Guidance on Biennial Performance Evaluation Requirements for Enhanced Vehicle Inspection and Maintenance (I/M) Programs

United States Environmental Protection Agency

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Transportation and Climate Division
Office of Transportation and Air Quality
U.S. Environmental Protection Agency

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1. Purpose of Guidance

The Environmental Protection Agency (EPA) is providing this guidance to clarify how the biennial performance evaluation requirements can be met for states with mandatory Enhanced vehicle emission inspection and maintenance (I/M) programs. Biennial performance evaluations are a necessary element of an I/M program that is required by the Clean Air Act (CAA) to be operated at the Enhanced performance level. Performance evaluations allow the effectiveness and emission reduction benefits of an Enhanced I/M program to be quantified every two years. This document is a minor update to the previous version of this guidance that was released in June 2020.[1] EPA is releasing this update to correct the I/M compliance factor formula and make that formula consistent with EPA's MOVES3 Technical Guidance.[2] In addition to updating the examples in the Appendix with those formula changes, this guidance includes updated reference cites and contact information. This document supersedes the previous June 2020 version of this guidance.

Elsewhere within the document, this guidance reaffirms and expounds upon EPA's previous program evaluation guidance, including the 2004 document entitled, *Guidance on Use of Remote Sensing for Evaluation of I/M Program Performance (EPA 420-B-04-010, July 2004)*.[3] This new guidance is to be used as a supplement, not a replacement, to the 2004 guidance document and as such, only a few relevant portions will be repeated here. This guidance supplements *Guidance on Use of Remote Sensing for Evaluation of I/M Program Performance* with additional strategies that more specifically address the prevalence of Onboard Diagnostic (OBD) testing in today's I/M programs.

The 2004 guidance mainly covers methods for conducting performance evaluations using out-of-program data (e.g., data obtained from remote sensing devices (RSD)).[4] It should also be noted that due to the variabilities and biases of the various program evaluation methodologies, an evaluation based on multiple methods, including using both out-of-program data and in-program data, will provide a more accurate estimate of overall program performance than simply relying on one method alone. To this end, this guidance also outlines a strategy to quantify an I/M program's effectiveness using in-program data in conjunction with mobile source emission factor modeling.

In support of efforts to increase compliance, EPA developed this guidance to help state and local governments meet their CAA and regulatory requirements in Enhanced I/M program areas. This guidance also provides options and reflects the latest technologies and practices in use by Enhanced I/M programs across the United States. Finally, this guidance was written as a result

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[1] *Guidance on Biennial Performance Evaluation Requirements for Enhanced Vehicle Inspection and Maintenance (I/M) Programs (EPA 420-B-20-040, June 2020).*

[2] *MOVES3 Technical Guidance: Using MOVES to Prepare Emission Inventories for State Implementation Plans and Transportation Conformity*, (EPA-420-B-20-052, November 2020), nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P1010LY2.pdf

[3] nepis.epa.gov/Exe/ZyPdf.cgi?Dockey=P1002J6C.pdf

[4] Such data can also be collected to satisfy the on-road testing requirements for Enhanced I/M programs. For more information, see *Guidance for On-Road Testing Requirements for Enhanced Vehicle Inspection and Maintenance (I/M) Programs* (EPA-420-B-20-020, March 2020). See nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P100YQX8.pdf.

of a 2018 audit by the Office of Inspector General (OIG) regarding EPA oversight of Enhanced I/M programs entitled, *Collecting Additional Performance Data from States Could Help EPA Better Assess the Effectiveness of Vehicle Inspection and Maintenance Programs* (OPE-FY17-0018).[5]

[5] This report was released on September 25, 2018 and is available at: www.epa.gov/office-inspector-general/report-collecting-additional-performance-data-states-would-help-epa-better.

