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State Implementation Plan Revision: Outstanding Requirements for the 2015 Ozone National Ambient Air Quality Standard

SIP Number: 26-03

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**Prepared for:
U.S. Environmental Protection Agency**

**Prepared by:
Maryland Department of the Environment**



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Executive Summary of Requirements

This document entitled *State Implementation Plan Revision: Outstanding Requirements for the 2015 Ozone National Ambient Air Quality Standard* addresses remaining requirements for the 2015 Ozone National Ambient Air Quality Standard (NAAQS) nonattainment areas in Maryland.

Ground-level ozone is one of six Criteria Air Pollutants of which EPA has set a NAAQS to best protect public health. Areas of the country that monitor air pollution above the federal standard are designated “nonattainment” and are required to develop and implement State Implementation Plans (SIPs) that show how a particular region will reduce pollution to meet the federal standard. In 2015, EPA set the NAAQS for ozone at 0.070 ppm (70 ppb).¹ Effective August 3, 2018, EPA designated 52 areas throughout the country as nonattainment for the 2015 ozone NAAQS, including the Washington DC region, the Baltimore region, and Philadelphia region, which were classified as Marginal nonattainment areas.²

On October 7, 2022, EPA determined that 24 Marginal areas, including the Washington DC Nonattainment Area, the Baltimore Nonattainment Area, and the Philadelphia Nonattainment Area failed to attain the 2015 ozone NAAQS by their applicable attainment date, and the areas were reclassified as Moderate nonattainment upon the effective date of the final reclassification notice.³

Baltimore Nonattainment Area

In 2023, there were significant smoke events along the East Coast of the United States originating from large wildfires in Quebec that elevated ozone levels in Maryland. On February 2, 2024, MDE submitted 5 exceptional event demonstrations that, if concurred with, would have brought the Baltimore area into attainment for the 2015 ozone NAAQS. The Clean Air Act (CAA) allows EPA to review and exclude air quality monitoring data that are influenced by exceptional events. Under the CAA, exceptional events include natural events that are not reasonably controllable or preventable and that affect air quality, such as wildfires. Under the EPA’s Exceptional Events

¹ U.S. Environmental Protection Agency (EPA). *National Ambient Air Quality Standards for Ozone*. (October 26, 2015). 80 FR 65292. <https://www.federalregister.gov/documents/2015/10/26/2015-26594/national-ambient-air-quality-standards-for-ozone>

² U.S. Environmental Protection Agency (EPA). *Additional Air Quality Designations for the 2015 Ozone National Ambient Air Quality Standards* June 4, 2018). 83 FR 25776. <https://www.federalregister.gov/documents/2018/06/04/2018-11838/additional-air-quality-designations-for-the-2015-ozone-national-ambient-air-quality-standards>

³ U.S. Environmental Protection Agency (EPA). *Determinations of Attainment by the Attainment Date, Extensions of the Attainment Date, and Reclassification of Areas Classified as Marginal for the 2015 Ozone National Ambient Air Quality Standards*, (October 7, 2022). 87 FR 60897. <https://www.federalregister.gov/documents/2022/10/07/2022-20460/determinations-of-attainment-by-the-attainment-date-extensions-of-the-attainment-date-and>

Rule, States can request to exclude this data from NAAQS compliance demonstrations, i.e., design value calculations.⁴

The attainment date for Moderate nonattainment areas was August 3, 2024. In July 2024, EPA still had not acted upon the exceptional events requests. As a result, MDE agreed to be voluntarily reclassified to Serious, which was finalized on August 1, 2024.⁵ Over a year later, on November 12, 2025, the EPA concurred on portions of the June 2, June 29-30, and July 17-18 exceptional event demonstrations for 2023.⁶ The concurrence altered the Baltimore Nonattainment Area's 4th-highs for 2023, which led to all monitors in the area having design values of 70 ppb or lower for 2023. A Clean Data Determination (CDD) was proposed on January 23, 2026⁷ and finalized on May 29, 2026.⁸ Design values for 2024 and 2025 also demonstrate continued attainment of the NAAQS. Despite having been in attainment for three years in a row by the Moderate attainment date due to the Exceptional Events rule, because of EPA's delayed actions, the Baltimore Nonattainment Area is classified as Serious.

Cecil County, MD Nonattainment Area

The Philadelphia Nonattainment Area was also voluntarily reclassified to Serious.⁹ On February 13, 2025, MDE submitted a redesignation request and accompanying five-factor analysis for EPA to revise the boundary of the Philadelphia Nonattainment Area for the 2008 Ozone NAAQS and 2015 Ozone NAAQS. MDE requested under CAA section 107(d)(3)(D) to revise the boundary for the existing Philadelphia Nonattainment Area by splitting it into two distinct nonattainment areas for both ozone NAAQS: a Southern Philadelphia Nonattainment Area encompassing all of Cecil County, MD and a Central Philadelphia Nonattainment Area encompassing the existing

⁴ U.S. Environmental Protection Agency (EPA). *The Final 2016 Exceptional Events Rule, Supporting Guidance Documents, Updated FAQs, and Other Rule Implementation Resources*. <https://www.epa.gov/air-quality-analysis/final-2016-exceptional-events-rule-supporting-guidance-documents-updated-faqs>

⁵ U.S. Environmental Protection Agency (EPA). *Designations of Areas for Air Quality Planning Purposes; Maryland; Baltimore, MD 2015 8-Hour Ozone Nonattainment Area; Reclassification to Serious* (August 1, 2024). 89 FR 62663. <https://www.federalregister.gov/documents/2024/08/01/2024-16899/designations-of-areas-for-air-quality-planning-purposes-maryland-baltimore-md-2015-8-hour-ozone>

⁶ U.S. Environmental Protection Agency (EPA). *2023 MDE O3 EE Concurrence Letter* (November 12, 2025). EPA-R03-OAR-2025-2532-0014. <https://www.regulations.gov/document/EPA-R03-OAR-2025-2532-0014>

⁷ U.S. Environmental Protection Agency (EPA). *Air Plan Approval; Maryland; Clean Data Determination for the Baltimore, MD Nonattainment Area for the 2015 Ozone National Ambient Air Quality Standards* (January 23, 2026). 91 FR 2887. <https://www.federalregister.gov/documents/2026/01/23/2026-01314/air-plan-approval-maryland-clean-data-determination-for-the-baltimore-md-nonattainment-area-for-the>

⁸ U.S. Environmental Protection Agency (EPA). *Air Plan Approval; Maryland; Clean Data Determination for the Baltimore, MD Nonattainment Area for the 2015 Ozone National Ambient Air Quality Standards* (May 29, 2026). 91 FR 31914. <https://www.federalregister.gov/documents/2026/05/29/2026-10755/air-plan-approval-maryland-clean-data-determination-for-the-baltimore-md-nonattainment-area-for-the>

⁹ U.S. Environmental Protection Agency (EPA). *Designations of Areas for Air Quality Planning Purposes; Pennsylvania, New Jersey, Maryland, Delaware; Philadelphia-Wilmington-Atlantic City, PA-NJ-MD-DE 2015 8-Hour Ozone Nonattainment Area; Reclassification to Serious* (July 30, 2024). 89 FR 61025. <https://www.federalregister.gov/documents/2024/07/30/2024-16570/designations-of-areas-for-air-quality-planning-purposes-pennsylvania-new-jersey-maryland-delaware>

nonattainment area counties in Delaware, New Jersey, and Pennsylvania. On January 23, 2026, EPA proposed to approve MDE’s request, as well as a concurrent request from Delaware to split New Castle County into a separate nonattainment area.¹⁰ The rule was finalized on June 4, 2026.¹¹ This ruling split the Philadelphia Nonattainment Area into three: the Cecil County, MD Nonattainment Area, the New Castle County, DE Nonattainment Area, and the Philadelphia-Atlantic City, PA-NJ Nonattainment. All resulting nonattainment areas retained their nonattainment status. As a result, the Cecil County, MD Nonattainment Area is considered Marginal for the 2008 Ozone NAAQS and Serious for the 2015 Ozone NAAQS. In the same ruling, EPA issued CDDs for the Cecil County, MD Nonattainment Area and the New Castle County, DE Nonattainment Area for both the 2008 and 2015 Ozone NAAQS.

Washington DC Nonattainment Area

After being reclassified to Moderate on October 7, 2022, the Washington DC Nonattainment Area received a CDD based on 2019-2021 monitoring data.¹²

Table 1 contains all nonattainment counties in Maryland, as well as associated nonattainment area and classification.

Table 1: Maryland Counties in Nonattainment Areas

County FIPS Code	County Name	Nonattainment Area and Classification
24009	Calvert	Washington, DC-MD-VA - Moderate
24017	Charles	
24021	Frederick	
24031	Montgomery	
24033	Prince George’s	
24003	Anne Arundel	Baltimore, MD – Serious
24005	Baltimore	
24013	Carroll	
24025	Harford	
24027	Howard	

¹⁰ U.S. Environmental Protection Agency (EPA). *Proposed Revisions of the Nonattainment Designation for the 2008 and 2015 Ozone Standards and Clean Data Determinations for the 2008 and 2015 Ozone Standards: Cecil County, MD and New Castle County, DE* (January 2, 2026). 91 FR 98.

<https://www.federalregister.gov/documents/2026/01/02/2025-24200/proposed-revisions-of-the-nonattainment-designation-for-the-2008-and-2015-ozone-standards-and-clean>

¹¹ U.S. Environmental Protection Agency (EPA). *Proposed Revisions of the Nonattainment Designation for the 2008 and 2015 Ozone Standards and Clean Data Determinations for the 2008 and 2015 Ozone Standards: Cecil County, MD and New Castle County, DE* (June 4, 2026). 91 FR 33610.

<https://www.federalregister.gov/documents/2026/06/04/2026-11169/revisions-of-the-nonattainment-designation-for-the-2008-and-2015-ozone-standards-and-clean-data>

¹² U.S. Environmental Protection Agency (EPA). *Clean Data Determination; District of Columbia, Maryland, and Virginia; Washington, DC-MD-VA Nonattainment Area for the 2015 Ozone National Ambient Air Quality Standard Clean Data Determination* (February 1, 2023). 88 FR 6688.

<https://www.federalregister.gov/documents/2023/02/01/2023-01973/clean-data-determination-district-of-columbia-maryland-and-virginia-washington-dc-md-va>

24510	Baltimore City	
24015	Cecil	Cecil County, MD - Serious

As a result, MDE is providing this supplemental document to address outstanding classification requirements as presented below.

Part I: State of Maryland Program Elements for Modifications to the Vehicle Emission Inspection/Maintenance Program

Part II: State of Maryland Performance Standard Modeling for Modifications to the Vehicle Emission Inspection/Maintenance Program

Part III: State of Maryland Clean Air Act Section 110(l) Non-Interference Demonstration for Modifications to the Vehicle Emissions Inspection/Maintenance Program

Part IV: State of Maryland Basic Motor Vehicle Inspection and Maintenance Program Certification for the 2015 Ozone National Ambient Air Quality Standard

Part V: State of Maryland Enhanced Motor Vehicle Inspection and Maintenance Program Certification for the 2015 Ozone National Ambient Air Quality Standard

Part VI: State of Maryland Reasonably Available Control Technology for the 2015 Ozone National Ambient Air Quality Standards Serious Classification

Part VII: State of Maryland Enhanced Monitoring Plan



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State of Maryland Program Elements for Modifications to the Vehicle Emission Inspection/Maintenance Program in Maryland

SIP Number: 26-03
Part I

Prepared for:
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Prepared by:
Maryland Department of the Environment



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- Relevant Sections of Transportation Article Title 23, Subtitle 2, Annotated Code of Maryland
- Miscellaneous Relevant Sections of Transportation Article Titles 13 and 17 Registration Requirements

Appendix 2. Code of Maryland Regulations (COMAR) Title 11, Subtitle 14, Chapter 08 - Vehicle Emissions Inspection Program

- 2009 Regulatory Action
- 2018 Regulatory Action
- 2023 Regulatory Action

Appendix 3. Interagency Agreements

- Contract Award Letter and Contract Document
- Interagency VEIP Agreement for Fiscal Year 2026
- Relevant Portions of VEIP Operations Contract

Appendix 4. MOVES Modeling Input Files – Enhanced Performance Standard Demonstration

Appendix 5. Test Procedures, Test Equipment, Test System Quality Control, and Waiver Procedures

- VEIP Station Customer Service Reference Guide
- Daily Station Status Reporting - Audit
- Gas Cap Pressure Test Equipment Specifications
- Idle Test Equipment Specifications
- On Board Diagnostics Workstation Description
- Repair Waiver Procedures
- Vehicle Test Procedures
- Vehicle Emissions Inspection Certificate (VEIC) Security Procedures

1. Introduction and Purpose

Ground-level ozone is formed in the atmosphere when precursor pollutants, Nitrogen Oxides (NO_x) and Volatile Organic Compounds (VOCs), undergo a photochemical reaction in the presence of heat and sunlight. Motor vehicles produce a significant portion of NO_x and VOC emissions which contribute to ozone levels. As a result, the CAA requires certain states to implement an “enhanced” vehicle emissions inspection and maintenance (I/M) program to identify gasoline-fueled motor vehicles which exhibit excessive emissions of certain air pollutants. The enhanced I/M program is intended to help states meet federal health-based national ambient air quality standards (NAAQS) by requiring vehicles with excess emissions to be repaired.

In Maryland, the Vehicle Emissions Inspection Program (VEIP) addresses I/M requirements in the state. Initially implemented in 1984, the VEIP has been revised several times over the years to reflect technological advancements in both vehicle emissions control systems and I/M testing methods. EPA fully approved Maryland's enhanced I/M program as meeting CAA requirements on October 29, 1999.

The Baltimore Nonattainment Area was reclassified to “serious” on August 1, 2024,¹ while the Philadelphia Nonattainment Area was reclassified to “serious” on July 30, 2024.² At the time of this reclassification, Cecil County, MD was a part of the Philadelphia Nonattainment Area. However, on February 13, 2025, MDE submitted a redesignation request and accompanying five-factor analysis for the EPA to revise the boundary of the Philadelphia Nonattainment Area for the 2008 Ozone NAAQS and 2015 Ozone NAAQS under CAA section 107(d)(3)(D) by splitting it into two distinct nonattainment areas. On January 2, 2026, EPA proposed to approve MDE’s request, as well as a concurrent request from Delaware to split New Castle County into a separate nonattainment area. This ruling split the Philadelphia Nonattainment Area into three: the Cecil County, MD Nonattainment Area, the New Castle County, DE Nonattainment Area, and the Philadelphia-Atlantic City, PA-NJ Nonattainment Area. The Washington DC-MD-VA Nonattainment area remains classified as a “moderate” nonattainment area.

