State Implementation Plan Revision: Motor Vehicle Emission Budget Revisions Based on the MOVES3.0.4 Model

Washington DC-MD-VA 2008 Ozone NAAQS Maintenance Plan

Prepared by:
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for the
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Maryland Department of the Environment
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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 District"), the State of Maryland ("Maryland"), and the Commonwealth of Virginia ("Virginia") request that the United States Environmental Protection Agency (EPA) approve revisions to the 2008 ozone national ambient air quality standard (NAAQS) maintenance plan ("maintenance plan") for the Washington DC-MD-VA 2008 Ozone NAAQS Maintenance Area ("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 USEPA approved MOVES3.0.4 model.

The three jurisdictions are revising the initial ozone maintenance plan and MVEBs therein, which was approved by EPA (effective May 15, 2019 [84 FR 15108] for Maryland and Virginia and effective April 15, 2029 [84 FR 33855) for the District of Columbia) to establish a revised set of MVEBs. The initial maintenance plan relied upon the MOVES2014a model to generate onroad estimates and projections since that 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 a new model called MOVES3 effective January 7, 2021, 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, which showed that NOx emissions estimates generated using MOVES3.0.4 were higher than those generated by MOVES2014b[1] for model 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 model years 2021, 2023, 2025, 2030, 2040, and 2045 by 17%, 17%, 18%, 14%, 8%, and 7% respectively.[2] Higher NOx estimates generated by MOVES3.0.4 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.

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.[3] 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

[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] 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.

calculated by the new model." (pp. 8 - 9). The above document 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.

MOVES3.0.4 incorporates new regulations, features and data, and, 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 MOVES3 policy guidance, listed here:

- 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 initial maintenance plan and provides updated estimates of volatile organic compounds (VOCs) and nitrogen oxides (NOx) for the 2014 attainment year and 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 ozone maintenance area ensures the area will maintain compliance with the 2008 ozone NAAQS. The following sections describe the revisions to the attainment year, the interim year, and the outyear inventories, which reflect changes to the onroad and nonroad mobile sectors.

3.1. Reasons for Retaining Attainment Year 2014 Inventory

Table 3-1 provides the 2014 attainment year inventory summary from the initial maintenance plan. The onroad and nonroad model inventories provided in 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. However, there are no benefits to updating those inventories as doing so is not only resource intensive and doesn't serve any environmental benefits, but also the primary purpose of updating the maintenance plan is to update MVEBs for 2025 and 2030 to allow successful demonstrations of conformity in those two milestone years and beyond. The emission estimates from all other sectors continue to be valid and need no further updating.

Table 3-1: 2014 Attainment Year Inventory

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

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

Analysis of Point Source Emission Growth and Control Assumptions

District of Columbia

In the December 20, 2017 maintenance plan, the District provided point source emissions in ozone season tons per day (OStpd) for the initial maintenance plan. The District's 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 portion of the region's point sources as well as the reported VOC and NO_X from the 2020 and 2021 emissions inventories for the District's 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, OStpd	VOC, OStpd
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 well beneath 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 maintenance 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.

Virginia

In the December 20, 2017 maintenance plan, Virginia provided point source emissions for the initial maintenance plan for the Northern Virginia portion of the maintenance area. For the Northern Virginia point source sector, 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 Northern Virginia point source inventory was used as the basis for the projection year inventories of 2025 (the interim year inventory) and 2030 (the outyear inventory) included in the totals for the maintenance area in the table above.

Virginia provided two spreadsheets identifying Northern Virginia point source emission estimates in units of OStpd 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 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 2008 ozone NAAQs maintenance 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 COG Cooperative Forecasts for the county in which the data center is located.

Table 3-3 summarizes the 2014, 2025, and 2030 emission estimates from Northern Virginia point sources found in the two spreadsheets. This table also provides the reported VOC and NO_X from the 2019, 2020, and 2021 emissions inventory for sources required to provide emission statements in the Northern Virginia portion of the maintenance area. 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 law, 9 VAC5-20-160(B), 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 CEDS.

