest emissions data. As a result, MOVES3.0.4 is expected to generate different nonroad and onroad mobile emissions estimates than MOVES2014a. For this reason, the maintenance area is updating its 2025 and 2030 onroad and nonroad (except for MAR) mobile emissions in this revised plan using the MOVES3.0.4 model.

As described in Section 3.1, the maintenance area is updating only 2025 and 2030 onroad and nonroad (except for MAR) mobile emissions while retaining the attainment year 2014 onroad and nonroad mobile emissions developed using MOVES2014a.

Appendix C1 provides details of the development of MOVES3.0.4 nonroad mobile (except for MAR sources) emissions inventories for 2025 and 2030. Appendix C2 provides details of the MOVES3.0.4 nonroad mobile runspec, input, and output (by SCC) files for 2025 and 2030.

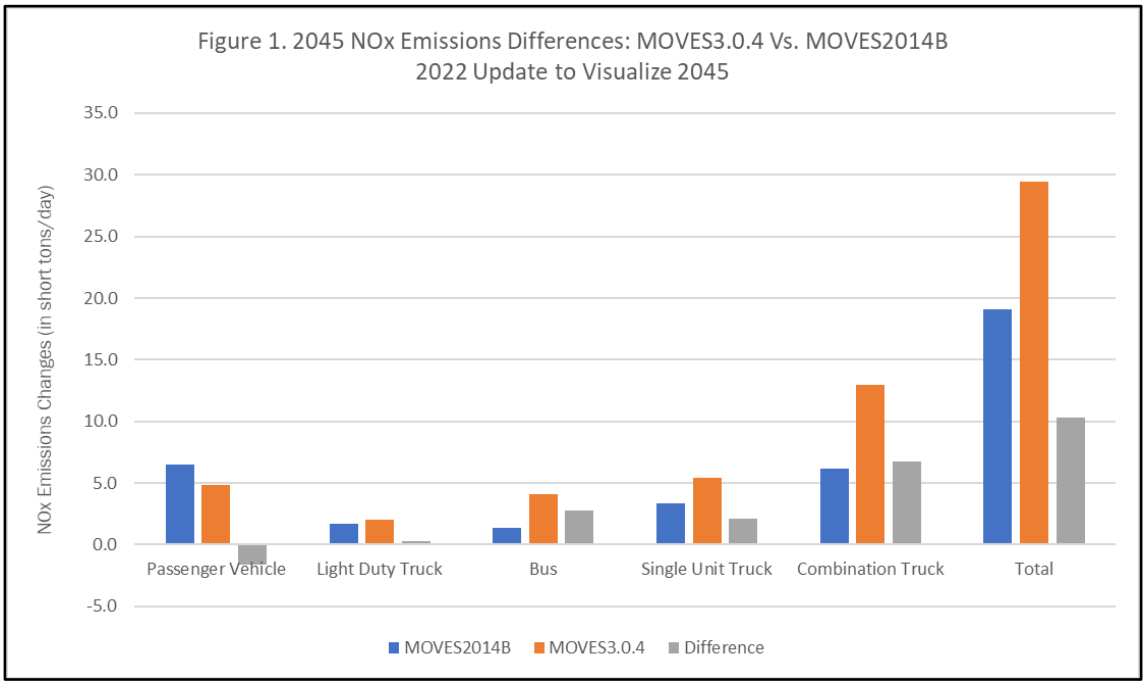
Appendix D1 provides details of the development of MOVES3.0.4 onroad mobile emissions inventories for 2025 and 2030. Appendix D2 provides details of MOVES3.0.4 onroad mobile runspec, input, and output (by SCC) files for 2025 and 2030.

The four appendices of this revised plan mentioned above will replace the 2025 and 2030 nonroad and onroad mobile model emissions inventories and runspec, auxiliary inputs, and input and output files provided in corresponding appendices of the 2017 plan.