Altogether, this SIP document satisfies the requirements for Maryland to certify that the VEIP meets the “enhanced” I/M performance standards as required for a “serious” classification for the Baltimore Nonattainment Area and the Cecil County, MD Nonattainment Area. Since the Washington DC-MD-VA remains classified as “moderate”, this SIP also recertifies that the VEIP meets the “basic” I/M performance standards for the “moderate” classification for the Maryland portion of the Washington DC Nonattainment area. The recertification is being made because the accompanying documents and supporting analyses (Performance Standard Modeling and Non-

¹ U.S. Environmental Protection Agency (EPA). *Designations of Areas for Air Quality Planning Purposes; Maryland; Baltimore, MD 2015 8-Hour Ozone Nonattainment Area, Reclassification to Serious* (August 1, 2024). 89 FR 62663. <https://www.federalregister.gov/documents/2024/08/01/2024-16899/designations-of-areas-for-air-quality-planning-purposes-maryland-baltimore-md-2015-8-hour-ozone>

² U.S. Environmental Protection Agency (EPA). *Designations of Areas for Air Quality Planning Purposes; Pennsylvania, New Jersey, Maryland, Delaware; Philadelphia-Wilmington-Atlantic City, PA-NJ-MD-DE 2015 8-Hour Ozone Nonattainment Area, Reclassification to Serious* (July 30, 2024). 89 FR 61025. <https://www.federalregister.gov/documents/2024/07/30/2024-16570/designations-of-areas-for-air-quality-planning-purposes-pennsylvania-new-jersey-maryland-delaware>

interference demonstration) show that the modifications to the VEIP over time do not interfere with attainment or maintenance of the NAAQS.

2. Program Elements

This section describes the current VEIP program elements.

2.1. Operating Agencies

The VEIP is jointly administered by the Maryland Department of Transportation Motor Vehicle Administration (MDOT MVA) and the Maryland Department of the Environment (MDE). Testing operations are conducted by a Contractor under contract to the State.

2.2. Legal Authority

Legal authority to fund, implement, administer, and operate the VEIP until the program is no longer necessary is provided in the Maryland Annotated Code by the Transportation Article at Title 23, Subtitle 2, and the Environment Article, Subtitle 1 and Subtitle 2, which are contained in Appendix 1.

2.3. Implementing Regulations and Interagency Agreements

Implementing regulations for the VEIP are in the Code of Maryland Regulations (COMAR) Chapter 11.14.08. Appendix 2 contains the documentation of regulatory actions on this chapter that became effective in 2009, 2018, and 2023.

The MDOT MVA and MDE each have responsibilities for administration and oversight of the VEIP, which are reflected in a funding agreement between the agencies. The agreement is renewed annually. The fiscal year 2026 agreement is included in Appendix 3.

The VEIP is operated by a Contractor under a legally binding State contract. Supporting contract documentation and relevant portions of the contract are included in Appendix 3.

2.4. Applicability

VEIP requirements apply in the following metropolitan statistical areas (MSAs). The geographic boundaries of the program are the county boundaries.

- Baltimore, MD MSA, consisting of Anne Arundel, Baltimore, Carroll, Harford, Howard, and Queen Anne's counties, and Baltimore City. The 2020 census population of this area was 2,848,898.
- Washington, DC MSA, consisting of Calvert, Charles, Frederick, Montgomery, and Prince Georges counties in Maryland. The 2020 census population of the Maryland portion of this MSA was 2,560,420.

- Philadelphia-Wilmington-Trenton, PA-DE-NJ-MD, which includes Cecil County in Maryland. The 1990 census population of the Maryland portion of this CMSA was 103,721.
- Hagerstown, MD MSA, consisting of Washington County which had a 1990 census population of 154,699.

2.5. Performance Standard Modeling Analysis

In compliance with the CAA, EPA established an enhanced I/M performance standard, consisting of certain program elements that would provide a baseline of emissions reductions to be achieved in a state I/M program. States have the authority to determine the features of their I/M programs so long as the program provides the same or greater level of reductions as the performance standard program would provide. States must demonstrate the equivalence by modeling their program, compared to the performance standard program, using EPA's latest mobile source emissions model.

MOVES5 was used to model both the VEIP area and the enhanced I/M performance standard in 2026, the attainment year for the Serious designation. The modeling demonstrates that the VEIP meets or exceeds the levels of emissions reductions that would be achieved by the performance standard. The modeling results are shown in Table 1. Appendix 4 contains the modeling elements and input files.

Table 1: Performance Standard Modeling Results – 2026 July Weekday Emissions Rates (grams per mile)

Geographical Area	Scenario 1 Existing Program		Scenario 2 Enhanced Performance Standard		Scenario 3 Performance Standard with Buffer		Overall Results Scenario 1 is Less Than Scenario 3	
	NOx	VOC	NOx	VOC	NOx	VOC	NOx	VOC
Baltimore Ozone Nonattainment Area	0.2186	0.1680	0.2181	0.1630	0.2381	0.1830	Pass	Pass
Washington, DC Ozone Nonattainment Area	0.2073	0.1818	0.2069	0.1763	0.2269	0.1963	Pass	Pass
Cecil County	0.3983	0.1752	0.3980	0.1711	0.4180	0.1911	Pass	Pass
Queen Anne's County	0.2541	0.1378	0.2541	0.1344	0.2741	0.1544	Pass	Pass
Washington County	0.4216	0.1786	0.4220	0.1746	0.4420	0.1946	Pass	Pass

2.6. Network Type and Program Evaluation

The VEIP is a centralized, test-only system operated by a Contractor.

VEIP regulations provide for a Fleet Inspection Station (FIS) program where government agencies and private businesses meeting certain criteria may purchase the VEIP test equipment from the Contractor to conduct tests on vehicles owned and maintained by the fleet. The FIS program affected approximately 0.3% of all vehicles tested in the VEIP in calendar year 2025.

To fulfill federal requirements for collecting I/M program evaluation data, the VEIP contract requires the Contractor to perform on-road remote sensing tests on a 1% sample of the VEIP vehicle population on a biennial basis. The remote sensing requirements of the contract are included in Appendix 3.

2.7. Adequate Tools and Resources

VEIP operations and oversight are funded through motorist inspection fees. Section 23-205 of the Annotated Code of Maryland (Appendix 1) provides authority for MDOT MVA and MDE to collect a motorist fee not to exceed \$30 (through June 30, 2026) and CPI adjusted thereafter for each vehicle to be inspected and allows payment of a specific portion of the fee to cover the cost of administration and enforcement of the emissions control program.

In fiscal year 2026, MDE employed approximately 10 positions to fulfill its VEIP obligations that include quality assurance monitoring of all elements of the testing system including test equipment auditing and extensive test data analysis. The obligations and funding levels are outlined in an annual joint agency VEIP Agreement with MDOT MVA. The fiscal year 2026 Agreement is contained in Appendix 3.

In fiscal year 2026, MDOT MVA employed approximately 14 positions to provide public education and assistance, motorist compliance oversight, and VEIP Contractor oversight. Penalties in the form of liquidated damages that may be assessed for findings of Contractor noncompliance are in Appendix 3.

The Contractor employs approximately 175 positions for VEIP testing system management and operations.

2.8. Test Frequency, Motorist Convenience, Public Information, and Consumer Protection

Testing is conducted on a biennial cycle. At least one full-service VEIP station is located in each of the 14 jurisdictions affected by VEIP, for a total of 18 stations. The Contractor is required to adhere to motorist wait time limits at the stations and the state can impose penalties if the requirements are not met, as contained in Appendix 3. Ten self-service VEIP

kiosks, with additional kiosks planned for the future, provide additional convenient motorist test options.

MDOT MVA has a website for motorists to learn more about VEIP testing requirements and test locations, and access specific information about their vehicle test status.³ MDE also offers information for the public about VEIP on its website.⁴

Testing requirement information is also provided in the Vehicle Emissions Inspection Notice sent to motorists. The Vehicle Emissions Inspection Certificate issued by the Contractor upon vehicle testing contains additional important motorist information including a notice of potential availability of vehicle manufacturer warranty coverage for vehicles failing the VEIP test. Customer Service Representatives are available at all central stations to assist motorists.

MDE also provides a Certified Emissions Repair Facility (CERF) program to ensure motorists have access to repair facilities with the diagnostic equipment and technical information necessary to properly diagnose and repair vehicles with emissions problems and employ technicians who possess the highest nationally recognized level of emissions system repair proficiency through certification by the National Institute for Automotive Service Excellence (ASE).

Further, the VEIP regulations provide for the implementation of a Motorist Assistance Center (MAC). MACs include an emissions repair specialist available at the central stations to assist both motorists and the repair industry with getting the correct repairs completed in a timely fashion and help ensure effective, lasting emissions repairs are performed. The improvements in repair success will carry through multiple VEIP test cycles, reducing overall fail rates and customer inconveniences, and ensuring continued air quality progress. This is an especially important component of the program, given the complexity of modern vehicle emissions technology. MACs will improve the repair industry's ability to maintain vehicles and help more people get the repairs needed to pass their VEIP test.

The VEIP contract requires the Contractor to provide motorists with information on emissions-related recalls if US EPA provides a database of emissions-related recalls.

³ Maryland Department of Transportation (MDOT) Motor Vehicle Administration (MVA). *Vehicle Emissions Inspection*. <https://mva.maryland.gov/title-registration/vehicle-emissions-safety-inspections/vehicle-emissions-inspection>

⁴ Maryland Department of the Environment (MDE). *Vehicle Emissions Inspection Program*. <https://mde.maryland.gov/programs/air/mobilesources/pages/veip.aspx>

2.9. Vehicle Coverage

Table 2: Subject vehicles

Gross Vehicle Weight (pounds)	Vehicle Model Year	Test Type
Less than or equal to 8,500	1996 and newer	On Board Diagnostics (OBD) test
8,501 - 14,000	1977 - 2007	Idle exhaust emissions test, Catalytic converter check, and Gas cap leak test
8,501 - 14,000	2008 and newer	On Board Diagnostics (OBD) test
14,001 - 26,000	1977 and newer	Idle exhaust emissions test, Catalytic converter check, and Gas cap leak test

Exempted vehicles are specified in COMAR 11.14.08.04. Requirements for initial testing of a new, not previously registered vehicle are specified in COMAR 11.14.08.05. The complete COMAR chapter 11.14.08 is in Appendix 2.

Maryland offers voluntary VEIP testing for non-Maryland registered vehicles that meet the criteria in Table 2.

2.10. Test Procedures and Standards, Test Equipment, and Test Equipment Quality Control and Maintenance

Statutory authority to establish testing procedures and standards is contained in Appendix 1 and implementing regulations for test procedures and standards and test equipment functionality, performance, security, quality control, and maintenance are contained in Appendix 2.

Appendix 3 contains contractually binding requirements of the Contractor to comply with proper test procedures and standards, and test equipment quality control and maintenance, including penalties in the form of liquidated damages if test system performance requirements are not met.

Appendix 5 contains test procedures and standards, test equipment descriptions and specifications, and test equipment quality control requirements.

2.11. Repair Waivers

Appendix 1 contains legal authority to provide repair waivers for motorists who demonstrate efforts to repair their vehicles to pass VEIP testing. Other exceptions are provided for

motorists who are senior citizens, disabled, or out of state due to active military service and meet certain requirements (Appendix 1). Implementing regulations for repair waivers and the other exceptions are in Appendix 2. MDE, MDOT MVA, and the Contractor operate a quality control program to ensure that the legal requirements for repair waivers are met. Only trained and certified Contractor management personnel and MDOT MVA personnel are authorized to issue repair waivers. Individual inspectors at central stations and FIS may not issue repair waivers.

Appendix 5 contains repair waiver procedures.

2.12. Motorist Compliance Enforcement

Appendix 2 contains the legal authority for Maryland to suspend registration of non-complying vehicles and subsequently deny the reregistration, and to require motorists to file their current registration address with the MDOT MVA.

Initial test notices are mailed to motorists in advance of the vehicle test date. If the vehicle is not tested within seven days after the due date, a warning letter is mailed to the vehicle owner stating the vehicle must be tested within 30 days or the registration will be suspended. If the vehicle is not tested within 30 days, the registration is suspended. When it is time for registration renewal, a letter is mailed to the motorist informing them that their registration will not be renewed until the VEIP test requirements are satisfied.

2.13 Quality Assurance

MDE and MDOT MVA, along with the Contractor, operate a multi-faceted VEIP test system quality assurance effort that includes:

- Extensive fraud prevention requirements for test equipment, operational test software, and data handling;
- Inspection personnel training and certification requirements;
- Test equipment audits;
- Station compliance audits;
- Personnel performance audits;
- Video surveillance image review; and
- A test data analysis and feedback system that provides for ongoing test system improvements when shortcomings are identified.

Regulations providing for the test system quality assurance elements of the VEIP are contained in Appendix 2. Quality control and staff training requirements of the operations contractor are contained in Appendix 3.

Test Equipment Audits

MDE performs periodic quality assurance audits of the test equipment at the central stations, kiosks, and FIS. Collectively among these test sites, MDE performs approximately 3,000 test

equipment audits per year. Detailed reports of the results of the audits are provided to EPA on an annual basis as required by federal regulations.

Contractor Compliance Audits

MDOT MVA conducts approximately 300 unannounced compliance audits of VEIP stations and kiosks on an annual basis.

The Contractor's Customer Service Representative performs ongoing audits of all centralized test lanes on an hourly basis and reports the audit data to the MDOT MVA. Appendix 5 contains the audit procedures.

Video surveillance digital video files of the testing process are generated in all test lanes. The Contractor conducts approximately 1,000 surveillance audits annually, many in follow-up to issues arising from extensive test data review and analysis that MDE and MDOT MVA conduct on an ongoing basis.

Investigations of test data, including covert visual performance audits and review of video files, are performed by MDE and MDOT MVA personnel and the Contractor when suspected incidents of fraudulent or unacceptable testing practices occur.

Vehicle Testing Software Functionality and Test Data Quality Monitoring

MDE monitors testing software functionality and system performance through data analysis to ensure the integrity of the testing process. Detailed analyses of vehicle test records and quality assurance data are conducted to examine accuracy, consistency, and trends, and to identify potential problems early so corrections can be promptly applied. Special statistical analyses are also performed as needed to evaluate specific technical and operational aspects of the VEIP. These efforts have prompted the development and implementation of numerous testing software revisions, both to correct identified problems as well as introduce related enhancements. MDE prepares monthly data analysis reports and provides them to MDOT MVA and the Contractor.