Table 3-3: Virginia Point Source Inventory

Data Description	NO_X, OStpd	VOC, Ostpd
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
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 maintenance 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 the table above 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 for Northern Virginia used in the initial maintenance 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.

Maryland

In the December 20, 2017 maintenance plan, 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 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) included in the totals for the maintenance area in the above table.

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 standard.

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 initial maintenance 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 (AEO) electricity projections. Emissions from non-EGU point sources were grown based on Maryland Department of Labor, Licensing & Regulation (MD DLLR) industry projections.

Table 3-4: Maryland Point Source Inventory

Source Category	NO_X (OStpd)			VOC (OStpd)		
	2014	2025	2030	2014	2025	2030
MD Point Source Emissions	47.81	53.04	55.18	5.27	6.48	7.02
2017 Actual Emissions	49.72			2.52		
2020 Actual Emissions	48.18			2.71		

Table 3-4 provides the total actual reported VOC and NO_X emissions from the 2017 and 2020 emissions inventory for point sources 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 standard 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 initial maintenance plan were conservative in nature, and updates are not necessary to ensure continued maintenance of the 2008 ozone NAAQS.

Conclusion

Based on the above analyses of point sources located in the District, Virginia, and Maryland, it is clear that growth and control strategy assumptions for those sources described in the initial maintenance plan are still valid. Therefore, there is no need to update projected 2025 and 2030 emissions from those sources in the plan.

Analysis of Nonpoint & Marine, Airport, and Railroad (MAR) Source Emission Growth and Control Assumptions

Growth factors used to project nonpoint and MAR emissions from 2014 to 2025 and 2030 in the initial maintenance plan were compared with current estimates. The table below 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 LRTP, which was updated in both 2020 and 2022, is also known as Visualize 2045.

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

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

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 Vehicle Miles Travelled (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 initial maintenance plan are generally still valid, and any slight change in emissions in future years will not materially change the overall conclusion of the initial maintenance plan.

Conclusion

The above analysis demonstrates that the emission estimates and projections from nonpoint and MAR sources in the initial maintenance 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 Nonroad Model and Onroad Mobile Sources

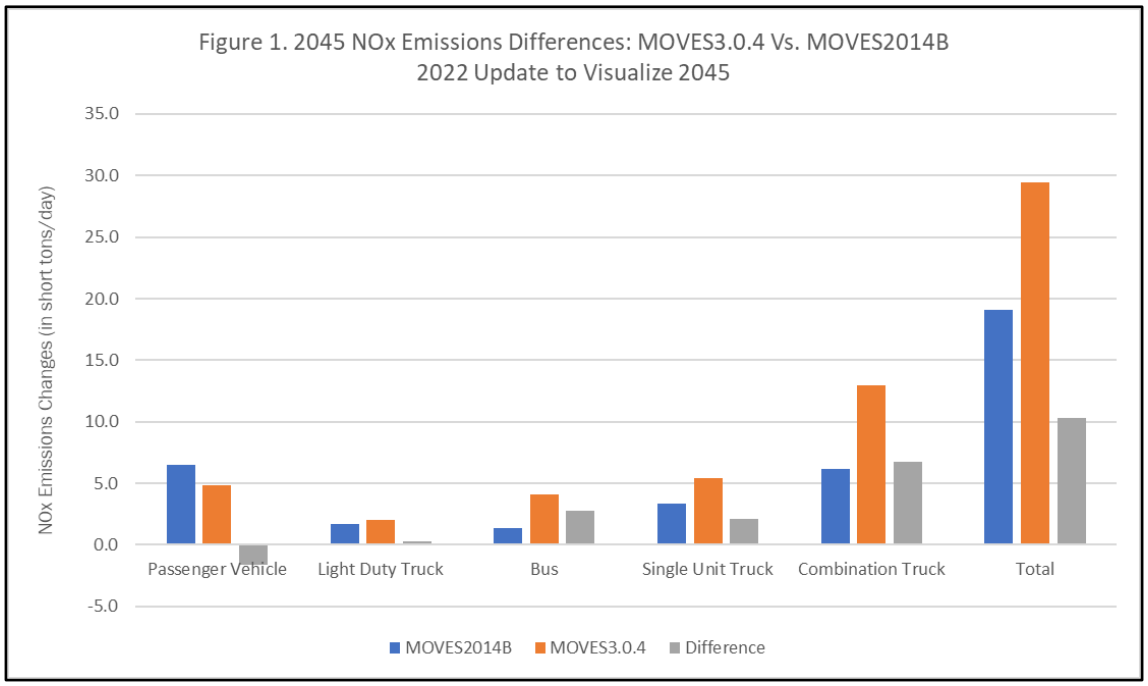
Emissions for nonroad (except for MAR) and onroad mobile sources for 2014, 2025 and 2030 were developed using the MOVES2014a model in the initial (2017) maintenance plan. EPA recently published its latest MOVES3.0.4 model, which allows users to model the benefits from new regulations promulgated since 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 Washington region is updating its 2025 and 2030 nonroad model and onroad mobile emissions in this revised plan using the MOVES3.0.4 model.