The MOVES3.0.4 model contains nonroad equipment population growth rates and diesel Tier 4 emission rates that have been updated since MOVES2014a. A comparison of nonroad model emissions generated using MOVES2014a for the 2017 plan and MOVES3.0.4 for this revision, presented in Table 3-6 and Table 3-7, shows that the difference in emissions between the two models increases with time. While differences for VOC and NOx emissions were 16.3% and 35.1% respectively in 2025, the comparable values increased to 20.2% and 39.0% respectively in 2030. Therefore, the difference in emissions in 2014 will likely be lower or at least be the same as in 2025. Assuming MOVES3.0.4 based VOC and NOx emissions are lower by 16.3% and 35.1% respectively in 2014 compared to MOVES2014a-based emissions in 2014, the revised total emissions from all four sectors in 2014 still turn out to be higher compared to the revised total

emissions in 2025 and 2030, which is one of the most important criteria for approval of a maintenance plan. For this reason, updating the 2014 nonroad model emissions using MOVES3.0.4 is unnecessary.

Figure 3-1: 2045 NOx Emissions Differences by Vehicle Type: MOVES3.0.4 Vs MOVES2014b



Based on the onroad mobile emissions trend in this plan revision document and the most recent air quality conformity analysis for the maintenance area, onroad mobile source emissions are decreasing due to the implementation of the National Low Emission Vehicle Program (NLEV), the Heavy-Duty Engine and Vehicle Standards (HDDV), Tier 3, and Safer Affordable Fuel Efficient (SAFE) Vehicles and Corporate Average Fuel Economy (CAFE) rules, Stage II, and Maryland's LEV/ZEV programs. These emission reductions occur even as vehicle miles traveled (VMT) estimates continue to grow.

Table 3-6 and Table 3-7 below show emissions inventories for 2014, 2025, and 2030 in 2017 and revised maintenance plans. The total inventories from all sources together for 2014 are higher compared to the total inventories for 2025 and 2030 in this revised maintenance plan.

Table 3-6: VOC Emissions Inventories – Initial and Revised Maintenance Plan – Washington DC-MD-VA 2008 Ozone NAAQS Maintenance Area

Year	Point	Nonpoint	MAR	Nonroad Model (MOVES 2014a)	Nonroad Model (MOVES 3.0.4)	Onroad (MOVES 2014a)	Onroad (MOVES 3.0.4)	Total (Initial Maintenance Plan)	Total (Revised Maintenance Plan)
2014	8.95	139.29	2.37	47.48	39.72[a]	61.25	61.25[b]	259.34	251.58
2025	10.08	153.70	2.55	44.88	37.55	33.18	27.92	244.39	231.80

Year	Point	Nonpoint	MAR	Nonroad Model (MOVES 2014a)	Nonroad Model (MOVES 3.0.4)	Onroad (MOVES 2014a)	Onroad (MOVES 3.0.4)	Total (Initial Maintenance Plan)	Total (Revised Maintenance Plan)
Δ (2014–2025)	-1.13	-14.41	-0.18	2.60	2.17	28.07	33.33	14.95	19.78
2030	10.66	160.31	2.64	47.15	37.61	24.06	21.75	244.81	232.97
Δ (2014–2030)	-1.71	-21.01	-0.27	0.33	2.11	37.19	39.50	14.53	18.61

Table 3-7: NOx Emissions Inventories – Initial and Revised Maintenance Plan – Washington DC-MD-VA 2008 Ozone NAAQS Maintenance Area

Year	Point	Nonpoint	MAR	Nonroad Model (MOVES 2014a)	Nonroad Model (MOVES 3.0.4)	Onroad (MOVES 2014a)	Onroad (MOVES 3.0.4)	Total (Initial Maintenance Plan)	Total (Revised Maintenance Plan)
2014	79.22	9.62	19.21	51.99	33.74[a]	136.84	136.84[b]	296.88	278.63
2025	80.40	9.85	21.41	29.62	19.23	40.68	46.52	181.96	177.41
Δ 2014–2025)	-1.18	-0.23	-2.19	22.36	14.51	96.16	90.32	114.92	101.22
2030	82.87	9.96	22.36	27.80	16.94	27.39	34.26	170.38	166.39
Δ 2014–2030)	-3.65	-0.34	-3.14	24.19	16.80	109.45	102.58	126.51	112.24

Notes: MOVES3.0.4 based VOC and NOx emissions for 2014 were estimated in Table 3-6 and Table 3-7 for the revised maintenance plan for the purpose of demonstrating that those emissions are higher compared to the ones in 2025 and 2030.