2. What are the Clean Air Act and regulatory requirements?

The 1990 Amendments to the CAA required I/M programs for certain areas across the country based upon various criteria, such as air quality status, population, and/or geographic location. The CAA established two performance levels of I/M programs: "Basic" I/M for ozone nonattainment areas classified as moderate, and "Enhanced" I/M. Pursuant to CAA sections 182, 184 and 187, Enhanced I/M programs are mandated in the following areas:

- All serious or worse ozone nonattainment areas that had a 1980 urban population of 200,000 or more;

- Metropolitan statistical areas with a 1990 population of 100,000 or more in the Ozone Transport Region (regardless of their air quality classification); and

- All moderate or worse CO nonattainment areas with a design value greater than 12.7 parts per million (ppm) at the time of classification that had a 1980 urban population of 200,000 or more.

One of the obligations of an Enhanced I/M program is to conduct a performance evaluation every two years. Among other things, section 182(c)(3)(C) of the CAA requires that all states subject to Enhanced I/M shall:

> *...biennially prepare a report to the Administrator which assesses the emission reductions achieved by the program required under this paragraph based on data collected during inspection and repair of vehicles. The methods used to assess the emission reductions shall be those established by the Administrator.*

In 1992, EPA promulgated the original I/M rule at 40 CFR 51 Subpart S, and EPA has since amended the rule several times. The I/M rule establishes the technical, procedural and administrative requirements to be met by Basic and Enhanced I/M programs. Within the I/M rule, section 51.353 *Network type and program evaluation* establishes the requirements for a biennial program evaluation:

> *(c) Program evaluation. Enhanced I/M programs shall include an ongoing evaluation to quantify the emission reduction benefits of the program, and to determine if the program is meeting the requirements of the Clean Air Act and this subpart.*
>
> *(1) The State shall report the results of the program evaluation on a biennial basis, starting two years after the initial start date of mandatory testing as required in §51.373 of this subpart.*
>
> *(2) The evaluation shall be considered in establishing actual emission reductions achieved from I/M for the purposes of satisfying the requirements of sections 182(g)(1) and 182(g)(2) of the Clean Air Act, relating to reductions in emissions and compliance demonstration.*

> *(3) The evaluation program shall consist, at a minimum, of those items described in paragraph (b)(1) of this section and program evaluation data using a sound evaluation methodology, as approved by EPA, and evaporative system checks, specified in §51.357(a) (9) and (10) of this subpart, for model years subject to those evaporative system test procedures. The test data shall be obtained from a representative, random sample, taken at the time of initial inspection (before repair) on a minimum of 0.1 percent of the vehicles subject to inspection in a given year. Such vehicles shall receive a State administered or monitored test, as specified in this paragraph (c)(3), prior to the performance of I/M-triggered repairs during the inspection cycle under consideration.*
>
> *(4) The program evaluation test data shall be submitted to EPA and shall be capable of providing accurate information about the overall effectiveness of an I/M program, such evaluation to begin no later than 1 year after program start-up.*
>
> *(5) Areas that qualify for and choose to implement an OTR low enhanced I/M program, as established in §51.351(h), and that claim in their SIP less emission reduction credit than the basic performance standard for one or more pollutants, are exempt from the requirements of paragraphs (c)(1) through (c)(4) of this section. The reports required under §51.366 of this part shall be sufficient in these areas to satisfy the requirements of Clean Air Act for program reporting.*

Section 51.353(c)(3) cross-references to section 51.353(b)(1) for the minimum program evaluation items. However, due to an error over the course of several I/M rule amendments, paragraph (b)(1) was not included and is listed as (b) and "Reserved." EPA has committed to revise the rule to remove this reference the next time the rule is revised for more substantial revisions. This issue will be discussed further in Section 3 of this document below. States conducting I/M program performance evaluations should consult this and the other noted guidance for the appropriate methods and elements.

In addition, the reporting section of the I/M rule requires qualitative program evaluations of all I/M programs (both Basic and Enhanced) biennially. Section 51.366(e) states that all I/M programs shall submit to EPA by July of every other year, biennial reports addressing:

> *(1) Any changes made in program design, funding, personnel levels, procedures, regulations, and legal authority, with detailed discussion and evaluation of the impact on the program of all such changes; and*
>
> *(2) Any weaknesses or problems identified in the program within the two-year reporting period, what steps have already been taken to correct those problems, the results of those steps, and any future efforts planned.*

Many states with Enhanced I/M programs choose to include these additional biennial qualitative program reporting elements with their quantitative biennial performance evaluations.