Appendix C1 provides details of the development of MOVES3.0.4 nonroad mobile (except for marine, airport, and railroad sources) emissions inventories for 2014, 2025, and 2030. Appendix C2 provides details of the MOVES3.0.4 nonroad mobile runspec, input, and output (by SCC) files for 2014, 2025, and 2030.

Appendix D1 provides details of the development of MOVES3.0.4 onroad mobile emissions inventories for 2014, 2025, and 2030. Appendix D2 provides details of MOVES3.0.4 onroad mobile runspec, input, and output (by SCC) files for 2014, 2025, and 2030.

As mentioned above in Section 1 of this document, estimated onroad NOx emissions increased significantly when using MOVES3 compared to MOVES2014. Upon release of the MOVES3 model, EPA provided model documentation[4] noting that congested urban areas, especially those with little truck hoteling, could see NOx increases with the use of MOVES3. Although each of the EPA model updates cannot be tested in isolation due to the nature of the MOVES model, this increase in NOx emissions estimates is largely driven by the changes in truck emissions in the model, as can be seen in Figure 3-1, below. These increases are well in line with some of the possible outcomes that the EPA documented related to urban areas with congested roads and little hoteling activity.

Figure 3-1: 2045 NOx Emissions Differences by Vehicle Type: MOVES3.0.4 Vs MOVES2014B



[4] USEPA, "Overview of EPA's MOtor Vehicle Emission Simulator (MOVES3)." Assessment and Standards Division Office of Transportation and Air Quality, March 2021.

The analysis by TPB staff showed that MOVES3.0.4 produced increasingly higher onroad NOx emission between 2021 and 2045 compared to MOVES2014b. The difference was particularly significant for 2025 and beyond while it was relatively insignificant in 2021. With this trend in the difference in 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.

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 initial maintenance plan and MOVES3.0.4 for this revision, presented in Table 3-6, 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% and 39% respectively in 2030. With this trend, it is quite reasonable to assume that 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 the same year, 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, there was no need to update nonroad model emissions in 2014.

Table 3-6 below shows emissions inventories for 2014, 2025, and 2030 in the initial and revised maintenance plans. It is clear that 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.