[a] MOVES3.0.4 nonroad model emissions for 2014 were derived by reducing MOVES2014a nonroad model emissions for VOC and NOx in the 2017 plan by 16.3% and 35.1% respectively in that year.

[b] TPB's preliminary analysis showed that while NOx emission generated by both models are expected to be essentially the same for 2014, VOC emission is expected to be much lower for MOVES3.0.4 compared to MOVES2014b in that year. However, taking a conservative approach, both VOC and NOx emissions generated by MOVES3.0.4 are assumed to be the same as MOVES2014a for 2014.

3.4. Revisions to the 2025 Interim Year and the 2030 Outyear Motor Vehicle Emissions Budgets and Safety Margins

Error! Reference source not found. This submittal revises the 2025 and 2030 MVEBs using MOVES3.0.4 and updated planning assumptions. These MVEBs are used to ensure that transportation emissions conform with each state's SIP.

The revised MVEBs are presented in Table 3-8 for 2025 and 2030 along with the 2014 MVEB from the 2017 plan. The MVEBs were developed for 2014 based on the attainment year 2014 onroad mobile emissions in the 2017 plan. The MVEBs were developed for 2025 and 2030 by adding safety margins to the projected onroad mobile VOC and NOx emissions for those years. A safety margin is the amount of emission by which the total projected emission from all sources of a given pollutant is less than the total emission that would satisfy the applicable requirement for reasonable further progress, attainment, or maintenance (40 CFR 93.101). Projected onroad mobile emissions were developed using EPA's most current MOVES3.0.4 model as well as the current regional travel demand forecasting model (Gen2/Ver. 2.4).

The 2017 plan demonstrated that the region attained the 2008 NAAQS and could therefore emit up to the attainment year 2014 emission level. Table 3-8 shows the differences in total emissions for VOC and NOx from all sources between the attainment year 2014 and the intermediate year 2025 and the attainment year 2014 and the final maintenance year 2030. These differences in emissions provide estimates of the total available safety margins for VOC for 2025 (27.7 tpd) and 2030 (44.9 tpd) and for NOx for 2025 (101.1 tpd) and 2030 (130.4 tpd). All or a portion of these safety margins can be allotted to onroad mobile source inventories to develop MVEBs. As discussed below, only portions of the total available safety margins for VOC and NOx were used to develop the revised MVEBs for 2025 and 2030 in this revision of 2017 plan.

The MVEBs provided in Table 3-8 have been developed by adding a 20% safety margin to the onroad mobile emissions inventory projections for VOC and NOx in 2025 and 2030. The buffers will add 5.6 tpd of VOC and 9.3 tpd of NOx to the 2025 emission inventories, and 4.4 tpd of VOC and 6.9 tpd of NOx to the 2030 emission inventories. These MVEBs, even with these safety margins, remain below the attainment year 2014 levels needed to maintain compliance with the 2008 ozone NAAQS (See Table 3-9).

The District, Maryland, and Virginia developed the previous and revised MVEBs in consultation with TPB, which is responsible for transportation planning in the maintenance area.

The MVEBs will be re-evaluated if there is a roll-back of federal emissions control programs and/or changes to EPA's emissions estimation model that result in significant increases in emissions projections or to accommodate transportation planning issues when the Long-Range Transportation Plan horizon year is extended beyond 2040.