3. What OIG recommendation is addressed by this guidance?

The OIG report included a finding that several states with Enhanced I/M programs were not conducting biennial program evaluations that included estimates of the emission reduction benefits of the program, as prescribed by regulation.[6] As a result, the OIG highlighted that this hampered EPA's ability to properly assess the effectiveness of these I/M programs:

> *When states do not conduct program evaluations, the EPA and states do not have empirical evidence to determine whether the inspection and maintenance program is achieving its projected emission reductions. This lessens the EPA's assurance that the programs are achieving the anticipated emission reductions and air quality improvements projected for those programs. Further, in the absence of these reports, deficiencies in the program can go unidentified and uncorrected.*[7]

The OIG also noted that, due to a missing reference, the regulation for I/M program evaluations caused confusion for some states:

> *Paragraph 40 CFR § 51.353(c)(3) describes the program evaluation requirement and includes a cross reference to another paragraph for a description of the minimum program items. However, the referenced paragraph was marked "reserved" and provided no additional information.*[8]

In addition, the OIG indicated some confusion with the EPA's program evaluation guidance. Some states did not realize the 2004 guidance could be used in conjunction with OBD testing or for I/M programs that no longer conduct tailpipe testing.[9]

As a result of these and other findings, the OIG audit made several recommendations to EPA's Office of Air and Radiation (OAR) for assuring consistent and effective implementation of Enhanced I/M programs. The complete list of the OIG's recommendations may be found in Appendix A of the OIG report. Recommendation #3 of the OIG's 2018 report addressed mandatory biennial performance evaluations in Enhanced I/M areas, and OAR responded:

> ***Recommendation 3:*** *Revise the vehicle inspection and maintenance rule to remove the cross reference to Title 40, § 51.353(b)(1) of the Code of Federal Regulations, and provide defined evaluation methodology guidance to enable states to quantify emission reductions.*
>
> ***Response 3:*** *OAR agrees with this recommendation and – as noted by OIG in its draft report – intends to direct EPA's Office of Transportation and Air Quality (OTAQ) to revise the I/M rule to remove the reference the next time the rule is revised for more substantial revisions. Additionally, and in the interim, OAR will direct OTAQ to issue*

[6] *Collecting Additional Performance Data from States Could Help EPA Better Assess the Effectiveness of Vehicle Inspection and Maintenance Programs* (OPE-FY17-0018); pg. 11.
[7] Ibid. pg. 12.
[8] Ibid. pg. 11.
[9] Ibid. pg. 12.

guidance to clarify this provision as well as that enhanced I/M programs that are not already using some other approved program evaluation methodology should be using the OTAQ guidance document issued in July 2004, Guidance on Use of Remote Sensing for Evaluation of I/M Program Performance (EPA420-B-04-010).[10]

To satisfy this recommendation by clearing up some of the confusion that states with Enhanced I/M programs may have regarding the methods and requirements for biennial performance evaluations, OTAQ worked closely with the EPA Regional Offices to develop this guidance. In the next two sections, this document will briefly outline example methods to evaluate the emission benefits of an OBD-based program using either RSD data (Section 4) and mobile source modeling (Section 5).

4. Performance Evaluations of an OBD-based I/M program using methods from the 2004 Guidance

As part of its response to the 2018 OIG audit report, EPA reaffirms that the 2004 guidance[11] may be used to evaluate the effectiveness and emissions benefits of an I/M program that conducts OBD testing.

The 2004 guidance details three methods on how to use independent or out-of-program data (i.e., data collected via an on-road testing regimen employing RSD and/or roadside pullovers)[12] to perform I/M program evaluations. These three methods are:

- Step Change Method,
- Comprehensive Method, and
- Reference Analysis Method.