Based on the onroad mobile emissions trend in this plan revision document and the most recent air quality conformity analysis for the 2008 ozone NAAQS 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: Emissions Inventories – Initial and Revised Maintenance Plan

(Washington DC-MD-VA 2008 Ozone NAAQS Maintenance Area)

VOC, OStpd									
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	39.74[a]	61.25	61.25[b]	259.34	251.60
2025	10.08	153.70	2.55	44.88	37.55	33.18	27.92	244.39	231.80
Δ (2014–2025)	-1.13	-14.41	-0.18	2.60	2.19	28.07	33.33	14.95	19.80
2030	10.66	160.31	2.64	47.15	19.23	24.06	21.75	244.81	214.59
Δ (2014–2030)	-1.71	-21.02	-0.27	0.33	20.51	37.19	39.50	14.53	37.01
NO_X, OStpd									
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	37.61	40.68	46.52	181.96	195.79
Δ (2014–2025)	-1.18	-0.23	-2.20	22.37	-3.87	96.16	90.32	114.92	82.84
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	-3.15	24.19	16.80	109.45	102.58	126.50	112.24

Notes: MOVES3.0.4 based VOC and NOx emissions for 2014 were estimated in the above table 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 initial maintenance 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

This submittal revises the 2025, and 2030 MVEBs using MOVES3.0.4 and updated planning assumptions. These MVEBs represent the level of onroad mobile source emissions that can be emitted in the area while supporting the air quality plan.

The revised MVEBs are presented in Table 3-7 (below) for 2025 and 2030 along with the 2014 MVEB from the initial maintenance plan. The MVEBs were developed for 2014 based on the attainment year 2014 onroad mobile emissions. 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 the most current EPA MOVES3.0.4 model as well as the current regional travel demand forecasting model (Gen2/Ver. 2.4).

The initial maintenance plan demonstrated that the region attained the standard 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 the initial maintenance plan.

The MVEBs provided in Table 3-7 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 3-8).

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

Table 3-7: Revised Onroad Motor Vehicle Emissions Budgets based on MOVES3.0.4

Year	VOC Onroad Emissions (OStpd)	NO_X Onroad Emissions (OStpd)
2014 Attainment Year	**61.3**	**136.8**
2025 Predicted Emissions without Safety Margin	27.9	46.5
2025 Safety Margin	5.6	9.3
2025 Interim Budget with Safety Margin	**33.5**	**55.8**
2030 Predicted Emissions without Safety Margin	21.8	34.3
2030 Safety Margin	4.4	6.9
2030 Final Budget with Safety Margin	**26.2**	**41.2**

Table 3-8: Washington DC-MD-VA Revised Maintenance Plan NOx and VOC Emissions, 2014 to 2030, Including MVEBs with Transportation Buffer

Source Category	VOC (tpd)			NO_x (tpd)		
	2014	2025	2030	2014	2025	2030
Point	7.7	8.8	9.4	64.9	66.0	68.5
Nonpoint	139.3	153.7	160.3	9.6	9.9	10.0
MAR	2.4	2.6	2.6	19.2	21.4	22.4
Nonroad Model	47.5	37.5	19.2	52.0	37.6	16.9
On-road/MVEBs[1]	61.3/61.3	27.9/33.5	21.8/26.2	136.8/136.8	46.5/55.8	34.3/41.2
Quasi-Point	1.2	1.2	1.2	14.4	14.4	14.4
TOTAL Without/With MVEBs[1]	259.4/259.4	231.7/237.3	214.5/218.9	296.9/296.9	195.8/205.1	166.5/173.4
Δ (2014-2025) Without/With MVEBs[1]	27.7/22.1			101.1/91.8		
Δ (2014-2030) Without/With MVEBs[1]	44.9/40.5			130.4/123.5		

Note:
[1]The MVEBs were developed for 2025 and 2030 by adding 20% safety margins to the projected onroad mobile VOC and NOx emissions for those years.

3.5. Trends in Emissions Inventories and Air Quality

The Washington DC-MD-VA region has been in attainment of the 2008 ozone NAAQS since 2015, and ozone levels have been continually decreasing over the years. The trends in the ozone design values in Figure 3-2 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. Tables 3-9 through 3-11 show the breakdown of VOC and NOx emissions by jurisdiction and sector for all three milestone years of the revised plan. It is clear that emissions of both ozone precursors have been declining from 2014 through 2025 and 2030 resulting in lowering of ozone levels through those years.