VEIP Technical Committee

MDE and MDOT MVA's quality assurance monitoring and data analysis efforts serve as sources of vital information for the VEIP Technical Committee, which is comprised of representatives of MDE, MDOT MVA, and the Contractor. The Committee is founded on a contractual requirement for the Contractor to hold regularly scheduled technical meetings with the State to develop plans for achieving continuous improvement in testing system performance and accuracy, customer service activities, and other technical and programmatic issues related to VEIP operations and management.

2.14 Enforcement Against Contractors, Stations, and Inspectors

Penalties for findings of Contractor noncompliance are stipulated in the contract with the Contractor. The State has authority to impose liquidated damages as contained in Appendix 3. Enforceable items include:

- Failure to commence the operation of the program at all central VEIP stations by the contractually required date;
- Excessive motorist wait times at central VEIP stations;
- Failure to properly transfer vehicle test records to the State;
- Performing vehicle inspections with instruments which should have locked out from testing due to quality control parameters out of range or a missed periodic calibration check deadline;
- Performing vehicle inspections with instruments for which quality assurance procedures were not conducted as required;
- Performing vehicle tests with incorrect test parameters, including test standards;
- Failure to submit or update the mandatory Quality Assurance and Maintenance Plan;
- Failure to submit equipment quality assurance or maintenance records;
- Failure to promptly repair elements of the testing system upon any hardware or software failure and resume normal operations;
- Intentional use of improper test procedures, or improperly passing a vehicle for any required portion of the vehicle inspection;
- Failure to adhere to proper vehicle test procedures;
- Failure to provide a qualified audit technician at a VEIP station for State personnel to perform an audit;
- Failure to comply with the Contractor's Traffic Management Plan, inside or outside of the VEIP station building;
- Failure to adhere to the required VEIP station operating schedule;
- Failure to adhere to FIS equipment maintenance and repair requirements and response times; and
- Findings of other serious violations of rules or procedural requirements, or findings of gross neglect that directly affect emissions reduction benefits.



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State of Maryland Performance Standard Modeling for Modifications to the Vehicle Emission Inspection/Maintenance Program

SIP Number: 26-03

Part II

Prepared for:

U.S. Environmental Protection Agency

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1. Introduction

The Clean Air Act (CAA) requires Inspection and Maintenance (I/M) programs for areas that meet certain criteria, such as air quality status, population, and/or geographic locations. The CAA established two performance levels for I/M programs:

1. Basic I/M for ozone nonattainment areas classified as Moderate and,
2. Enhanced I/M that is required in the following areas:
 - All Serious or higher ozone nonattainment areas that had a 1980 population of 200,000 or more
 - Metropolitan statistical areas (MSA) with a 1990 population of 100,000 or more in the Ozone Transport Region (OTR) regardless of air quality classification
 - All Moderate or higher carbon monoxide (CO) nonattainment areas with a design value greater than 12.7 ppm at the time of classification that had a 1980 urban population of 200,000 or more

Based on the above criteria, Maryland implements an enhanced I/M program in the following 14 jurisdictions:

- The Baltimore ozone Nonattainment Area which contains the counties of Anne Arundel, Baltimore, Carroll, Harford, and Howard and the City of Baltimore,
- The MD portion of the multi-state Washington DC ozone Nonattainment Area which contains the MD counties of Calvert, Charles, Frederick, Montgomery, and Prince George's
- The Cecil County, MD Nonattainment Area¹
- Queen Anne's County due to its inclusion in the Baltimore MSA
- Washington County, MD under the OTR provisions.

The EPA's I/M regulations allow states flexibility in designing state I/M programs. However, the state programs must meet I/M requirements including the respective performance standard as described above. Maryland's Enhanced I/M program, known as the Vehicle Emissions Inspection Program (VEIP), is a part of Maryland's State Implementation Plan (SIP). VEIP, along with other initiatives, has helped reduce emissions and improve air quality in Maryland.

¹ Cecil County, MD has historically been a part of the Philadelphia Nonattainment Area. However, on February 13, 2025, MDE submitted a redesignation request and accompanying five-factor analysis for the EPA to revise the boundary of the Philadelphia Nonattainment Area for the 2008 Ozone NAAQS and 2015 Ozone NAAQS under CAA section 107(d)(3)(D) by splitting it into two distinct nonattainment areas. On January 2, 2026, EPA proposed to approve MDE's request, as well as a concurrent request from Delaware to split New Castle County into a separate nonattainment area. This ruling split the Philadelphia Nonattainment Area into three: the Cecil County, MD Nonattainment Area, the New Castle County, DE Nonattainment Area, and the Philadelphia-Atlantic City, PA-NJ Nonattainment Area.

2. Purpose

This Performance Standard Modeling (PSM) analysis is required to incorporate outstanding changes to Maryland's I/M program that have occurred in the program to reflect advancements in vehicle technology. It is also required since Maryland's Baltimore and Cecil County, MD ozone nonattainment areas have been reclassified from Moderate to Serious for the 2015 Ozone National Ambient Air Quality Standard (NAAQS) under EPA's final rules in August² and July³ 2024, respectively. The Maryland portion of the Washington DC nonattainment area remains a Moderate nonattainment area under the 2015 8-hour ozone standard.

The Serious ozone classification requires implementation of an Enhanced I/M program, and the Moderate ozone classification requires implementation of a Basic I/M program consistent with the I/M regulations. States with existing I/M programs need to conduct and submit a SIP and PSM analysis, as well as make any necessary program revisions as part of their Serious area SIP submissions to ensure that I/M programs are operating at or above the Enhanced I/M performance standard level. States that determine through the PSM analysis that an existing SIP-approved program would meet the performance standard for purposes of the 2015 Ozone NAAQS without modification can submit a SIP revision with the PSM and a written statement certifying their determination.

Maryland operates one I/M program that is consistent throughout the 14 county VEIP area. The VEIP does not change based on ozone designations. Maryland has made changes to its I/M program over time to reflect vehicle technology advancements. This SIP and supporting analyses satisfy all of Maryland's outstanding obligations related to its I/M SIP. This SIP also demonstrates that the changes made to Maryland's I/M program meet the enhanced I/M performance standard and do not interfere with attainment or maintenance of the NAAQS. MDE and EPA have previously discussed this situation and agreed that compliance with the Enhanced performance standard can be used to satisfy both SIP and PSM requirements related to the Enhanced SIP update, the Enhanced I/M Certification required by the Serious designation, and the Basic I/M SIP and certification required in the state's Moderate nonattainment area. Parts IV and V of this SIP document contain statements certifying this Enhanced SIP, PSM and non-interference demonstration meet the requirements of both the Serious and Moderate ozone designations.

² U.S. Environmental Protection Agency (EPA). *Designations of Areas for Air Quality Planning Purposes; Maryland; Baltimore, MD 2015 8-Hour Ozone Nonattainment Area, Reclassification to Serious* (August 1, 2024). 89 FR 62663. <https://www.federalregister.gov/documents/2024/08/01/2024-16899/designations-of-areas-for-air-quality-planning-purposes-maryland-baltimore-md-2015-8-hour-ozone>

³ U.S. Environmental Protection Agency (EPA). *Designations of Areas for Air Quality Planning Purposes; Pennsylvania, New Jersey, Maryland, Delaware; Philadelphia-Wilmington-Atlantic City, PA-NJ-MD-DE 2015 8-Hour Ozone Nonattainment Area; Reclassification to Serious* (July 30, 2024). 89 FR 61025. <https://www.federalregister.gov/documents/2024/07/30/2024-16570/designations-of-areas-for-air-quality-planning-purposes-pennsylvania-new-jersey-maryland-delaware>

3. Performance Standard Modeling

3.1 Maryland VEIP Overview

Maryland's VEIP program is a centralized, test only system operated by a Contractor under contract with the state. At least one VEIP station is in each of the 14 jurisdictions affected by VEIP for a total of 18 stations. Ten self-service VEIP kiosks provide additional convenient motorist test options. Testing is conducted on a biennial cycle. Table 1 depicts the model year and weight classes of gasoline and hybrid vehicles subject to VEIP testing along with the applicable test type.

Table 1: VEIP Subject Vehicles and Applicable Test Types

Gross Vehicle Weight (lbs)	Vehicle Model Year	Test Type
Less than or equal to 8,500	1996 and newer	On Board Diagnostics (OBD) test
8,501-14,000	1977-2007	Idle exhaust emissions test, catalytic converter check, and gas cap leak test
8,501-14,000	2008 and newer	On Board Diagnostics (OBD) test
14,001-26,000	1977 and newer	Idle exhaust emissions test, catalytic converter check, and gas cap leak test

Certain vehicles are exempted from VEIP testing. The exempted vehicles are specified in the VEIP regulations (COMAR 11.14.08.04). The current program also provides for Motorist Assistance Centers (MACs) that will help motorist and repair technicians better diagnose failures and allow for better, longer lasting repairs.

The VEIP also provides for repair waivers for motorists who demonstrate efforts to repair their vehicles to pass VEIP testing. Other exceptions are provided for motorists who are senior citizens, disabled, or out of state due to active military service and meet certain requirements (see Part I - Appendix 1). Implementing regulations for vehicle exemptions, repair waivers, and the other exceptions listed above can be found in Part I – Appendix 2 of this SIP document. Detailed information on Maryland's VEIP I/M program can be found in Part I of this SIP.

3.2 Performance Standard Modeling Analysis

The Performance Standard Modeling (PSM) analysis is designed to show that an I/M program or modifications to an existing I/M program meet the applicable performance standard. The performance standard establishes the level of emission reductions that a mandatory I/M program must meet or exceed.

An I/M performance standard is a collection of program design elements which defines the EPA benchmark program to which Maryland's program is compared in terms of its potential to reduce emissions of the ozone precursors, VOCs, and NOx, by certain comparison dates. I/M program design elements include test frequency (annual or biennial), waiver/compliance rate, vehicle types tested, model year (MY) vehicles included in testing, network type (centralized or decentralized), and test type (idle or onboard diagnostic-OBD). The I/M performance standards

are defined in the I/M regulations at 40 CFR 51.352 for Basic I/M programs and 40 CFR 51.351 for Enhanced I/M programs.

To perform a PSM analysis, two scenarios must be modeled:

1. Existing state program scenario – this scenario represents Maryland’s VEIP program in operation today and includes all of the local parameters and control measures as well as the inputs required to define the existing VEIP; and,
2. EPA’s Performance standard benchmark scenario – this scenario represents the applicable EPA defined benchmark program, which includes all of the local area parameters and control measures and the EPA’s I/M program with the elements of the applicable performance standard.

The results of these scenarios are compared to determine whether the existing program’s emissions rates are the same or lower than the EPA’s performance standard benchmark scenario. For an Enhanced I/M program, if the existing program obtains the same or lower emissions levels for VOC and NO_x as the EPA’s performance standard benchmark program to within 0.02 grams-per-mile (g/mile), then it is considered to have met the enhanced performance standard.

Modeling for this PSM analysis was performed using the MOVES5 emissions model and reflected the latest planning assumptions (local fleet age distribution, vehicle miles traveled, meteorology, fuel parameters, etc.). The latest planning assumptions are based on 2023 data which are updated triennially in conjunction with the federal requirements for statewide National Emissions Inventory (NEI) development. The MOVES5 model inputs for the existing I/M program were developed using Maryland VEIP data for calendar years 2021 and 2022.

For the 2015 Ozone NAAQS, a monitor is considered in attainment if its design value (DV) is 70 parts per billion (ppb) or less. The DV is calculated by averaging the fourth-highest daily maximum 8-hour ozone concentration over 3 years. The Serious Attainment date is August 3, 2027. However, attainment must be measured over the course of an entire ozone season, so the nonattainment areas must demonstrate attainment by the 2026 ozone season. As a result, the analysis year for the Enhanced I/M program is 2026.

3.2.1 Modeling Methodology

This section summarizes Maryland’s methodology for estimating emissions from highway vehicles using EPA’s Motor Vehicle Emission Simulator (MOVES) model and PPSuite, a custom pre- and post-processing system. This methodology is used for Maryland’s official emission inventories and State Implementation Plans (SIP). It includes a summary of the methodology and data assumptions used for the PSM and the accompanying Section 110(l) demonstration. It provides details regarding the MOVES input parameters, vehicle miles traveled (VMT), and emission results for Maryland’s 14 I/M jurisdictions.

Background:

The operation of highway vehicles has proven to be a significant contributor to air pollution, particularly to ground-level ozone, as they emit both volatile organic compounds (VOC) and oxides of nitrogen (NO_x) during operation. Ground-level ozone is not directly emitted; rather, it is formed through a chemical reaction between VOCs and NO_x in the presence of sunlight. Given that both VOCs and NO_x are emitted from the operation of highway vehicles, Maryland's ozone-related emission modeling efforts have been focused on these pollutants.

In order to estimate both the rate at which emissions are being generated and to calculate vehicle miles traveled (activity level), Maryland examines its road network and fleet to estimate vehicle activity. For ozone-related modeling and inventories, the analysis is done for a typical summer weekday. For emission modeling and inventories of other pollutants such as carbon monoxide (CO) or greenhouse gases (GHG), the analyses may be done for a typical winter weekday or annual conditions.

This PSM modeling was performed using the MOVES5.0.1 (or simply MOVES5) model, EPA's latest official version of MOVES for estimating emissions from highway vehicles. The MOVES5.0.1 model version was released in October 2025 and contains some minor revisions to the MOVES5.0.0 model, initially released in November 2024 as a major update to the MOVES series of mobile source emission models.

EPA's Guidance Resources for MOVES5 Modeling:

The following EPA guidance documents were used to develop the modeling methodology used in Maryland's official highway emissions inventory, SIPs and this PSM analysis. The documents include:

- *MOVES Policy Guidance: Use of MOVES5 for State Implementation Plan Development, Transportation Conformity, General Conformity, and Other Purposes*, US EPA Office of Transportation and Air Quality, November 2024, EPA-420-B-24-038) T
- *MOVES5 Technical Guidance: Using MOVES to Prepare Emission Inventories for State Implementation Plans and Transportation Conformity*, US EPA Office of Transportation and Air Quality, November 2024, EPA-420-B-24-043)
- *Performance Standard Modeling for New and Existing Vehicle Inspection and Maintenance (I/M) Programs Using the MOVES Mobile Source Emission model*; US EPA Office of Transportation and Air Quality, EPA-420-B-22-034, October 2022.