Table 3-8: Revised Onroad Motor Vehicle Emissions Budgets based on MOVES3.0.4

Year	VOC Onroad Emissions (tpd)	NO_X Onroad Emissions (tpd)
2014 Attainment Year	**61.25**	**136.84**
2025 Predicted Emissions without Safety Margin	27.92	46.52
2025 Safety Margin	5.58	9.30
2025 Interim Budget with Safety Margin	**33.50**	**55.82**
2030 Predicted Emissions without Safety Margin	21.75	34.26
2030 Safety Margin	4.35	6.85
2030 Final Budget with Safety Margin	**26.10**	**41.11**

Table 3-9: Washington DC-MD-VA Revised Maintenance Plan VOC Emissions, 2014 to 2030, Including MVEBs with Safety Margins (tpd)

Source Category	2014 w/o safety margins	2014 with safety margins	2025 w/o safety margins	2025 with safety margins	2030 w/o safety margins	2030 with safety margins
Point	7.71	7.71	8.83	8.83	9.41	9.41
Nonpoint	139.29	139.29	153.70	153.70	160.31	160.31
MAR	2.37	2.37	2.55	2.55	2.64	2.64
Nonroad	47.48	47.48	37.55	37.55	37.61	37.61
On-road/MVEBs	61.25	61.25	27.92	33.50	21.75	26.10
Quasi-Point	1.24	1.24	1.24	1.24	1.24	1.24
Total	259.34	259.34	231.80	237.37	232.97	237.31
Change from 2014	n/a	n/a	27.54	21.97	26.37	22.03

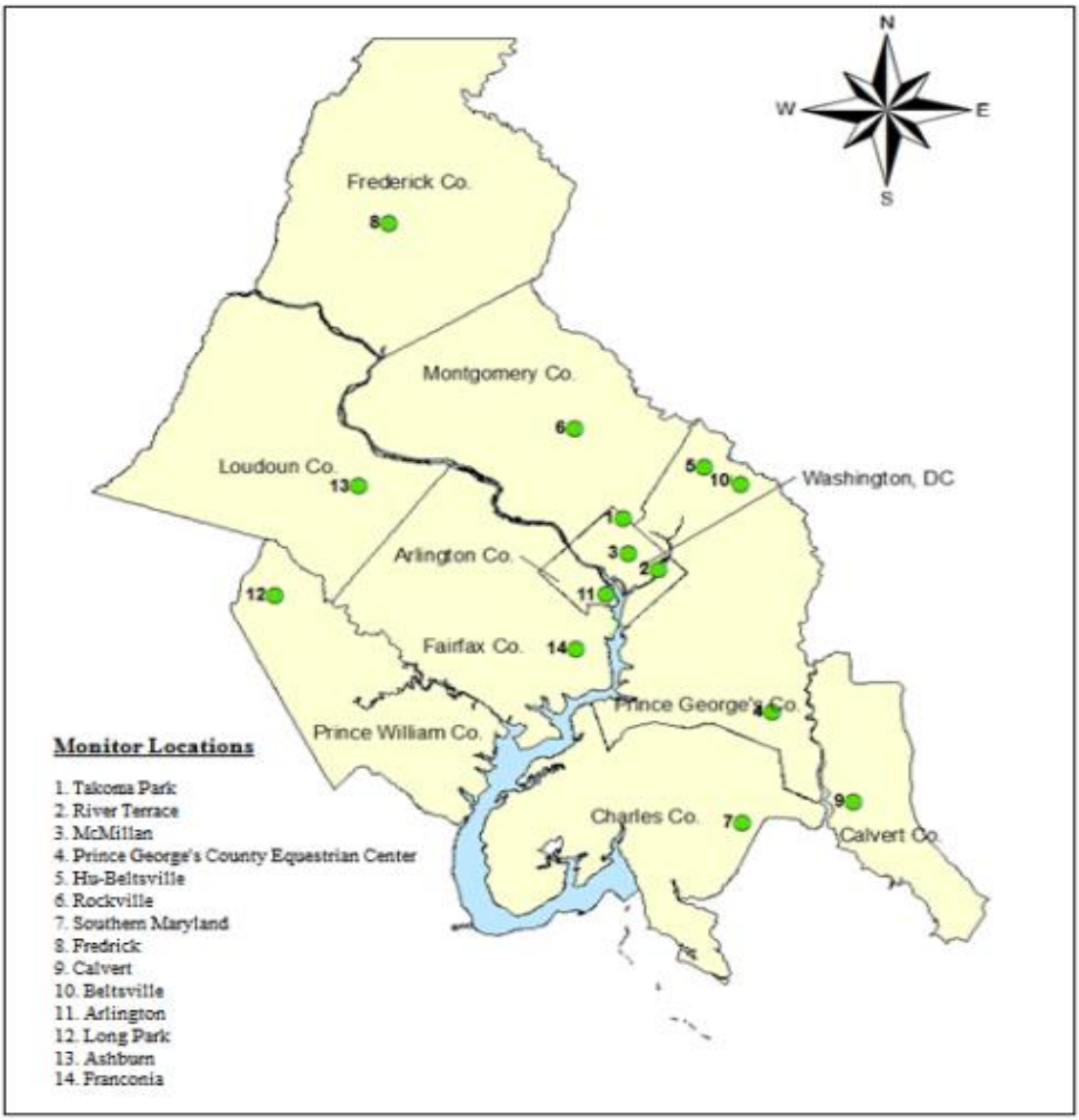
Table 3-10: Washington DC-MD-VA Revised Maintenance Plan NOx Emissions, 2014 to 2030, Including MVEBs with Safety Margins (tpd)