The Step Change Method is useful for evaluating the short-term impacts of a program during the brief window after a new I/M program is implemented or after changes to an existing program. Using the RSD data collected on a fleet of vehicles in an I/M program area, as described in the 2004 guidance, the fleet is then divided into two sub-fleets, based on whether individual vehicles have been tested under the current I/M program or not. The emissions of the two sub-fleets are then compared. After accounting for differences in vehicle type and age, the difference in the emissions of the tested fleet and the untested fleet is the estimated benefit of the current I/M program in reducing emissions.

The Comprehensive Method is similar to the Step Change Method in that it can evaluate the short-term benefits (e.g., for a single inspection cycle) of an I/M program through comparison with RSD data from two sub-fleets in the same I/M program area. However, the Comprehensive Method involves comparing RSD data from the sub-fleet measured prior to initial I/M testing with the sub-fleet measured during or after final I/M testing. The difference in average measured

[10] Ibid. pg. 24.
[11] *Guidance on Use of Remote Sensing for Evaluation of I/M Program Performance (EPA 420-B-04-010, July 2004);* nepis.epa.gov/Exe/ZyPdf.cgi?Dockey=P1002J6C.pdf.
[12] For the purposes of this document, out-of-program data collected either by RSD or roadside pullovers will generally be referred to as "RSD data".

emissions between the sub-fleets yields the benefit of the I/M program for that inspection period. Sub-fleets can be further divided by vehicle type and/or age (model year or model year groups). Then the average emissions for each vehicle type or age group can be weighted by the corresponding percentage of these groups in the I/M fleet thus allowing the benefits of the RSD-tested fleet to match the I/M-tested fleet.

The third method described in the 2004 guidance, the Reference Analysis Method, estimates the benefits of an I/M program on a vehicle fleet by comparing the emissions of a fleet subject to I/M with estimated fleet emissions if no I/M program were in place. The Reference Method involves comparing RSD data from vehicles registered in an I/M program area to vehicles from a non-I/M program (or reference) area. The difference in total fleet emissions between the I/M program area and the untested reference area represents the emission reductions benefit of the I/M program.

States with Enhanced I/M programs can continue to refer to EPA's 2004 guidance for applying the above methods. In addition, this guidance will elaborate on how the Comprehensive Method in the 2004 guidance could also be used for states with OBD testing wishing to conduct a biennial I/M program performance evaluation using RSD data.

As noted in the OIG report, some states did not realize the 2004 guidance could be used in conjunction with OBD testing. Some of the confusion might be due to the fact the 2004 guidance does not specifically mention OBD testing. OBD testing does not yield emission measurements, but rather verifies the operation of a vehicle's emission control system. Also, the 2004 guidance indicates that the collected RSD data is compared to actual emissions obtained from an in-program tailpipe test. Indeed, on page 44, the 2004 guidance does say:

> *The Comprehensive Method differs from other remote sensing methods, in that it explicitly compares emissions reductions of the I/M tested fleet as measured by the program and as measured independently by remote sensing.*

However, instead of using in-program data for this comparison, RSD data can also be used for determining the post I/M-tested fleet's average emissions with this method. RSD data can be used for comparing vehicle sub-fleets both before and after their I/M program test to determine the net emissions benefit. Since a pre-inspection test RSD-sampled fleet is compared to a post-inspection RSD-sampled fleet, it is irrelevant what type of inspection is conducted by the I/M program. Thus, by analyzing the emission measurements of vehicles sampled prior to, and after, their regularly-scheduled OBD test, the emissions benefit of the OBD-tested fleet can be estimated. Several states are currently using the Comprehensive Method in developing their I/M programs' biennial performance evaluations.