Analysis Methodology:

The methodologies used to produce the emission results conform to the recommendations provided in EPA's technical guidance documents. A mix of local and national default (internal to MOVES5) data has been used for this work. All the MOVES5 modeling input parameters are summarized in Table 2 entitled, "Maryland I/M SIP Modeling Inputs Checklist for 2026". Local

data has been used for the primary data items that have a significant impact on emissions and reflects the latest available planning assumptions developed by the Maryland Department of the Environment (MDE) using data obtained from the Maryland Department of Transportation Motor Vehicle Administration (MDOT MVA), the Maryland Department of Transportation State Highway Administration (MDOT SHA), the local Metropolitan Planning Organizations (MPOs) and other local/national sources as identified in the table.

A detailed explanation of the model, how the inputs in the table below were developed and the emissions methodology used in determining on-road mobile source emissions for MDE's official inventories and SIPs can be found in Maryland's *State Implementation Plan Revision: Redesignation Request and Maintenance Plan for the 2015 Ozone National Ambient Air Quality Standards for the Serious Baltimore Nonattainment Area*. The mobile modeling methodologies in this document are applicable to all of MDE's official modeling efforts.

Table 2: Maryland I/M SIP Modeling Inputs Checklist for 2026

Data Item	2026 Emission Inventory Inputs Assumptions (SHA-PPSuite Process with MOVES5)
Traffic Data	
Highway Network	2023 MD-MDOT SHA Universal Highway Database
Seasonal/Daily Adjustments	2023 MD-MDOT SHA Traffic Trends Report
County HPMS VMT Adjustments	2023 MD-HPMS Adjustments
Mapfile	Use MOVES5 national defaults VMT distributions for Maryland to disaggregate light duty vehicles/buses/trucks to the 13 MOVES source types
Hourly Patterns	MPO Modified hourly distributions to be used for MD hourly patterns
Vehicle Mixes	1. 2023 Vehicle Classification by Functional Class 2. 2023 TMS & hourly distribution from SHA traffic count data 3. Truck percentage assumption consistent with MPO travel modeling
VMT Growth Forecast	2000- 2023 HPMS growth trend, applied to 2023 HPMS Base Year and applied forecasted VMT growth factor to obtain the 2026 VMT

Vehicle Population Growth Forecast	1. Source Type 11, 21, 31, 32, 41, 42, 43, 51 & 54: max of population, household and VMT 2. Trucks (source type 52, 53 ,61 & 62): Estimated by using VMT, MOVES5 national default VMT and population ratios
MOVES Inputs	
Month VMT Fractions	Calculated based on 2023 seasonal adjustment factors
Day VMT Fractions	Calculated based on 2023 seasonal adjustment factors
Hourly VMT Fractions	Calculated by PPSUITE
Average Speed Distribution	Calculated by PPSUITE
Source Type Population	1. Source Type 11, 21, 31, 32, 41, 42, 43, 51 & 54: Applied 2026 VPOP growth to 2023 base year inputs developed using VIN-Decoded data 2. Trucks (source type 52, 53 ,61 & 62): Estimated by using 2026 modeled VMT, MOVES5 national default VMT, and population ratios
Vehicle Age Distribution	Developed in-house using MDOT MVA vehicle registration data as of July 1, 2023. VIN decoding was done by ESP Data Solutions, a commercial VIN decoding service. MOVES5 defaults were used for the heavy-duty truck types 53, 61 and 62.
Fuel Supply	MOVES5 inputs developed in-house using MD's Fuel Data
Fuel Formulation	MOVES5 inputs developed in-house using MD's Fuel Data
Fuel Usage Fraction	MOVES5inputs developed from the MOVE3 default database
Temperatures/Humidity	2023 inputs developed in-house using meteorological data for local airports through NOAA
I/M Parameters	Two separate I/M Programs for 2026; 1) the current I/M program, and 2) the enhanced performance standard
Early NLEV / CALLEV	Early NLEV and CALEV program databases developed with MOVES5

AVFT	Developed in-house by MDE from 2023 MVA data and projected to 2026 using the AVFT Tool of MOVES5 model.
Federal Fuel & Emissions Standards	Controlled Measures included in MOVES5

The analysis methodology is consistent with statewide inventory efforts including the 2023 National Emissions Inventory (NEI) submission. This includes the use of statewide traffic roadway data and custom post-processing software (PPSUITE) to calculate hourly speeds and prepare key traffic input files to the MOVES5 emission model. PPSUITE consists of a set of programs that perform the following functions:

- Analyzes highway operating conditions,
- Calculates highway speeds,
- Compiles vehicle miles of travel (VMT) and vehicle type mix data,
- Pre-processes MOVES inputs and MOVES Run Specs,
- Runs MOVES in batch mode, and
- Post-processes MOVES outputs and develops Excel reports and Summaries.

PPSUITE is a widely used and accepted tool for estimating speeds and processing emissions rates. It has been used for past SIP highway inventories in Maryland, Pennsylvania, and New Jersey. The software is based upon accepted transportation engineering methodologies. For example, PPSUITE utilizes speed and delay estimation procedures based on planning methods provided in the Highway Capacity Manual, a report prepared by the Transportation Research Board (TRB) summarizing current knowledge and analysis techniques for capacity and level-of-service analyses of the transportation system.

MOVES Runs:

After calculating speeds and aggregating VMT and VHT, PPSUITE prepares traffic-related inputs needed to run EPA's MOVES5 model. Additional required MOVES inputs are tapped from the folders already prepared/stored external to the processing software such as meteorology, I/M program parameters, fuel characteristics, vehicle fleet age distributions and source type population.

The MOVES County importer is run in batch mode. This program converts all data files into the MariaDB formats used by the MOVES model. At that point a MOVES run specification file (*.mrs) is created which specifies options and key data locations for the run. MOVES is then run in batch mode.

MOVES can be run using either the *inventory* or *rate-based* approach. For this I/M SIP work, MOVES is run using the *inventory-based* approach. Under this method, actual VMT and population are provided as inputs to the model; MOVES is responsible for producing the total emissions for the modeling domain.

MOVES Output Summary:

After all the 14 individual jurisdiction MOVES runs (separate run for each scenario) are completed, quality assurance checks are done to ascertain that there are no data import errors or execution errors. Then PPSuite's Summary module is used to aggregate the 14 individual jurisdiction emissions results into one comprehensive, I/M domain-wide summary of daily VOC and NOx emissions in grams per day (gpd), and VMT by jurisdiction by various modes such by source type, by roadway type, etc.

The emissions in grams per day (gpd) by pollutant are then converted to tons per day (tpd) for each jurisdiction by applying a conversion factor. The same approach is applicable to the area wide emissions.

Emission factors in grams per mile (gpm) are developed for each jurisdiction by dividing the total emissions (gpd) by the associated total VMT in miles per day. The same approach is applicable to the area wide emission factors used in this Enhanced I/M PSM.

The MOVES5 model is equipped with an SQL script-based function that can be used to obtain the gpm emissions factor. This function can only be used in the stand-alone mode which is a time-consuming process and is counter to the automated PPSuite-based process MDE uses. MDE used the SQL script-based function for one county and found the results matched very well to the MDE approach described above. In consultation with EPA OTAQ, MDE was given approval to use MDE's gpm emissions factor approach for calculating the emissions factors used to demonstrate compliance with the Enhanced Performance Standard.

Quality Assurance:

Quality assurance checks have been applied throughout the development of MOVES inputs, MOVES import operations, and MOVES runs through a review of feedback reports after each county run. The MOVES5 integrated into the PPSuite software, has been validated and produces the same emissions/VMT results when compared to a stand-alone MOVES run.

A sample run for 2026 Baltimore County (current I/M with 6MY delay scenario) is included in the MOVES5 output folder demonstrating a near perfect match between results of MOVES stand-alone and PPSuite runs.

Modeling Data Description:

Per EPA Guidance on Performance Standard Modeling for New and Existing Vehicle Inspection and Maintenance (I/M) Programs Using the MOVES Mobile Source Emission model, all required data, and descriptions to support the conclusion that the I/M program meets the applicable performance standard, the following MOVES files and/or databases are being provided with this SIP.

- MOVES Run Specification (RunSpec) files – these files define the scope of the MOVES run by defining elements such as time period(s), geographical area, source types, etc. included in the modeling.
- MOVES Input MariaDB Databases – input databases provide vehicle characteristics, vehicle activity, and other local conditions.
- MOVES Output MariaDB Databases – output databases contain the results of the MOVES analysis.
- MOVES Output MS-Excel Spreadsheets: MOVES output tables processed into Excel with a sample case for quality assurance demonstrating match with MOVES standalone operation.
- Post-processed MS-Excel Spreadsheets: Containing emissions and emission factor tables by scenario, by jurisdictions, by pollutant and by I/M Area demonstrating how the I/M program meets the applicable performance standard in the I/M regulations.

3.2.2 Development of Inspection and Maintenance (I/M) Program Input Table-Current Program Evaluated in 2026

The I/M evaluation consists of many parameters. This section describes MDE's approach to each parameter of the I/M input table in MOVES. Section 4.9 of EPA's MOVES5 Technical Guidance document explains the appropriate input assumptions and sources of data.⁴ The MOVES I/M input table was developed following the assumptions and methods described in EPA's guidance.

Pollutant Process ID

Maryland's I/M program includes exhaust and evaporative OBD tests as well as an exhaust idle test and evaporative gas cap pressure check. All tests provide emission benefits for hydrocarbons/volatile organic compounds (VOCs) and the OBD tests provide additional emission benefits for nitrogen oxides (NO_x). For exhaust emissions, I/M programs can affect both running and starting emissions. For evaporative emissions, I/M programs affect hydrocarbon emissions from fuel vapor venting and fuel leaks. For the relevant test types, Pollutant Process IDs in this input include 101, 102, 112, 113, 301 and 302.

Source Type ID

Maryland's I/M program includes passenger cars and trucks with a gross vehicle weight rating of 26,000 pounds or less. Therefore, the MOVES source type IDs included in the I/M input table are passenger cars, passenger trucks, and light commercial trucks. (IDs = 21, 31, and 32, respectively). Maryland's I/M program covers heavy duty vehicles, and this would include source type 51, and 52. The benefit from including these in the I/M inputs are negligible and MDE, after discussions with EPA, was advised not to include them.

⁴ U.S. Environmental Protection Agency (EPA). *MOVES5 Technical Guidance: Using MOVES to Prepare Emission Inventories for State Implementation Plans and Transportation Conformity* (November 2024). <https://www.epa.gov/moves/latest-version-motor-vehicle-emission-simulator-moves#guidance>

Fuel Type ID

Maryland's I/M program applies to gasoline and flex fuel vehicles. MOVES calculates an I/M emissions benefit for these vehicles. Therefore, two MOVES fuel type IDs were included in the I/M input table (ID = 1 for regular gasoline, and ID = 5 for E85 gasoline).

Inspection Frequency

Maryland's I/M program requires emission tests every two years. Therefore, the MOVES inspection frequency ID that represents biennial tests (ID = 2) was used in the I/M input table.

Test Standards

Maryland's I/M program is a centralized program with OBD tests for exhaust and evaporative systems, as well as an idle test with gas cap pressure check. Therefore, the MOVES test standard IDs for exhaust OBD check, evaporative system OBD check, idle test, and gas cap pressure test (IDs = 43, 51, 11, and 41, respectively), were used.

I/M Program ID

This is an arbitrary number developed by the MOVES user to define a unique test given for vehicles within a range of model years. I/M program IDs were arbitrarily assigned to the various unique tests within the I/M program.

Beginning and Ending Model Years

Maryland's I/M program applies to light duty gasoline vehicles with a model year of 1996 and newer, and to heavy duty (8,501-26,000 GVWR) vehicles 1977 and newer. In the MOVES input, light duty vehicles cover 1996-2020. Heavy duty vehicles cause a split, as OBD was introduced for vehicles under 14,000 lbs in 2008. Heavy duty vehicles from 1977-1995 are pre-OBD and entirely idle tested, 1996-2007 of the commercial trucks are <8,500 and are modeled as OBD tested, and 2008-2020.

Not included in the model are 1996 and newer idle tested vehicles. Source Types 31 & 32 have minority segments that are heavy duty pre-OBD; since MOVES considers additional rows covering the same Year/Source Type combination as double-counting, these were not included in the I/M inputs to prevent errors.

Compliance Factor

The I/M Compliance Factor was calculated according to the MOVES guidance document using Equation 1.

Equation 1:

$$\text{Compliance Factor} = \text{compliance rate} \times (1 - \text{waiver rate} \times \text{failure rate}) \times \text{regulatory class coverage adjustment}$$

To calculate the compliance factor for each MOVES source type ID included in Maryland's I/M program (IDs = 21, 31, and 32, respectively), the compliance rate, failure rate, waiver rate, and regulatory class coverage adjustment were determined as follows:

Compliance Rate, Failure Rate, and Waiver Rate

The Compliance Rate is the percentage of vehicles that either pass a test or receive a waiver compared to the total number of vehicles in the program. MDE's Mobile Program keeps track of vehicles that were sent a test notice but did not receive an initial test, Mobile refers to these vehicles as "no shows". "No show" vehicles are included in the denominator of the compliance rate calculation. The Failure Rate is the percentage of vehicles that fail their initial test compared to all vehicles that receive an initial test. The Waiver Rate is the number of vehicles that receive a waiver divided by the number of vehicles that fail their initial test. Because Maryland's I/M program is a biennial program, meaning half the vehicles were tested in 2021 and half in 2022, the combined data from the 2021-2022 was used.

Table 3: I/M Data and MOVES Compliance, Waiver, and Failure Rates

Parameter	Total
Subject Vehicles	2,423,316
No Shows	11,979
Compliance Rate	94.99%
Total Initial Fails	184,138
Failure Rate	7.7%
Total Waivers	19,722
Waiver Rate	10.7%

Regulatory Class Coverage Adjustment

The regulatory class coverage adjustment accounts for the fraction of vehicles within a source type that are included in Maryland's I/M program. Because Maryland's I/M tests non-OBD heavy, duty vehicles, the regulatory class coverage adjustment factor is split up differently depending on what model year range is being modeled. Mobile used Table A.1 in the Appendix of the MOVES technical guidance document to develop the regulatory class coverage adjustment factor, as shown in Table 4.