Source Category	2014 w/o safety margins	2014 with safety margins	2025 w/o safety margins	2025 with safety margins	2030 w/o safety margins	2030 with safety margins
Point	64.85	64.85	66.03	66.03	68.50	68.50
Nonpoint	9.62	9.62	9.85	9.85	9.96	9.96
MAR	19.21	19.21	21.41	21.41	22.36	22.36
Nonroad	51.99	51.99	19.23	19.23	16.94	16.94
On-road/MVEBs	136.84	136.84	46.52	55.82	34.26	41.11
Quasi-Point	14.37	14.37	14.37	14.37	14.37	14.37
Total	296.88	296.88	177.41	186.71	166.40	173.24
Change from 2014	n/a	n/a	119.47	110.17	130.48	123.64

3.5. Trends in Air Quality and Emissions Inventories

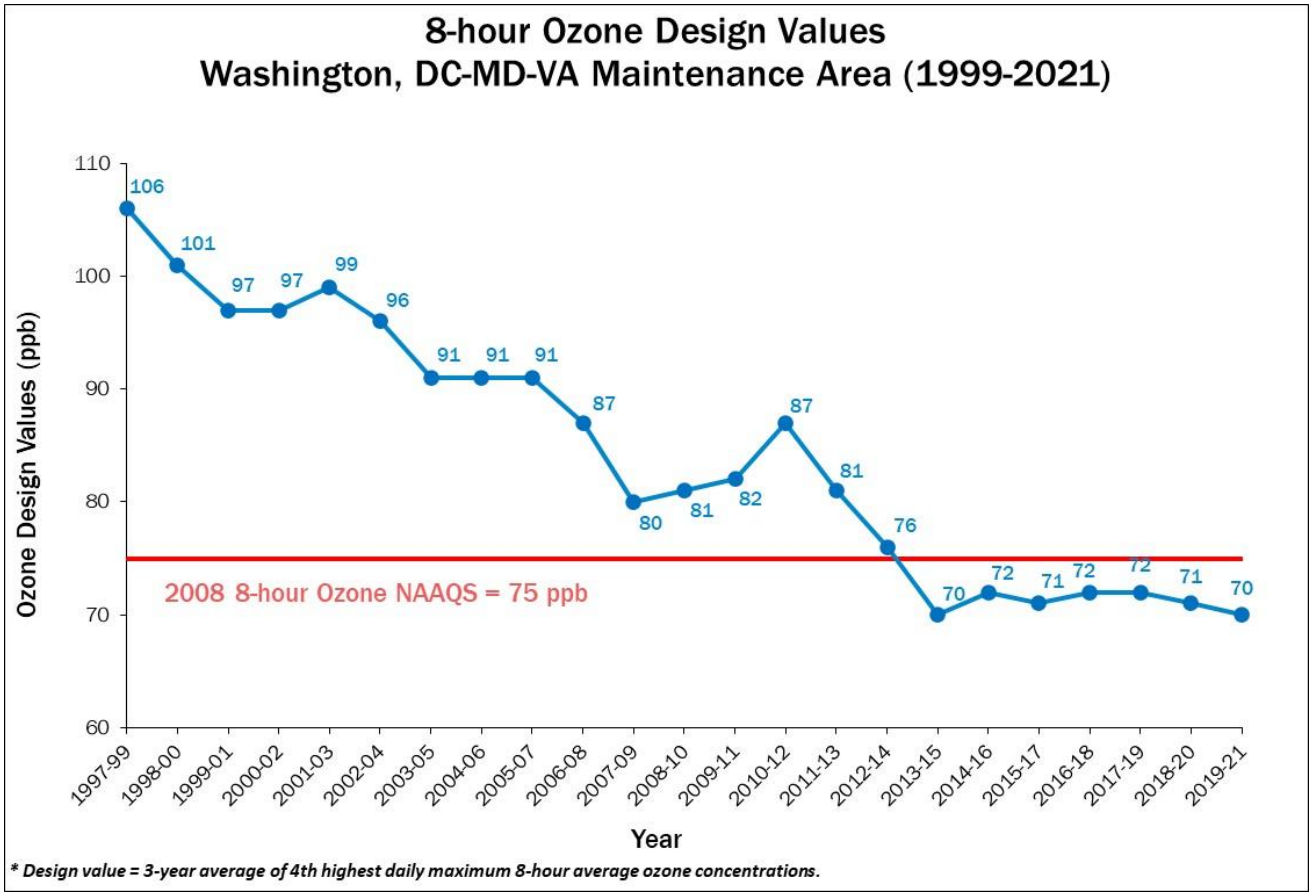
The Washington DC-MD-VA region has been attaining the 2008 ozone NAAQS since 2015, and ozone levels have been continually decreasing over the years. Figure 3-2 shows the ozone monitors currently operating in the maintenance area.

Figure 3-2: Washington DC-MD-VA 2008 Ozone NAAQS Maintenance Area Monitoring Sites



The trends in the ozone design values in Figure 3-3 reflect the effect of the declining emissions trends on ozone levels in the region and further demonstrate that the maintenance area will continue to comply with the 2008 ozone NAAQS in the future.