Figure 3-3 shows the ozone monitors currently operating in the Washington, DC-MD-VA 2008 ozone NAAQS maintenance region.

Table 3-9: 2014 Attainment Year Inventory

Pollutant	EGU	NEGU	Quasi-Point	POINT TOTAL	Nonpoint	Marine/Air/ Rail	Nonroad Model	NONROAD TOTAL	Onroad	TOTAL
District of Columbia, Emissions in tpd										
VOC	0.00	0.45	0.00	0.45	18.76	0.36	2.39	2.75	4.87	26.83
NO_X	0.00	1.22	0.00	1.22	0.05	5.56	6.83	12.39	9.28	22.94
Maryland, Emissions in tpd										
VOC	1.39	3.88	1.24	6.51	59.16	0.52	24.26	24.78	31.20	121.65
NO_X	38.37	9.44	14.37	62.18	7.07	3.76	21.85	25.61	70.87	165.73
Virginia, Emissions in tpd										
VOC	0.31	1.68	0.00	1.99	61.38	1.49	20.83	22.32	25.18	110.87
NO_X	9.88	5.95	0.00	15.83	2.50	9.89	23.30	33.20	56.68	108.20
Washington DC-MD-VA 2008 Ozone NAAQS Maintenance Area, Emissions in tpd										
VOC	1.70	6.01	1.24	8.95	139.29	2.37	47.48	49.85	61.25	259.34
NO_X	48.25	16.61	14.37	79.22	9.62	19.21	51.99	71.20	136.84	296.88

Table 3-10: 2025 Intermediate Year Inventory

Pollutant	EGU	NEGU	Quasi-Point	POINT TOTAL	Nonpoint	Marine/Air/ Rail	Nonroad Model	NONROAD TOTAL	Onroad	TOTAL
District of Columbia, Emissions in tpd										
VOC	0.00	0.45	0.00	0.45	21.96	0.41	1.29	1.70	2.37	26.48
NO_X	0.00	1.22	0.00	1.22	0.06	6.31	1.29	7.60	2.78	11.66
Maryland, Emissions in tpd										
VOC	1.55	4.93	1.24	7.73	63.54	0.54	17.78	18.32	12.85	102.44
NO_X	42.68	10.36	14.37	67.41	7.28	4.17	18.07	22.24	21.95	118.88
Virginia, Emissions in tpd										
VOC	0.21	1.69	0.00	1.90	68.20	1.60	18.47	20.07	12.70	102.88
NO_X	5.82	5.96	0.00	11.78	2.52	10.92	18.26	29.18	21.79	65.27
Washington DC-MD-VA 2008 Ozone NAAQS Maintenance Area, Emissions in tpd										
VOC	1.76	7.08	1.24	10.08	153.70	2.55	37.55	40.09	27.92	231.80
NO_X	48.50	17.53	14.37	80.40	9.85	21.41	37.61	59.02	46.52	195.80

Table 3-11: 2030 Outyear Year Inventory

Pollutant	EGU	NEGU	Quasi-Point	POINT TOTAL	Nonpoint	Marine/Air/ Rail	Nonroad Model	NONROAD TOTAL	Onroad	TOTAL
District of Columbia, Emissions in tpd										
VOC	0.00	0.45	0.00	0.45	23.35	0.43	1.15	1.58	1.93	27.31
NO_X	0.00	1.22	0.00	1.22	0.06	6.61	1.03	7.64	1.91	10.83
Maryland, Emissions in tpd										
VOC	1.61	5.41	1.24	8.27	65.79	0.56	7.94	8.50	9.90	92.46
NO_X	44.40	10.77	14.37	69.55	7.38	4.34	7.33	11.67	15.56	104.16
Virginia, Emissions in tpd										
VOC	0.23	1.71	0.00	1.94	71.17	1.66	10.14	11.79	9.91	94.81
NO_X	6.13	5.98	0.00	12.11	2.52	11.41	8.58	19.98	16.79	51.40
Washington DC-MD-VA 2008 Ozone NAAQS Maintenance Area, Emissions in tpd										
VOC	1.84	7.57	1.24	10.66	160.31	2.64	19.23	21.86	21.75	214.58
NO_X	50.53	17.97	14.37	82.87	9.96	22.36	16.94	39.30	34.26	166.40