Using RSD for program evaluations is a highly complex process. Agencies wishing to conduct these analyses should familiarize themselves with the 2004 guidance and develop a minimum level of expertise with the Comprehensive Method procedures, found on pages 45-47 of the 2004 guidance, to ensure reliable data are collected and analyses performed. Below are some additional considerations when conducting a performance evaluation of an OBD I/M program using the Comprehensive Method:

- Pre-Inspection Repairs - Since OBD testing has become prevalent, initial fail rates have trended downward. This is partially due to the newer vehicles entering the fleet being cleaner and emission controls being more durable. Motorist education and awareness of OBD testing is also a contributing factor. One of the benefits of the OBD system is that it allows the motorist to know beforehand that the vehicle would fail the I/M test when the malfunction indictor light (MIL) is illuminated. When an inspection is coming due, a motorist, in seeing a lit-MIL, is likely to get the vehicle repaired prior to the inspection. An advantage of the Comprehensive Method is that it allows the effect of pre-test repairs on average emissions to be estimated. The 2004 guidance addresses how to handle this possible bias of these pre-inspection repairs when developing a program evaluation by eliminating vehicles from the RSD-sampled fleet that are within a month of their scheduled inspection:

  > *To minimize the effect of pre-test repairs on baseline emissions, remote sensing measurements made within a month before a scheduled I/M test can be excluded from the analysis (i.e., remote sensing measurements from 1 to 3 months prior to the initial I/M test can be compared with remote sensing measurements from 0 to 3 months after the final I/M test).*[13]

  This paragraph also demonstrates that the emission measurements from prior to the initial test, and after the final test, can both be obtained from RSD data, which is particularly applicable to performance evaluation analyses on I/M programs with OBD testing.

- Analysis using RSD data from vehicles that fail an initial test but pass a subsequent test – To allow the limited amount of RSD-sampled data to best capture the I/M program's effectiveness, the post-test average emissions may be estimated from only vehicles that fail their initial test but pass a subsequent test. Per the Comprehensive Method, vehicles in the RSD-sampled fleet can be further categorized into several groups, based on the results of their I/M test(s): 1) vehicles that pass their initial I/M test; 2) vehicles that fail their initial test but pass a subsequent test; 3) vehicles that fail their initial test and do not receive a subsequent I/M test; and 4) vehicles that fail their initial test and fail a subsequent I/M test.[14] Given that the benefit to an I/M program comes from the repair of vehicles as a result of inspection, only vehicles from category #2 (vehicles that fail their initial test but pass a subsequent test) receive benefit from the I/M program. Therefore, agencies conducting a performance evaluation of an OBD-tested fleet may wish to focus their post-inspection RSD fleet data analysis only on this category #2 group. The other three I/M test-outcome categories may be eliminated from the calculation of post-OBD inspection emissions averages.

[13] *Guidance on Use of Remote Sensing for Evaluation of I/M Program Performance (EPA 420-B-04-010, July 2004); pg. 47.*
[14] Ibid. pg. 46.

5. Program Evaluation Using Mobile Source Modeling

This section outlines how mobile source modeling can be used to perform a biennial performance evaluation for an I/M program. EPA's Motor Vehicle Emission Simulator (MOVES) is a state-of-the-science emission modeling system that estimates emissions for mobile sources at the national, county, and project levels for criteria air pollutants.[15,16] MOVES includes the capability of modeling the essential elements of an I/M program.

For a program evaluation, MOVES can be used to determine the benefits of an I/M program by comparing the emissions of the current I/M program to a no-I/M scenario. This result is analogous to that achieved with the Reference Method described in the 2004 guidance. In fact, the 2004 guidance references mobile source emission models to be used in conjunction with the Reference Method in performing an I/M program evaluation:

> *Finally, emission factor modeling output from MOBILE or another model that predicts emissions of the inspected and non-inspected fleets can then be used to compare with real-world differences in inspected and non-inspected fleets measured by the remote sensing data.*[17]

And

> *RSD emission differences in inspected and reference fleets can be compared to the differences predicted by EPA mobile models to determine an I/M program effectiveness rating.*[18]

To use MOVES to perform a biennial program evaluation, two model runs are needed:

1. I/M run using actual program details (the "Actual I/M run"): This run should include all the relevant local inputs used for state implementation plan (SIP) demonstration modeling and include the actual I/M program details. See the *Inspection and Maintenance Programs* section of the most current MOVES Technical Guidance for a list of relevant I/M program inputs and detailed instructions on how to create an I/M input table.[19] However, this run may differ from runs conducted for SIP purposes. For the purposes of the biennial program evaluation, a MOVES I/M input known as the Compliance Factor should reflect the actual program performance, as reported by the I/M program in its annual reports (pursuant to 40 CFR 51.366) for the years covered by the corresponding performance evaluation period or from data derived from the program's

[15] For more detailed information on MOVES visit: www.epa.gov/moves.
[16] In California, a different onroad emissions model, EMFAC, is used for regulatory purposes instead of MOVES.
[17] *Guidance on Use of Remote Sensing for Evaluation of I/M Program Performance (EPA 420-B-04-010, July 2004);* nepis.epa.gov/Exe/ZyPdf.cgi?Dockey=P1002J6C.pdf;
[18] Ibid. pg. 53.
[19] As of the date of release of this guidance, the current version of the MOVES Technical Guidance is *MOVES3Technical Guidance: Using MOVES to Prepare Emission Inventories for State Implementation Plans and Transportation Conformity*, (EPA-420-B-20-052, November 2020), nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P1010LY2.pdf.Check the latest MOVES model webpage for any updated guidance on the latest version of MOVES: www.epa.gov/moves/latest-version-motor-vehicle-emission-simulator-moves.

on-road testing regimen, rather than projected program data. See Section 5.2 *Compliance Factor Parameters and Calculation* for further information.

2. No-I/M program run: This run should be functionally the same as the I/M run described above (i.e. the RunSpec and Input Database should be the same) but the "No I/M Program" box must be checked within I/M tab of the MOVES County Data Manager. Checking the "No I/M program" check box will clear all existing I/M data from the input database and set the database to a no I/M status.

The net difference in emissions between the No-I/M run and the Actual I/M run is the emissions benefit of the I/M program for the purposes of the biennial program evaluation. Similar to performance standard modeling, this estimated actual I/M program evaluation benefit can be compared to the target benefit of the I/M program established in the SIP.

5.1 Background on the Use of Modeling for Program Evaluation

EPA believes that the use of MOVES for program evaluations is a viable option that is consistent with I/M program implementation to date, including the continued reliance on OBD technology. The provisions for biennial performance evaluations were added to the I/M rule at 40 CFR 51 Subpart S in 1998 at the beginning of the transition to OBD testing in I/M programs. At the time, EPA's mobile source modeling system was MOBILE. But there was no accounting for the benefit of OBD I/M testing in the model until the release of MOBILE6.0 in 2002. In the proposal for the 1998 amendment to the I/M rule, EPA stated that:

> *The program effectiveness evaluation does not itself produce emission reductions. Rather, the program evaluation is intended to confirm that emission reductions projected by modeling and claimed in the states' implementation plans have been achieved in actual practice.*[20]

Thus, if emission reduction projections are made using modeling, it is appropriate to assess these projections using the latest available emissions model based on actual data (obtained from RSD or I/M program test results).

Similarly, prior to the release of the 2004 guidance which detailed the use of RSD data in program evaluations, EPA had issued the 1998 document entitled, *Inspection and Maintenance (I/M) Program Effectiveness Methodologies* (EPA420-S-98-015, October 1998).[21] This document outlined three alternative I/M program evaluation methodologies. One of those methods relied on modeling data as an element of a performance evaluation. At the time, the I/M program data was obtained from tailpipe testing and then correlated to a benchmark program to determine program effectiveness. Today, however, I/M program testing is characterized by OBD data. Over the years, with the advancements in mobile source emissions modeling, including the incorporation of various sources of benchmark data, EPA's model effectively correlates OBD data to fleet emissions while accounting for local I/M program variables. Thus,

[20] 62 FR 48196, September 19, 1987.
[21] https://nepis.epa.gov/Exe/ZyPDF.cgi/P1008F3N.PDF?Dockey=P1008F3N.PDF.