Figure 3-3: Ozone Design Value Trend



Tables 3-11 through 3-13 show the breakdown of VOC and NOx emissions by jurisdiction and sector for all three milestone years of the revised plan. Emissions of both ozone precursors have been declining from 2014 through 2025 and 2030 resulting in lowering of ozone levels through those years.

Table 3-11: 2014 Attainment Year Inventory (tpd)

Sector	District VOC	District NO_X	Maryland VOC	Maryland NO_X	Virginia VOC	Virginia NOx	Metro DC VOC	Metro DC NO_X
EGU	0.00	0.00	1.39	38.37	0.31	9.88	1.70	48.25
NonEGU	0.45	1.22	3.88	9.44	1.68	5.95	6.01	16.37
Quasi-Point	0.00	0.00	1.24	14.37	0.00	0.00	1.24	14.37
Point-Total	0.45	1.22	6.51	62.18	1.99	15.83	8.95	79.22
Nonpoint	18.76	0.05	59.16	7.07	61.38	2.50	139.29	9.62
MAR	0.36	5.56	0.52	3.76	1.49	9.89	2.37	19.21
Nonroad	2.39	6.83	24.26	21.85	20.83	23.30	47.48	51.99
Nonroad total	2.75	12.39	24.78	25.61	22.32	33.20	49.85	71.20
Onroad	4.87	9.28	31.20	70.87	25.18	56.68	61.25	136.84
Total	26.83	22.94	121.65	165.73	110.87	108.20	259.34	296.88