Figure 3-2: Ozone Design Value Trend

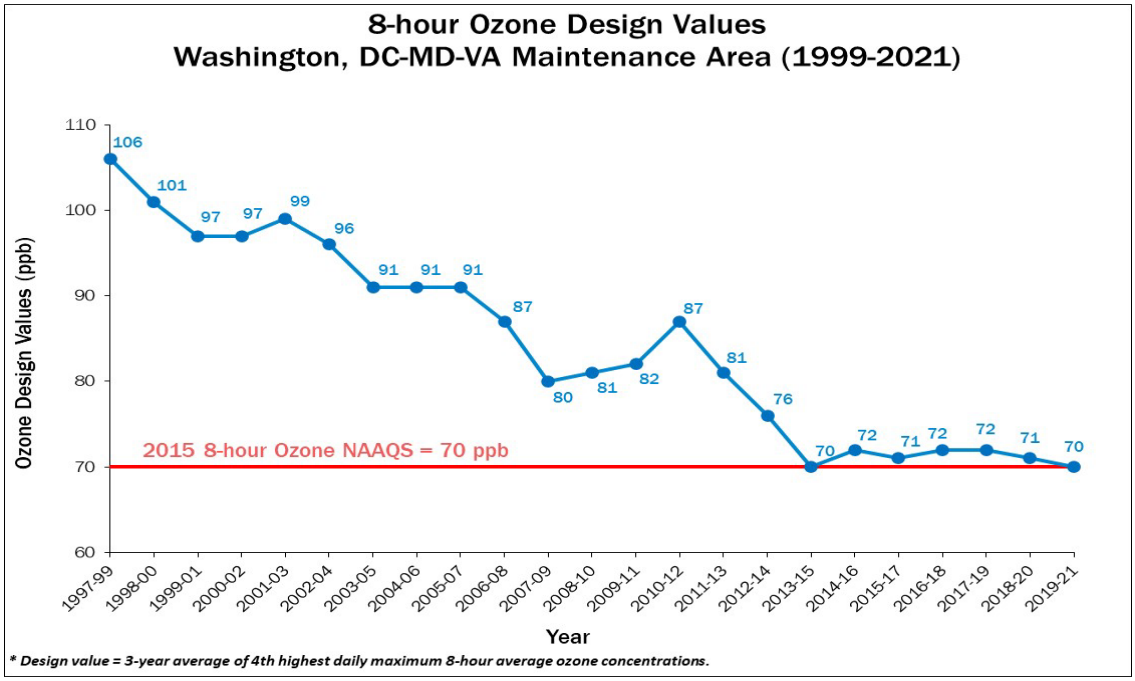


Figure 3-3: Washington DC-MD-VA Ozone Monitoring Sites

4. CONCLUSION

Based on the analysis of emissions for 2014, 2025 and 2030, it is evident that 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 Washington, DC-MD-VA 2008 ozone NAAQS maintenance area has demonstrated successfully that the above area 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 above NAAQS.

In this maintenance plan revision, the maintenance area has updated emissions of VOC and NOx that were included in the initial maintenance 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 initial maintenance plan, to show 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 revisions to the initial ozone maintenance plan for the Washington DC-MD-VA 2008 ozone NAAQS maintenance area. These revisions establish updated Motor Vehicle Emissions Budgets 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.