Table 4: Regulatory Class Coverage Adjustment Factors

MOVES Vehicle Classification	MOVES Source Type ID	Model Year Range	Regulatory Class Coverage Adjustment Factor
Passenger Cars	21	1996-2017	100%
Passenger Trucks	31	1977-1995	2.63%
		1996-2007	97.23%
		2008-2017	100%
Light Commercial Trucks	32	1977-1995	21.88%
		1996-2007	76.97%
		2008-2017	100%

Calculating the Compliance Factor

Using these values for the compliance rate, waiver rate, failure rate, and regulatory class coverage adjustment, the compliance factors for the following three MOVES vehicle types were calculated using Equation 1.

Equation 1:

Passenger Cars Compliance Factor

$$= (94.99\%) \times (1 - 10.7\% \times 7.7\%) \times 100\% = 94.21\%$$

Passenger Trucks Compliance Factor

1977-1995

$$= (94.99\%) \times (1 - 10.7\% \times 7.7\%) \times 2.63\% = 2.61\%$$

1996-2007

$$= (94.99\%) \times (1 - 10.7\% \times 7.7\%) \times 97.23\% = 91.60\%$$

2008-2020

$$= (94.99\%) \times (1 - 10.7\% \times 7.7\%) \times 100\% = 94.21\%$$

Light Commercial Trucks Compliance Factor

1977-1995

$$= (94.99\%) \times (1 - 10.7\% \times 7.7\%) \times 21.88\% = 21.70\%$$

1996-2007

$$= (94.99\%) \times (1 - 10.7\% \times 7.7\%) \times 76.97\% = 72.51\%$$

2008-2020

$$= (94.99\%) \times (1 - 10.7\% \times 7.7\%) \times 100\% = 94.21\%$$

Combining these values provides the MOVES I/M input table as shown in Table 5 for one Maryland I/M county.

Table 5: I/M Input Table for One Maryland County

Pol Process ID	State ID	County ID	Year ID	Source type ID	Fuel Type ID	IM Program ID	Inspect Freq	Test Standards ID	Begin Model Year ID	End Model Year ID	Use IM (y/n)	Compliance Factor
101	24	24003	2026	21	1	21511	2	51	1996	2020	Y	94.21
102	24	24003	2026	21	1	21511	2	51	1996	2020	Y	94.21
201	24	24003	2026	21	1	21511	2	51	1996	2020	Y	94.21
202	24	24003	2026	21	1	21511	2	51	1996	2020	Y	94.21
301	24	24003	2026	21	1	21511	2	51	1996	2020	Y	94.21
302	24	24003	2026	21	1	21511	2	51	1996	2020	Y	94.21
112	24	24003	2026	21	1	21431	2	43	1996	2020	Y	94.21
113	24	24003	2026	21	1	21431	2	43	1996	2020	Y	94.21
101	24	24003	2026	31	1	31511	2	51	1996	2007	Y	91.60
102	24	24003	2026	31	1	31511	2	51	1996	2007	Y	91.60
201	24	24003	2026	31	1	31511	2	51	1996	2007	Y	91.60
202	24	24003	2026	31	1	31511	2	51	1996	2007	Y	91.60
301	24	24003	2026	31	1	31511	2	51	1996	2007	Y	91.60
302	24	24003	2026	31	1	31511	2	51	1996	2007	Y	91.60
112	24	24003	2026	31	1	31431	2	43	1996	2007	Y	91.60
113	24	24003	2026	31	1	31431	2	43	1996	2007	Y	91.60
101	24	24003	2026	31	1	31512	2	51	2008	2020	Y	94.21
102	24	24003	2026	31	1	31512	2	51	2008	2020	Y	94.21
201	24	24003	2026	31	1	31512	2	51	2008	2020	Y	94.21
202	24	24003	2026	31	1	31512	2	51	2008	2020	Y	94.21
301	24	24003	2026	31	1	31512	2	51	2008	2020	Y	94.21
302	24	24003	2026	31	1	31512	2	51	2008	2020	Y	94.21
112	24	24003	2026	31	1	31432	2	43	2008	2020	Y	94.21
113	24	24003	2026	31	1	31432	2	43	2008	2020	Y	94.21
101	24	24003	2026	32	1	32511	2	51	1996	2007	Y	72.51
102	24	24003	2026	32	1	32511	2	51	1996	2007	Y	72.51

201	24	24003	2026	32	1	32511	2	51	1996	2007	Y	72.51
202	24	24003	2026	32	1	32511	2	51	1996	2007	Y	72.51
301	24	24003	2026	32	1	32511	2	51	1996	2007	Y	72.51
302	24	24003	2026	32	1	32511	2	51	1996	2007	Y	72.51
112	24	24003	2026	32	1	32431	2	43	1996	2007	Y	72.51
113	24	24003	2026	32	1	32431	2	43	1996	2007	Y	72.51
101	24	24003	2026	32	1	32512	2	51	2008	2020	Y	94.21
102	24	24003	2026	32	1	32512	2	51	2008	2020	Y	94.21
201	24	24003	2026	32	1	32512	2	51	2008	2020	Y	94.21
202	24	24003	2026	32	1	32512	2	51	2008	2020	Y	94.21
301	24	24003	2026	32	1	32512	2	51	2008	2020	Y	94.21
302	24	24003	2026	32	1	32512	2	51	2008	2020	Y	94.21
112	24	24003	2026	32	1	32432	2	43	2008	2020	Y	94.21
113	24	24003	2026	32	1	32432	2	43	2008	2020	Y	94.21
101	24	24003	2026	31	1	31111	2	11	1977	1995	Y	2.61
102	24	24003	2026	31	1	31111	2	11	1977	1995	Y	2.61
201	24	24003	2026	31	1	31111	2	11	1977	1995	Y	2.61
202	24	24003	2026	31	1	31111	2	11	1977	1995	Y	2.61
112	24	24003	2026	31	1	31411	2	41	1977	1995	Y	2.61
101	24	24003	2026	32	1	32111	2	11	1977	1995	Y	21.70
102	24	24003	2026	32	1	32111	2	11	1977	1995	Y	21.70
201	24	24003	2026	32	1	32111	2	11	1977	1995	Y	21.70
202	24	24003	2026	32	1	32111	2	11	1977	1995	Y	21.70
112	24	24003	2026	32	1	32411	2	41	1977	1995	Y	21.70
101	24	24003	2026	21	5	1	2	51	1996	2020	Y	94.21
102	24	24003	2026	21	5	1	2	51	1996	2020	Y	94.21
201	24	24003	2026	21	5	1	2	51	1996	2020	Y	94.21
202	24	24003	2026	21	5	1	2	51	1996	2020	Y	94.21
301	24	24003	2026	21	5	1	2	51	1996	2020	Y	94.21
302	24	24003	2026	21	5	1	2	51	1996	2020	Y	94.21
112	24	24003	2026	21	5	2	2	43	1996	2020	Y	94.21

113	24	24003	2026	21	5	2	2	43	1996	2020	Y	94.21
101	24	24003	2026	31	5	3	2	51	1996	2007	Y	91.60
102	24	24003	2026	31	5	3	2	51	1996	2007	Y	91.60
201	24	24003	2026	31	5	3	2	51	1996	2007	Y	91.60
202	24	24003	2026	31	5	3	2	51	1996	2007	Y	91.60
301	24	24003	2026	31	5	3	2	51	1996	2007	Y	91.60
302	24	24003	2026	31	5	3	2	51	1996	2007	Y	91.60
112	24	24003	2026	31	5	4	2	43	1996	2007	Y	91.60
113	24	24003	2026	31	5	4	2	43	1996	2007	Y	91.60
101	24	24003	2026	31	5	5	2	51	2008	2020	Y	94.21
102	24	24003	2026	31	5	5	2	51	2008	2020	Y	94.21
201	24	24003	2026	31	5	5	2	51	2008	2020	Y	94.21
202	24	24003	2026	31	5	5	2	51	2008	2020	Y	94.21
301	24	24003	2026	31	5	5	2	51	2008	2020	Y	94.21
302	24	24003	2026	31	5	5	2	51	2008	2020	Y	94.21
112	24	24003	2026	31	5	6	2	43	2008	2020	Y	94.21
113	24	24003	2026	31	5	6	2	43	2008	2020	Y	94.21
101	24	24003	2026	32	5	7	2	51	1996	2007	Y	72.51
102	24	24003	2026	32	5	7	2	51	1996	2007	Y	72.51
201	24	24003	2026	32	5	7	2	51	1996	2007	Y	72.51
202	24	24003	2026	32	5	7	2	51	1996	2007	Y	72.51
301	24	24003	2026	32	5	7	2	51	1996	2007	Y	72.51
302	24	24003	2026	32	5	7	2	51	1996	2007	Y	72.51
112	24	24003	2026	32	5	8	2	43	1996	2007	Y	72.51
113	24	24003	2026	32	5	8	2	43	1996	2007	Y	72.51
101	24	24003	2026	32	5	9	2	51	2008	2020	Y	94.21
102	24	24003	2026	32	5	9	2	51	2008	2020	Y	94.21
201	24	24003	2026	32	5	9	2	51	2008	2020	Y	94.21
202	24	24003	2026	32	5	9	2	51	2008	2020	Y	94.21
301	24	24003	2026	32	5	9	2	51	2008	2020	Y	94.21
302	24	24003	2026	32	5	9	2	51	2008	2020	Y	94.21

112	24	24003	2026	32	5	10	2	43	2008	2020	Y	94.21
113	24	24003	2026	32	5	10	2	43	2008	2020	Y	94.21
101	24	24003	2026	31	5	15	2	11	1977	1995	Y	2.61
102	24	24003	2026	31	5	15	2	11	1977	1995	Y	2.61
201	24	24003	2026	31	5	15	2	11	1977	1995	Y	2.61
202	24	24003	2026	31	5	15	2	11	1977	1995	Y	2.61
112	24	24003	2026	31	5	16	2	41	1977	1995	Y	2.61
101	24	24003	2026	32	5	17	2	11	1977	1995	Y	21.70
102	24	24003	2026	32	5	17	2	11	1977	1995	Y	21.70
201	24	24003	2026	32	5	17	2	11	1977	1995	Y	21.70
202	24	24003	2026	32	5	17	2	11	1977	1995	Y	21.70
112	24	24003	2026	32	5	18	2	41	1977	1995	Y	21.70

3.2.3 Development of Enhanced Performance Standard Input Table

Along with EPA's November 2022 Performance Modeling Guidance document, EPA provided templates that states can use to develop the basic and/or enhanced performance standard input table to be used in their PSM modeling. MDE used the enhanced performance standard template which only requires the user to provide the following information into the excel-based template:

- state-specific information that includes state ID (state-level 2-digit FIPS code),
- county ID (county-level 5-digit FIPS code that share 2-digits with the state code), and
- analysis year.

A segment of the MOVES enhanced performance standard I/M input table used in this modeling is shown in Table 6.

Table 6: Sample MOVES Enhance Performance Standard I/M Input Table

Pol Process ID	State ID	County ID	Year ID	Source Type ID	Fuel Type ID	IM Program ID	Inspect Freq	Test Standards ID	Beg Model Year ID	End Model Year ID	Use IM (y/n)	Compliance Factor
101	24	24003	2026	21	1	111	1	11	1968	2000	y	95.7696
101	24	24003	2026	31	1	111	1	11	1968	2000	y	92.05374
101	24	24003	2026	32	1	111	1	11	1968	2000	y	72.0762
102	24	24003	2026	21	1	111	1	11	1968	2000	y	95.7696
102	24	24003	2026	31	1	111	1	11	1968	2000	y	92.05374
102	24	24003	2026	32	1	111	1	11	1968	2000	y	72.0762

301	24	24003	2026	21	1	111	1	11	1968	2000	y	95.7696
301	24	24003	2026	31	1	111	1	11	1968	2000	y	92.05374
301	24	24003	2026	32	1	111	1	11	1968	2000	y	72.0762
302	24	24003	2026	21	1	111	1	11	1968	2000	y	95.7696
302	24	24003	2026	31	1	111	1	11	1968	2000	y	92.05374
302	24	24003	2026	32	1	111	1	11	1968	2000	y	72.0762
101	24	24003	2026	21	1	151	1	51	2001	2022	y	95.7696
101	24	24003	2026	31	1	151	1	51	2001	2022	y	92.05374
101	24	24003	2026	32	1	151	1	51	2001	2022	y	72.0762
102	24	24003	2026	21	1	151	1	51	2001	2022	y	95.7696
102	24	24003	2026	31	1	151	1	51	2001	2022	y	92.05374
102	24	24003	2026	32	1	151	1	51	2001	2022	y	72.0762
301	24	24003	2026	21	1	151	1	51	2001	2022	y	95.7696
301	24	24003	2026	31	1	151	1	51	2001	2022	y	92.05374
301	24	24003	2026	32	1	151	1	51	2001	2022	y	72.0762
302	24	24003	2026	21	1	151	1	51	2001	2022	y	95.7696
302	24	24003	2026	31	1	151	1	51	2001	2022	y	92.05374
302	24	24003	2026	32	1	151	1	51	2001	2022	y	72.0762
112	24	24003	2026	21	1	143	1	43	2001	2022	y	95.7696
112	24	24003	2026	31	1	143	1	43	2001	2022	y	92.05374
112	24	24003	2026	32	1	143	1	43	2001	2022	y	72.0762
101	24	24003	2026	21	5	111	1	11	1968	2000	y	95.7696
101	24	24003	2026	31	5	111	1	11	1968	2000	y	95.7696
101	24	24003	2026	32	5	111	1	11	1968	2000	y	95.7696
102	24	24003	2026	21	5	111	1	11	1968	2000	y	95.7696
102	24	24003	2026	31	5	111	1	11	1968	2000	y	95.7696
102	24	24003	2026	32	5	111	1	11	1968	2000	y	95.7696
301	24	24003	2026	21	5	111	1	11	1968	2000	y	95.7696
301	24	24003	2026	31	5	111	1	11	1968	2000	y	95.7696
301	24	24003	2026	32	5	111	1	11	1968	2000	y	95.7696
302	24	24003	2026	21	5	111	1	11	1968	2000	y	95.7696
302	24	24003	2026	31	5	111	1	11	1968	2000	y	95.7696
302	24	24003	2026	32	5	111	1	11	1968	2000	y	95.7696
101	24	24003	2026	21	5	151	1	51	2001	2022	y	95.7696
101	24	24003	2026	31	5	151	1	51	2001	2022	y	95.7696
101	24	24003	2026	32	5	151	1	51	2001	2022	y	95.7696
102	24	24003	2026	21	5	151	1	51	2001	2022	y	95.7696
102	24	24003	2026	31	5	151	1	51	2001	2022	y	95.7696
102	24	24003	2026	32	5	151	1	51	2001	2022	y	95.7696
301	24	24003	2026	21	5	151	1	51	2001	2022	y	95.7696
301	24	24003	2026	31	5	151	1	51	2001	2022	y	95.7696
301	24	24003	2026	32	5	151	1	51	2001	2022	y	95.7696
302	24	24003	2026	21	5	151	1	51	2001	2022	y	95.7696

302	24	24003	2026	31	5	151	1	51	2001	2022	y	95.7696
302	24	24003	2026	32	5	151	1	51	2001	2022	y	95.7696
112	24	24003	2026	21	5	143	1	43	2001	2022	y	95.7696
112	24	24003	2026	31	5	143	1	43	2001	2022	y	95.7696
112	24	24003	2026	32	5	143	1	43	2001	2022	y	95.7696
101	24	24005	2026	21	1	111	1	11	1968	2000	y	95.7696
101	24	24005	2026	31	1	111	1	11	1968	2000	y	92.05374
101	24	24005	2026	32	1	111	1	11	1968	2000	y	72.0762
102	24	24005	2026	21	1	111	1	11	1968	2000	y	95.7696
102	24	24005	2026	31	1	111	1	11	1968	2000	y	92.05374

4. Performance Standard Modeling Results

The emissions rates from Maryland's VEIP need to be compared to the emissions rates from the EPA's enhanced performance benchmark standard to determine if the Maryland VEIP meets the enhanced performance standard. For an Enhanced I/M program, if the existing program obtains the same or lower emissions levels for NOx and VOC as the EPA's performance standard benchmark program to within 0.02 grams-per-mile (g/mile), then it is considered to have met the enhanced performance standard. The EPA's October 2022 PSM Guidance provides an example results table, provided here in Table 7, to demonstrate compliance.