Table 3-12: 2025 Intermediate Year Inventory (tpd)

Sector	District VOC	District NO_X	Maryland VOC	Maryland NO_X	Virginia VOC	Virginia NOx	Metro DC VOC	Metro DC NO_X
EGU	0.00	0.00	1.55	42.68	0.21	5.82	1.76	48.50
NonEGU	0.45	1.22	4.93	10.36	1.69	5.96	7.08	17.53
Quasi-Point	0.00	0.00	1.24	14.37	0.00	0.00	1.24	14.37
Point-Total	0.45	1.22	7.73	67.41	1.90	11.78	10.08	80.40
Nonpoint	21.96	0.06	63.54	7.28	68.20	2.52	153.70	9.85
MAR	0.41	6.31	0.54	4.17	1.60	10.92	2.55	21.41
Nonroad	1.29	1.15	17.78	7.94	18.47	10.14	37.55	19.23
Nonroad total	1.70	7.46	18.32	12.11	20.07	21.06	40.09	40.63
Onroad	2.37	2.78	12.85	21.95	12.70	21.79	27.92	46.52
Total	26.48	11.52	102.44	108.75	102.88	57.15	231.80	177.41

Table 3-13: 2030 Outyear Inventory (tpd)

Sector	District VOC	District NO_X	Maryland VOC	Maryland NO_X	Virginia VOC	Virginia NOx	Metro DC VOC	Metro DC NO_X
EGU	0.00	0.00	1.61	44.40	0.23	6.13	1.84	50.53
NonEGU	0.45	1.22	5.41	10.77	1.71	5.98	7.57	17.97
Quasi-Point	0.00	0.00	1.24	14.37	0.00	0.00	1.24	14.37
Point-Total	0.45	1.22	8.27	69.55	1.94	12.11	10.66	82.87
Nonpoint	23.35	0.06	65.79	7.38	71.17	2.52	160.31	9.96
MAR	0.43	6.61	0.56	4.34	1.66	11.41	2.64	22.36
Nonroad	1.29	1.03	18.07	7.33	18.26	8.58	37.61	16.94
Nonroad total	1.72	7.64	18.62	11.67	19.91	19.98	40.25	39.30
Onroad	1.93	1.91	9.90	15.56	9.91	16.79	21.75	34.26
Total	27.45	10.83	102.59	104.16	102.93	51.41	232.97	166.40

4. CONCLUSION

Based on the analysis of emissions for 2014, 2025 and 2030, estimated emissions in the interim year 2025 and the outyear or maintenance year 2030 are less than the attainment year 2014 emissions in the revised maintenance plan. Therefore, the maintenance area has demonstrated successfully that it will continue to maintain the 2008 ozone NAAQS, even after updating the onroad emissions estimates using the new EPA-approved MOVES3.0.4 model. Updating VOC and NOx MVEBs will not negatively affect the area's ability to maintain the 2008 ozone NAAQS.

In this maintenance plan SIP revision, the maintenance area has updated emissions of VOC and NOx that were included in the 2017 plan for nonroad model and onroad mobile sources. Additionally, the maintenance area compared updated growth factors for nonpoint and MAR sources with those that were included in the 2017 plan. This comparison shows that the change in overall growth was relatively insignificant and that the inventories for the two sources did not need to be revised. Emissions of point sources were not updated because growth in emissions for those sources decreased or were unaffected.

The District, Maryland, and Virginia request that EPA approve these SIP revisions to the 2017 plan for the maintenance area. These revisions establish updated MVEBs using the latest federally approved onroad source emissions estimation model, MOVES3.0.4. Future transportation conformity determinations will apply these revised MVEBs once they are deemed adequate by EPA.