Table 7: Summary of July Weekday Emission Rates (grams per mile) for the Example

Scenario	NOX	VOC
Proposed/existing Program	0.4549	0.2132
Performance Standard Benchmark	0.4552	0.2153
Performance Standard Benchmark with 0.02 gpm Buffer	0.4752	0.2353

Tables 8-12 follow the example in Table 7 to show the results of the enhanced performance standard modeling for the Maryland jurisdictions required to operate an enhanced performance I/M program.

Table 8: 2026 July Weekday Emissions Rates (grams per mile) for the Baltimore Nonattainment Area

County	Scenario 1 Current I/M Program		Scenario 2 EPA's Enhanced Performance Standard		Scenario 3 EPA's Performance Standard with Buffer		Overall Results Scenario 1 is less than Scenario 3	
	NOx	VOC	NOx	VOC	NOx	VOC	NOx	VOC
Anne Arundel	0.2098	0.1774	0.2092	0.1722	0.2292	0.1922	Pass	Pass
Baltimore	0.2206	0.1584	0.2200	0.1536	0.2400	0.1736	Pass	Pass
Carroll	0.2588	0.2853	0.2581	0.2778	0.2781	0.2978	Pass	Pass
Harford	0.2292	0.1887	0.2286	0.1832	0.2486	0.2032	Pass	Pass

Howard	0.1962	0.1238	0.1955	0.1197	0.2155	0.1397	Pass	Pass
Baltimore City	0.2341	0.1673	0.2336	0.1624	0.2536	0.1824	Pass	Pass
Baltimore Area	0.2186	0.1680	0.2181	0.1630	0.2381	0.1830	Pass	Pass

Table 9: 2026 July Weekday Emissions Rates (grams per mile) for the Washington DC Nonattainment Area

County	Scenario 1 Current I/M Program		Scenario 2 EPA's Enhanced Performance Standard		Scenario 3 EPA's Performance Standard with Buffer		Overall Results Scenario 1 is less than Scenario 3	
	NOx	VOC	NOx	VOC	NOx	VOC	NOx	VOC
Calvert	0.2089	0.2420	0.2086	0.2354	0.2286	0.2554	Pass	Pass
Charles	0.2097	0.2318	0.2092	0.2251	0.2292	0.2451	Pass	Pass
Frederick	0.2288	0.1698	0.2284	0.1650	0.2484	0.1850	Pass	Pass
Montgomery	0.1975	0.1890	0.1966	0.1828	0.2166	0.2028	Pass	Pass
Prince George's	0.2068	0.1674	0.2067	0.1627	0.2267	0.1827	Pass	Pass
Washington Area	0.2073	0.1818	0.2069	0.1763	0.2269	0.1963	Pass	Pass

Table 10: 2026 July Weekday Emissions Rates (grams per mile) for the Cecil County, MD Nonattainment Area

County	Scenario 1 Current I/M Program		Scenario 2 EPA's Enhanced Performance Standard		Scenario 3 EPA's Performance Standard with Buffer		Overall Results Scenario 1 is less than Scenario 3	
	NOx	VOC	NOx	VOC	NOx	VOC	NOx	VOC
Cecil	0.3983	0.1752	0.3980	0.1711	0.4180	0.1911	Pass	Pass

Table 11: 2026 July Weekday Emissions Rates (grams per mile) for Queen Anne's County

County	Scenario 1 Current I/M Program		Scenario 2 EPA's Enhanced Performance Standard		Scenario 3 EPA's Performance Standard with Buffer		Overall Results Scenario 1 is less than Scenario 3	
	NOx	VOC	NOx	VOC	NOx	VOC	NOx	VOC
Queen Anne's	0.2541	0.1378	0.2541	0.1344	0.2741	0.1544	Pass	Pass

Table 12: 2026 July Weekday Emissions Rates (grams per mile) for Washington County

County	Scenario 1 Current I/M Program		Scenario 2 EPA's Enhanced Performance Standard		Scenario 3 EPA's Performance Standard with Buffer		Overall Results Scenario 1 is less than Scenario 3	
	NOx	VOC	NOx	VOC	NOx	VOC	NOx	VOC
Washington	0.4216	0.1786	0.4220	0.1746	0.4420	0.1946	Pass	Pass

5. Conclusion

The enhanced performance modeling results in Tables 8 through 12 demonstrate that the gram per mile emissions from Maryland's current I/M program, both at the ozone nonattainment area level and at the individual jurisdiction level, are below EPA's Enhanced performance standard benchmark.



Maryland
Department of
the Environment

Wes Moore, Governor
Aruna Miller, Lt. Governor

Serena McIlwain, Secretary
Suzanne E. Dorsey, Deputy Secretary
Adam Ortiz, Deputy Secretary

State of Maryland Clean Air Act Section 110(l) Non-Interference Demonstration for Modifications to the Vehicle Emissions Inspection/Maintenance Program SIP Number: 26-03 Part III

**Prepared for:
U.S. Environmental Protection Agency**

**Prepared by:
Maryland Department of the Environment**



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Additional Items

Additional information related to the two modeling scenarios performed for this demonstration (the 2002 SIP approved program evaluated for 2026 and the current 2026 program) will be submitted separately and includes:

- MOVES Run Specification (RunSpec) files – these files define the scope of the MOVES run by defining elements such as time period(s), geographical area, source types, etc. included in the modeling.
- MOVES Input MariaDB Databases – input databases provide vehicle characteristics, vehicle activity, and other local conditions.
- MOVES Output MariaDB Databases – output databases contain the results of the MOVES analysis.
- MOVES Output MS-Excel Spreadsheet: MOVES output tables processed into Excel.
- Post-processed MS-Excel Spreadsheet containing emissions by scenario, by jurisdiction, by pollutant and by I/M Area.

1. Purpose and Background

The purpose of this report is to demonstrate that modifications within the Maryland Vehicle Emissions Inspection Program (VEIP) comply with Section 110(l) of the Clean Air Act (CAA or the Act). This section of the CAA states –

The Administrator shall not approve a revision of a plan if the revision would interfere with any applicable requirement concerning attainment and reasonable further progress (as defined in section 171), or any other applicable requirement of this Act.

CAA Section 110(l) applies to all areas of the country, whether attainment, nonattainment, unclassifiable or maintenance, for one or more of the six criteria pollutants: ozone, particulate matter (PM), nitrogen dioxide (NO₂), sulfur dioxide (SO₂), carbon monoxide (CO), and lead (Pb).

However, the VEIP program in Maryland is not statewide; it is limited to the counties of: Anne Arundel, Baltimore, Calvert, Carroll, Cecil, Charles, Frederick, Harford, Howard, Montgomery, Prince George's, Queen Anne's, and Washington Counties, as well as the City of Baltimore.

The report and supporting analyses demonstrate that the modifications to the VEIP program do not interfere with attainment or maintenance of all current criteria pollutant National Ambient Air Quality Standards (NAAQS), including the 2008 and 2015 Ozone NAAQS, the 2012 PM_{2.5} NAAQS, the 2010 NO₂ NAAQS, the 2010 SO₂ NAAQS, the 1971 CO NAAQS, and the 2008 lead NAAQS.

Table 1: Status of Maryland Jurisdictions per National Ambient Air Quality Standard (NAAQS)

Pollutant	Year Adopted by EPA	Primary/Secondary NAAQS	Averaging Time	Level*	Area/Designation Status
Ozone	2015	Primary and Secondary	8-hour	70 ppb	Washington DC/MD/VA – Moderate nonattainment with a Clean Data Determination
					Baltimore, MD – Serious nonattainment with a Clean Data Determination
					Cecil County, MD – Serious nonattainment with a Clean Data Determination
CO	2011	Primary	1-hour 8-hour	35 ppm 9 ppm	Attainment Statewide
Lead	2008	Primary and Secondary	Rolling 3-month average	0.15 µg/m ³	Attainment Statewide
NO ₂	2010	Primary	1-hour	100 ppb	Attainment Statewide
		Primary and Secondary	Annual	53 ppb	

Pollutant	Year Adopted by EPA	Primary/Secondary NAAQS	Averaging Time	Level*	Area/Designation Status
PM2.5	2012	Primary and Secondary	Annual	12 µg/m ³	Attainment Statewide
		Primary and Secondary	24-hour	15 µg/m ³	
PM10	2012	Primary and Secondary	24-hour	150 µg/m ³	Attainment Statewide
SO2	2010	Primary	1-hour	75 ppb	Anne Arundel-Baltimore Counties nonattainment with a Clean Data Determination
		Secondary	3-hour	0.5 ppm	

In Maryland, the following areas are currently designated nonattainment for the 2008 and 2015 Ozone NAAQS:

- The Maryland portion of the Washington DC Nonattainment Area consists of Calvert, Charles, Frederick, Montgomery, and Prince George’s Counties.
- The Baltimore Nonattainment Area consists of Anne Arundel, Baltimore, Carroll, Harford and Howard Counties, as well as the City of Baltimore.
- The Cecil County, MD Nonattainment Area consists of Cecil County.¹

2. Overview of I/M in Maryland

Following adoption of the CAA Amendments of 1990, Maryland’s ozone air quality was re-evaluated, and it was determined that portions of the state did not meet the 1-hour ozone NAAQS and were therefore designated by the U.S. Environmental Protection Agency (EPA) as “nonattainment.” As a result, Maryland was required to implement a Vehicle Emission Inspection and Maintenance (I/M) program that met the “Enhanced” performance standard.

The Maryland Department of the Environment (MDE or the Department) has submitted (and EPA has approved) various SIP revisions concerning the state’s VEIP over the years.

In July of 1995, MDE submitted an Enhanced I/M Program, which was ultimately approved by EPA. The approval of the I/M program SIP was subject to 15 conditions which were discussed in detail in EPA’s July 31, 1997, conditional approval. On July 31, 1997, EPA granted conditional approval of Maryland’s enhanced I/M SIP submitted on July 10, 1995, as supplemented on March 27, 1996, with SIP Revision 96-02.²

Maryland submitted a subsequent supplemental SIP Revision 98-13 on September 25, 1998.

¹ Cecil County, MD has historically been a part of the Philadelphia Nonattainment Area. However, on February 13, 2025, MDE submitted a redesignation request and accompanying five-factor analysis for the EPA to revise the boundary of the Philadelphia Nonattainment Area for the 2008 Ozone NAAQS and 2015 Ozone NAAQS under CAA section 107(d)(3)(D) by splitting it into two distinct nonattainment areas. On January 2, 2026, EPA proposed to approve MDE’s request, as well as a concurrent request from Delaware to split New Castle County into a separate nonattainment area. This ruling split the Philadelphia Nonattainment Area into three: the Cecil County, MD Nonattainment Area, the New Castle County, DE Nonattainment Area, and the Philadelphia-Atlantic City, PA-NJ Nonattainment Area. 91 FR 2894.

² U.S. Environmental Protection Agency (EPA). *Approval and Promulgation of Air Quality Implementation Plans; State of Maryland; Enhanced Motor Vehicle Inspection and Maintenance Program* (July 31, 1997). <https://www.govinfo.gov/content/pkg/FR-1997-07-31/pdf/97-20219.pdf>

EPA found that all conditions of the 1997 conditional approval were satisfied and granted full approval of Maryland's I/M SIP on October 29, 1999.³

In order to comply with evolving federal requirements and guidance for integrating On Board Diagnostics testing into state I/M programs, including an EPA rule published April 5, 2001⁴, Maryland submitted SIP Revision 02-01 on July 9, 2002. On January 16, 2003, EPA published a direct final rule approving the State of Maryland's State Implementation Plan (SIP) revision for an enhanced vehicle inspection and maintenance (I/M) program, with an effective date of March 17, 2003.⁵

Maryland has made several modifications to the VEIP testing process over the years as both vehicle emissions control technology and I/M testing technology have progressed. This demonstration is based on the VEIP as implemented in 2026.

2.1. Testing Process Changes

- In July 2002, Maryland initiated mandatory pass/fail On Board Diagnostics (OBD) testing for model year 1996 and newer light duty vehicles and light duty trucks, up to 8,500 pounds Gross Vehicle Weight Rating (GVWR), replacing the IM240 dynamometer test for these vehicles. The OBD test had previously been conducted on an advisory basis to gain experience and identify potential issues with the new OBD test method.
- In July 2005, Maryland changed the official testing procedure for model year 1984 and newer vehicles with a GVWR between 8,501 and 10,000 pounds from the IM240 dynamometer testing to idle testing, due to issues related to dynamometer testing of the heavier vehicles. A small number of vehicles were affected.
- In August 2009, IM240 dynamometer testing ceased due to the rapid improvements in vehicle technology brought about by introduction of the OBD system and the accompanying decline in number of vehicles subject to the IM240 test method. IM240-tested vehicles comprised approximately 10% of the vehicle population at the time, and the existing equipment was aged and would have required replacement at significant cost to the State. All non-OBD tested vehicles became subject to an idle test with mandatory pass/fail gas cap pressure test and catalytic converter check. Idle test cut points were tightened for model year 1991 and newer vehicles up to 10,000 pounds and model year 1993 and newer vehicles between 10,001 and 26,000 pounds to offset the test procedure change.

³ U.S. Environmental Protection Agency (EPA). *Approval and Promulgation of Air Quality Implementation Plans; State of Maryland; Enhanced Inspection and Maintenance Program* (October 29, 1999). <https://www.govinfo.gov/content/pkg/FR-1999-10-29/pdf/99-27197.pdf>

⁴ U.S. Environmental Protection Agency (EPA). *Amendments to Vehicle Inspection Maintenance Program Requirements Incorporating the Onboard Diagnostic Check* (April 5, 2001). <https://www.govinfo.gov/content/pkg/FR-2001-04-05/pdf/01-8276.pdf>

⁵ U.S. Environmental Protection Agency (EPA). *Approval and Promulgation of Air Quality Implementation Plans; Maryland; Motor Vehicle Inspection and Maintenance Program--Request for Delay in the Incorporation of OnBoard Diagnostics Testing* (January 16, 2003). https://www.epa.gov/sites/default/files/2017-07/documents/md_2208_4pgs_1.pdf

- Maryland also changed the mandatory test procedure for model year 2008 vehicles weighing between 8,501 and 14,000 pounds to the more-thorough OBD test, as the first step toward expansion of the OBD testing requirements to heavier vehicles due to anticipated technological improvements.
- At this same time, the EPA revised its required emissions model that states must use to model motor vehicle emissions to shift “modeled air quality” benefits away from I/M programs. This shift significantly reduced the modeled impact of Maryland’s I/M program even though Maryland was using the federally mandated OBD test for 90% of the vehicle population.
- In January 2018, Maryland delayed initial testing of new, not previously titled vehicles from 2 years to 3 years, due to the very low failure rate of the newest model years of vehicles given the advancements in technology and increasingly more stringent emissions standards for newly manufactured vehicles. Also, testing requirements ceased for model year 1977 through 1995 vehicles of 8,500 GVWR and lower, as these vehicles comprised a rapidly diminishing percentage of the affected vehicle fleet.
- In July 2023, Maryland delayed initial testing of new, not previously titled vehicles from 3 years to 6 years due to the very low failure rate of the newest model years of vehicles given further advancements in technology and increasingly more stringent emissions standards for newly manufactured vehicles.

2.2. Operational Changes

- In August 2009, Maryland closed a centralized VEIP inspection station located within Montgomery County in accordance with a request from the Federal Aviation Administration (FAA) due to the station’s proximity to an airport and stricter FAA restrictions that were instituted after the station was established in 1994. There are two remaining centralized testing stations in Montgomery County, as well as a self-service kiosk near the area of the station closure.
- In 2015 and 2016, ten self-service OBD testing kiosks were introduced. The kiosks provide additional testing outlets for motorists and a decreased test fee, improving motorist convenience.
- The COVID-19 pandemic resulted in the closing of all centralized VEIP stations from March 17, 2020, through October 19, 2020, as well as extension of testing due dates of many vehicles.
- Hand-held tablets were introduced into the program to provide additional testing capabilities at stations. The tablets have been especially useful in enhancing motorist convenience at the stations that experience high test volumes.
- In 2026, the VEIP transitioned to a new operations contract. The new contract includes physical changes to the VEIP stations (removal of the customer waiting booths previously used during IM240 testing), the real-time transfer of test data between the contractor and MDOT MVA, the use of hand-held tablets system wide, the introduction of in-lane kiosks for added customer convenience, replacement of the existing outdoor kiosks (additional outdoor kiosks planned for the future), and the introduction of Motorist Assistance Centers

(MACs) to assist customers with getting the correct repairs and help ensure effective, lasting emissions repairs.

3. Noninterference Demonstration for Modifications to VEIP

In the following sections, MDE presents the emissions modeling results necessary to demonstrate that the modifications to VEIP do not interfere with continued maintenance of the NAAQS.

- Section 3.1 presents the noninterference demonstration for the current 2015 Ozone NAAQS by nonattainment area.
- Section 3.2 presents the noninterference for the remaining NAAQS for PM, SO₂, NO₂, Lead, and CO.

3.1. 2015 Ozone NAAQS

On October 26, 2015, EPA promulgated a revised primary and secondary NAAQS for ozone to provide requisite increased protection of public health and welfare, respectively.⁶ In that action, EPA strengthened both standards from 0.075 parts per million (ppm) to 0.070 ppm, while retaining the indicator (O₃), averaging time (8-hour), and form (annual fourth-highest daily maximum, averaged over three years). Effective August 3, 2018, EPA designated 52 areas throughout the country as nonattainment for the 2015 ozone NAAQS, including the Washington DC region, the Baltimore region, and Philadelphia region, which were classified as Marginal nonattainment areas.⁷ In that action, EPA established the attainment date for Marginal nonattainment areas as three years from the effective date of the final designations. Thus, the attainment date for Marginal nonattainment areas for the 2015 ozone NAAQS was August 3, 2021. However, attainment must be demonstrated using complete ozone season data. Therefore, attainment for Marginal nonattainment areas should be demonstrated by 2020.

On October 7, 2022, EPA determined that 24 Marginal areas, including the Washington DC Nonattainment Area, the Baltimore Nonattainment Area, and the Philadelphia Nonattainment Area failed to attain the 2015 ozone NAAQS by their applicable attainment date, and the areas were reclassified as Moderate nonattainment upon the effective date of the final reclassification notice.⁸ This designation was based on quality-assured, quality-controlled, and certified ozone air quality monitoring data from calendar years 2018 to 2020.⁹

⁶ U.S. Environmental Protection Agency (EPA). *National Ambient Air Quality Standards for Ozone* (October 26, 2015). 80 FR 65292. <https://www.federalregister.gov/documents/2015/10/26/2015-26594/national-ambient-air-quality-standards-for-ozone>

⁷ U.S. Environmental Protection Agency (EPA). *Additional Air Quality Designations for the 2015 Ozone National Ambient Air Quality Standards* June 4, 2018). 83 FR 25776. <https://www.federalregister.gov/documents/2018/06/04/2018-11838/additional-air-quality-designations-for-the-2015-ozone-national-ambient-air-quality-standards>

⁸ U.S. Environmental Protection Agency (EPA). *Determinations of Attainment by the Attainment Date, Extensions of the Attainment Date, and Reclassification of Areas Classified as Marginal for the 2015 Ozone National Ambient Air Quality Standards*, (October 7, 2022). 87 FR 60897. <https://www.federalregister.gov/documents/2022/10/07/2022-20460/determinations-of-attainment-by-the-attainment-date-extensions-of-the-attainment-date-and>

⁹ *Determinations of Attainment by the Attainment Date, Extensions of the Attainment Date, and Reclassification of Areas Classified as Serious for the 2008 Ozone National Ambient Air Quality*

In 2023, there were significant smoke events along the East Coast of the United States originating from large wildfires in Quebec that elevated ozone levels in Maryland. On February 2, 2024, MDE submitted 5 exceptional event demonstrations that, if concurred with, would have brought the Baltimore area into attainment for the 2015 ozone NAAQS. The CAA allows EPA to review and manage air quality monitoring data that are influenced by exceptional events. Under the CAA, exceptional events include natural events that are not reasonably controllable or preventable and that affect air quality, such as wildfires. Under the EPA's Exceptional Events Rule, states can request to exclude this data from NAAQS compliance demonstrations, i.e., design value calculations.¹⁰

The attainment date for Moderate nonattainment areas was August 3, 2024. In July 2024, EPA still had not acted upon the exceptional events requests. As a result, MDE agreed to be voluntarily reclassified to Serious, which was finalized on August 1, 2024.¹¹ Over a year later, on November 12, 2025, the EPA concurred on portions of the June 2, June 29-30, and July 17-18, exceptional event demonstrations for 2023.¹² The concurrence altered the Baltimore Nonattainment Area's 4th-highs for 2023, which led to all monitors in the area having design values of 70 ppb or lower for 2023. Design values for 2024 and 2025 also demonstrate continued attainment of the NAAQS. Despite having been in attainment for three years in a row by the Moderate attainment date due to the Exceptional Events rule, because of EPA's delayed actions, the Baltimore Nonattainment Area is classified as Serious. MDE demonstrates in this non-interference demonstration that changes to Maryland's VEIP are consistent with section 110(l) of the Clean Air Act and do not interfere with the corresponding attainment and maintenance of the NAAQS.

The modifications to the VEIP I/M program only affect the on-road mobile sources. Modeling for this non-interference analysis was performed using the MOVES5 emissions model and reflected the latest planning assumptions (local fleet age distribution, vehicle miles traveled, meteorology, fuel parameters, etc.) which are updated triennially in conjunction with the federal requirements for statewide National Emissions Inventory (NEI) development. Additional information on the modeling approach and parameters can be found in Part II of this SIP.

Table 2 through Table 6 represent the MOVES5 modeling results by nonattainment area, as well as for the two Maryland counties (Queen Anne's on the eastern shore and Washington County in western Maryland) designated attainment that have VEIP. The tables include individual and area-wide emissions results for NOx and VOC, the primary pollutants targeted by the I/M program.

The projected NOx and VOC emissions in tons per ozone season day are provided for the

Standards, 87 FR 194, October 7, 2022, pp. 60926.

¹⁰ U.S. Environmental Protection Agency (EPA). *The Final 2016 Exceptional Events Rule, Supporting Guidance Documents, Updated FAQs, and Other Rule Implementation Resources*. <https://www.epa.gov/air-quality-analysis/final-2016-exceptional-events-rule-supporting-guidance-documents-updated-faqs>

¹¹ U.S. Environmental Protection Agency (EPA). *Designations of Areas for Air Quality Planning Purposes; Maryland; Baltimore, MD 2015 8-Hour Ozone Nonattainment Area; Reclassification to Serious* (August 1, 2024). 89 FR 62663. <https://www.federalregister.gov/documents/2024/08/01/2024-16899/designations-of-areas-for-air-quality-planning-purposes-maryland-baltimore-md-2015-8-hour-ozone>

¹² U.S. Environmental Protection Agency (EPA). *2023 MDE O3 EE Concurrence Letter* (November 12, 2025). EPA-R03-OAR-2025-2532-0014. <https://www.regulations.gov/document/EPA-R03-OAR-2025-2532-0014>

required VEIP areas under two scenarios for 2026. Scenario 1 assumes that the VEIP I/M program remained unchanged from 2002, and Scenario 2 represents the current implementation of the VEIP I/M program in Maryland. The difference between the two scenarios is also displayed.

Table 2: 2026 On-road Mobile Source NOx and VOC Emissions for Maryland Counties in the Washington DC-MD-VA Nonattainment Area

County		Non-Attainment Area	Scenario 1: SIP Approved I/M Program		Scenario 2: Current Maryland I/M Program		Emissions Benefits of Scenario 2 Over Scenario 1	
			NOx	VOC	NOx	VOC	NOx	VOC
			(tons/O3 day)	(tons/O3 day)	(tons/O3 day)	(tons/O3 day)	(tons/O3 day)	(tons/O3 day)
24009	Calvert	Washington DC	0.7461	0.7284	0.7460	0.7282	0.0001	0.0002
24017	Charles	Washington DC	1.2654	1.1842	1.2654	1.1842	0.0000	0.0000
24021	Frederick	Washington DC	3.3263	2.1154	3.3257	2.1149	0.0006	0.0005
24031	Montgomery	Washington DC	6.2668	5.1430	6.2648	5.1428	0.0020	0.0002
24033	Prince George's	Washington DC	8.2913	5.7364	8.2902	5.7360	0.0011	0.0003
Washington DC Total			19.8959	14.9074	19.8920	14.9061	0.0039	0.0013

Table 3: 2026 On-road Mobile Source NOx and VOC Emissions for Maryland Counties in the Baltimore Maryland Nonattainment Area

County		Non-Attainment Area	Scenario 1: SIP Approved I/M Program		Scenario 2: Current Maryland I/M Program		Emissions Benefits of Scenario 2 Over Scenario 1	
			NOx	VOC	NOx	VOC	NOx	VOC
			(tons/O3 day)	(tons/O3 day)	(tons/O3 day)	(tons/O3 day)	(tons/O3 day)	(tons/O3 day)
24003	Anne Arundel	BNAA	5.4518	3.9931	5.4509	3.9927	0.0008	0.0004
24005	Baltimore	BNAA	7.9859	4.9828	7.9844	4.9820	0.0015	0.0009
24013	Carroll	BNAA	1.5304	1.4389	1.5301	1.4383	0.0003	0.0005
24025	Harford	BNAA	2.5670	1.8266	2.5668	1.8264	0.0003	0.0002
24027	Howard	BNAA	3.5022	1.9236	3.5013	1.9233	0.0009	0.0003
24510	Baltimore City	BNAA	3.3188	2.1005	3.3181	2.1001	0.0007	0.0004
BNAA Total			24.3561	16.2655	24.3516	16.2629	0.0045	0.0027

Table 4: 2026 On-road Mobile Source NOx and VOC Emissions for the Cecil County, MD Nonattainment Area

County		Non-Attainment Area	Scenario 1: SIP Approved I/M Program		Scenario 2: Current Maryland I/M Program		Emissions Benefits of Scenario 2 Over Scenario 1	
			NOx	VOC	NOx	VOC	NOx	VOC
			(tons/O3 day)	(tons/O3 day)	(tons/O3 day)	(tons/O3 day)	(tons/O3 day)	(tons/O3 day)
24015	Cecil	Cecil County	2.3473	0.9250	2.3471	0.9250	0.0002	0.0000
Cecil County Total			2.3473	0.9250	2.3471	0.9250	0.0004	0.0000

Table 5: 2026 On-road Mobile Source NOx and VOC Emissions for Queen Anne's County, Maryland

County		Non-Attainment Area	Scenario 1: SIP Approved I/M Program		Scenario 2: Current Maryland I/M Program		Emissions Benefits of Scenario 2 Over Scenario 1	
			NOx	VOC	NOx	VOC	NOx	VOC
			(tons/O3 day)	(tons/O3 day)	(tons/O3 day)	(tons/O3 day)	(tons/O3 day)	(tons/O3 day)
24035	Queen Anne's	Attainment	1.2102	0.5649	1.2100	0.5647	0.0002	0.0002
Queen Anne's County Total			1.2102	0.5649	1.2100	0.5647	0.0002	0.0002

Table 6: 2026 On-road Mobile Source NOx and VOC Emissions for Washington County, Maryland

County		Non-Attainment Area	Scenario 1: SIP Approved I/M Program		Scenario 2: Current Maryland I/M Program		Emissions Benefits of Scenario 2 Over Scenario 1	
			NOx	VOC	NOx	VOC	NOx	VOC
			(tons/O3 day)	(tons/O3 day)	(tons/O3 day)	(tons/O3 day)	(tons/O3 day)	(tons/O3 day)
24043	Washington	Attainment	3.9590	1.4820	3.9584	1.4817	0.0006	0.0003
Washington County Total			3.9590	1.4820	3.9584	1.4817	0.0006	0.0003

Tables 2 through 6 show no increase in NOx and VOC emissions in 2026 associated with modifications to Maryland's VEIP I/M program. Overall, the modeling indicates that the modifications to the VEIP program for the area provide emissions benefits equal to or greater than the current SIP approved I/M program and reduce NOx and VOC emissions in these areas. Since there are no increases in NOx and VOC emissions, there is no concern that these revisions in the Maryland I/M SIP will interfere with compliance with the ozone NAAQS in these attainment areas. MDE demonstrates in this SIP revision that changes to Maryland's VEIP are

consistent with section 110(l) of the Clean Air Act and will not interfere with the corresponding attainment and maintenance of the NAAQS.

3.2. Remaining NAAQS – PM, SO₂, NO₂, Lead and CO

PM and SO₂

Modifications to the VEIP I/M program in the fourteen Maryland counties would not increase direct PM_{2.5} or SO₂ emissions. This is because pollution control systems for light-duty gasoline vehicles subject to the VEIP I/M are not designed to reduce emissions for these pollutants; therefore, modifications to the program do not have any impact on ambient concentrations of these pollutants and will not interfere with attainment or any other requirement of the CAA with respect to these pollutants.

NO₂

Maryland has always been in compliance with the NO₂ standards, and the fourteen counties in Maryland with VEIP are designated attainment under the 2010 NO₂ NAAQS. All of the NO₂ monitors in the state are measuring below the annual NO₂ standard, and all near-road monitors are measuring below the 1-hour NO₂ standard. Modifications to the VEIP I/M have not impacted compliance with the NO₂.

Lead

With the introduction of unleaded gasoline, on-road mobile source emissions of lead have become irrelevant. Therefore, modifications in the VEIP I/M program in these counties will not interfere with attainment or any other requirement of the CAA in these counties with respect to the 2008 lead standard.

CO

On road mobile source CO emissions have been declining for decades due to the phase in of federal motor vehicle emissions standards; therefore, the modifications in the VEIP I/M program in these counties are not anticipated to affect the areas' continued attainment status for this standard.

4. Conclusion

Based on the analyses presented in this report, modifications to the VEIP in Maryland do not interfere with attainment or maintenance of the NAAQS for any of the six criteria pollutants. The modeling results in Section 3.1 indicate that the modifications to the VEIP provide emissions benefits equal to or greater than the current SIP-approved I/M program and reduce NO_x and VOC emissions in the I/M areas. MDE has therefore demonstrated in this SIP revision that changes to Maryland's VEIP are consistent with section 110(l) of the Clean Air Act and do not interfere with the attainment and maintenance of the NAAQS.



Maryland
Department of
the Environment

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Aruna Miller, Lt. Governor

Serena McIlwain, Secretary
Suzanne E. Dorsey, Deputy Secretary
Adam Ortiz, Deputy Secretary

State of Maryland Basic Motor Vehicle Inspection and Maintenance Program Certification for the 2015 Ozone National Ambient Air Quality Standard

SIP Number: 26-03

Part IV

Prepared for:

U.S. Environmental Protection Agency

Prepared by:

Maryland Department of the Environment



Certification that Maryland's Vehicle Emissions Inspection Program Addresses the Requirements of the 2015 National Ambient Air Quality Standards for Ozone in the Maryland Portion of the Washington, DC-MD-VA Ozone Nonattainment Area and Meets the Environmental Protection Agency's Basic Performance Standard for Motor Vehicle Inspection and Maintenance Programs

Purpose

The State of Maryland attests that the existing Maryland Vehicle Emissions Inspection Program (VEIP) as implemented in the Maryland portion of the Washington, DC-MD-VA Nonattainment Area addresses the basic performance standard for motor vehicle inspection and maintenance (I/M) programs as required under the 2015 Ozone National Ambient Air Quality Standard (NAAQS).

Background

On October 7, 2022, EPA reclassified the nonattainment area of the Washington DC-MD-VA area from Marginal nonattainment to Moderate nonattainment under the 2015 ozone NAAQS.¹ Consistent with the applicable provisions under Clean Air Act (CAA) section 182(b)(4), moderate ozone nonattainment areas with 1990 urbanized populations of 200,000 or more must implement a basic I/M program. Accordingly, Maryland is required to submit a SIP revision that certifies that the VEIP meets the basic I/M requirements in these nonattainment areas.

Program Description

See Part I of SIP 26-03 for program description.

Summary of Demonstration

In compliance with the CAA, EPA established a basic I/M performance standard, consisting of certain program elements that would provide a baseline of emissions reductions to be achieved in a state I/M program. States have the authority to determine the features of their I/M programs, as long as the state program provides the same or greater level of reductions as the performance standard program would provide. States must demonstrate the equivalence by modeling their program, compared to the performance standard program, using EPA's latest mobile source emissions model.

See Part II of SIP 26-03 for the performance standard modeling.

¹ U.S. Environmental Protection Agency (EPA). *Determinations of Attainment by the Attainment Date, Extensions of the Attainment Date, and Reclassification of Areas Classified as Marginal for the 2015 Ozone National Ambient Air Quality Standards* (October 7, 2022). 87 FR 60897. <https://www.federalregister.gov/documents/2022/10/07/2022-20460/determinations-of-attainment-by-the-attainment-date-extensions-of-the-attainment-date-and>



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State of Maryland Enhanced Motor Vehicle Inspection and Maintenance Program Certification for the 2015 Ozone National Ambient Air Quality Standard SIP Number: 26-03 Part V

**Prepared for:
U.S. Environmental Protection Agency**

**Prepared by:
Maryland Department of the Environment**



Certification that Maryland's Vehicle Emissions Inspection Program Addresses the Requirements of the 2015 National Ambient Air Quality Standards for Ozone in the Baltimore Nonattainment Area and the Cecil County, MD Nonattainment Area and Meets the Environmental Protection Agency's Enhanced Performance Standard for Motor Vehicle Inspection and Maintenance Programs

Purpose

The State of Maryland attests that the existing Maryland Vehicle Emissions Inspection Program (VEIP) as implemented in the Baltimore Nonattainment Area and the Cecil County, MD Nonattainment Area addresses the enhanced performance standard for motor vehicle inspection and maintenance (I/M) programs as required under the 2015 Ozone National Ambient Air Quality Standard (NAAQS).

Background

On July 30, 2024, EPA reclassified the Philadelphia-Wilmington-Atlantic City PA-NJ-MD-DE Nonattainment Area from Moderate to Serious under the 2015 ozone NAAQS.¹ On August 1, 2024, EPA reclassified the Baltimore, MD ozone nonattainment from Moderate to Serious nonattainment under the 2015 ozone NAAQS.²

Consistent with the applicable provisions under Clean Air Act (CAA) section 182(c)(3), serious ozone nonattainment areas must implement an enhanced I/M program. Accordingly, Maryland is required to submit a SIP revision that certifies that the VEIP meets the enhanced I/M requirements in these nonattainment areas.

Program Description

See Part I of SIP 26-03 for program description.

Summary of Demonstration

In compliance with the CAA, EPA established an enhanced I/M performance standard, consisting of certain program elements that would provide a baseline of emissions reductions to be achieved in a state I/M program. States have the authority to determine the features of their I/M programs, as long as the state program provides the same or greater level of reductions as the performance standard program would provide. States must demonstrate the equivalence by modeling their program, compared to the performance standard program, using EPA's latest mobile source emissions model.

See Part II of SIP 26-03 for the performance standard modeling.

¹ U.S. Environmental Protection Agency (EPA). *Designations of Areas for Air Quality Planning Purposes; Pennsylvania, New Jersey, Maryland, Delaware; Philadelphia-Wilmington-Atlantic City, PA-NJ-MD-DE 2015 8-Hour Ozone Nonattainment Area; Reclassification to Serious* (July 30, 2024). 89 FR 61025.

<https://www.federalregister.gov/documents/2024/07/30/2024-16570/designations-of-areas-for-air-quality-planning-purposes-pennsylvania-new-jersey-maryland-delaware>

² U.S. Environmental Protection Agency (EPA). *Designations of Areas for Air Quality Planning Purposes; Maryland; Baltimore, MD 2015 8-Hour Ozone Nonattainment Area; Reclassification to Serious*. (August 1, 2024). 89 FR 62663.

<https://www.federalregister.gov/documents/2024/08/01/2024-16899/designations-of-areas-for-air-quality-planning-purposes-maryland-baltimore-md-2015-8-hour-ozone>



Maryland
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State of Maryland Reasonably Available Control Technology for the 2015 Ozone National Ambient Air Quality Standards Serious Classification SIP Number: 26-03 Part VI

**Prepared for:
U.S. Environmental Protection Agency**

**Prepared by:
Maryland Department of the Environment**



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1. Serious RACT Demonstration

The Reasonably Available Control Measures (RACM) requirement is rooted in Section 172(c)(1) of the Clean Air Act (CAA), which directs states to “provide for implementation of all reasonably available control measures as expeditiously as practicable”. In 1992, EPA published general guidance (the “General Preamble”) describing how it intended to implement the state implementation plan requirements of Title I of the CAA, including RACM analysis requirements.¹ In the General Preamble, EPA explains that it interprets Section 172(c)(1) as a requirement that states incorporate in a SIP all reasonably available control measures that would advance a region’s attainment date.

A subset of RACM are the NO_x and VOC control measures that implement a Reasonably Available Control Technology (RACT) level of control on a major emission source or source category. States that are designated as “moderate” or higher required to implement RACT “as expeditiously as practicable but no later than the sooner of 18 months after the proposed SIP submittal deadline or the beginning of the relevant attainment year ozone season.”² The CAA Sections 182(b)(2), 184(b)(1) and 182(f) and USEPA’s 2018 Ozone Implementation Rule require “moderate” and above nonattainment areas and all states in the Ozone Transport Region (OTR), including Maryland, to adopt RACT for all existing VOC and NO_x source categories covered by a Control Techniques Guideline (CTG), and for all other major sources of VOC and NO_x. Maryland has retained its major source levels at 25 tons per year for VOC and NO_x sources in all nonattainment areas in the state even though none of its nonattainment areas are classified as “severe.” For all other Maryland counties, the major source levels are 50 tons per year for VOC and 100 tons per year for NO_x. Maryland will retain these stringent thresholds to fulfill its Serious RACT requirements.

Maryland has submitted RACT SIPs for previous standards and designations. In 2018, MDE submitted a RACT SIP (#18-04) for the 2008 ozone NAAQS,³ and in 2020, MDE submitted a RACT SIP (#20-11) for the 2015 ozone NAAQS.⁴ Based on the review of technologies in its

¹ U.S. Environmental Protection Agency (EPA). *State Implementation Plans; General Preamble for the Implementation of Title 1 of the Clean Air Act Amendments of 1990*. (April 16, 1992). 57 FR 13498. Page 13498. https://archives.federalregister.gov/issue_slice/1992/4/16/13412-13570.pdf

² U.S. Environmental Protection Agency (EPA). *State Implementation Plan Submittal Deadlines and Implementation Requirements for Reclassified Nonattainment Areas Under the Ozone National Ambient Air Quality Standards*. (January 17, 2025). 90 FR 5651. <https://www.federalregister.gov/documents/2025/01/17/2025-00336/state-implementation-plan-submittal-deadlines-and-implementation-requirements-for-reclassified>

³ Maryland Department of the Environment (MDE). *State of Maryland 0.070 ppm 8-Hour Ozone Reasonably Available Control Technology (RACT) State Implementation Plan*. (August 10, 2020). <https://mde.maryland.gov/programs/air/AirQualityPlanning/Documents/SIPDocuments/OzoneRACT/OzoneRACT2015.pdf>

⁴ Maryland Department of the Environment (MDE). *State of Maryland 0.075 ppm 8-Hour Ozone Nitrogen Oxide Reasonably Available Control Technology (NO_x RACT) State Implementation Plan*. (July 2, 2018). https://mde.maryland.gov/programs/air/AirQualityPlanning/Documents/RACT%20-%20NOx/Proposed_%20MD_RACT_SIP_NOX_%2075ppbNAAQS.pdf

RACT SIPs, MDE has found no data indicating that the existing levels of control for these source categories are no longer RACT.

Overall, Maryland has fulfilled its Serious RACT requirements for the 2015 Ozone NAAQS.



Maryland
Department of
the Environment

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State of Maryland Enhanced Monitoring Plan

SIP Number: 26-03

Part VII

Prepared for:
U.S. Environmental Protection Agency

Prepared by:
Maryland Department of the Environment



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1. Enhanced Monitoring Plan Demonstration

Section 182(c)(1) of the Clean Air Act (CAA) requires Serious nonattainment areas to provide an enhanced monitoring plan (EMP). Additionally, States in the Ozone Transport Region (OTR) are required to submit EMPs to the U.S. Environmental Protection Agency (EPA). Maryland Department of the Environment (MDE) has implemented the following measures as elements of the required EMP:

- Year-round O₃ monitoring at Piney Run, Essex, HU-Beltsville, and Horn Point as of 2020.
- Additional VOC measurements at HU-Beltsville, as of June 2019, consisting of eight 3-hour canister samples collected every third day June through August.
- PAMS analysis performed on air toxics canisters collected at HU-Beltsville, Essex, Lake Montebello, and Howard County Near Road.
- Operation of radar wind profilers at Piney Run, HU-Beltsville, and Horn Point as of 2020.

MDE's most recent monitoring plan for calendar year 2027 can be found on MDE's Air Monitoring Program's webpage in addition to past monitoring plans.¹

Maryland has fulfilled its requirements relating to enhanced monitoring under CAA Section 182(c)(1).

¹ Maryland Department of the Environment (MDE). *Ambient Air Monitoring Network Plan for Calendar Year 2027* (April 14, 2026).
<https://mde.maryland.gov/programs/air/AirQualityMonitoring/Pages/Network.aspx>