EPA's mobile source modeling system uses data obtained from the I/M program-tested fleet in estimating the actual emission reductions of the I/M program.

5.2 Compliance Factor Parameters and Calculation

MOVES uses the compliance factor input to account for I/M program compliance rates, waiver rates, failure rates, and adjustments needed to account for the fraction of vehicles within a source type that are covered by the I/M program (these last adjustments will be referred to here as the "regulatory class coverage adjustment"). The compliance factor is entered as a number from 0 to 100 and represents the percentage of vehicles within a source type that actually receive the benefits of the program. Each row in a MOVES IMCoverage Table is a unique IMProgramID that represents a specific combination of vehicle type, test type, etc., therefore, each row may have a unique computed compliance factor value. The compliance factor entered in MOVES is calculated as: $CF = CR \times (1 - WR \times FR) \times RCCA$

Where CF = Compliance factor
CR = Compliance rate
WR = Waiver rate
FR = Failure rate
$RCCA$ = Regulatory class coverage adjustment

The compliance factor parameters are detailed in the *Inspection and Maintenance Programs* section of the most current MOVES Technical Guidance.[22] Descriptions of the compliance factor parameters are provided below:

- Compliance rate - the percentage of vehicles in the fleet covered by the I/M program that complete the I/M program and receive either a certificate of compliance or a waiver. However, the compliance rate can also be determined using out-of-program data collected from the Enhanced I/M program's required on-road testing regimen, such as RSD sampling. The sampled fleet can be compared to the state's vehicle registration database and emission inspection databases to estimate the percentage of the sampled fleet that completed the I/M Program during the inspection cycle covered by this evaluation period.

- Waiver rate - the fraction of initially failed vehicles receiving a waiver. The waiver rate should be calculated as the number of initially failed (OBD or tailpipe tested) vehicles receiving a waiver divided by the total number of vehicles initially failing the tailpipe or OBD test types. For more information on obtaining these vehicle counts from actual program test data, see Section 5 of *Guidance on Vehicle Inspection and Maintenance*

[22] As of the release of this guidance, the current version of the MOVES Technical Guidance is *MOVES3 Technical Guidance: Using MOVES to Prepare Emission Inventories for State Implementation Plans and Transportation Conformity*, (EPA-420-B-20-052, November 2020), https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P1010LY2.pdf. Check the latest MOVES model webpage for updated guidance on the latest version of MOVES: https://www.epa.gov/moves/latest-version-motor-vehicle-emission-simulator-moves.

(I/M) Test Data Statistics as Part of Annual I/M Reporting Requirements.[23] The waiver rate can therefore be calculated by the equation:

$$Waiver\ Rate = \frac{\#Waivered\ Vehicles}{\#Initial\ OBD\ Failed\ Veh. + \#Initial\ Tailpipe\ Failed\ Veh.}$$

- Failure Rate - the fraction of all tested vehicles that fail an initial I/M test (regardless of the vehicle's final outcome). This is calculated as the number of vehicles that fail an initial I/M test divided by the number of unique vehicles tested:

$$Failure\ Rate = \frac{Initially\ Failing\ Vehicles}{Unique\ Vehicles\ Tested}$$

- Regulatory Class Coverage Adjustment - I/M programs entered in MOVES can only be applied by source types. However, I/M programs and source type may be inconsistent with state I/M program regulations that define I/M programs by the vehicle weight classes. Since MOVES source types are a composite of several vehicle weight classes, applying I/M benefits to the entire MOVES source type may be inappropriate. The MOVES Technical Guidance contains a table of regulatory class coverage adjustments to account for this discrepancy. The adjustments are percentages of VMT by the various regulatory weight classes within a source type.

For the "Actual I/M run" described above, the compliance factor parameters (i.e. compliance rate and waiver rate) should reflect the actual program performance for the years covered by the corresponding performance evaluation period or from data derived from the program's on-road testing regimen, rather than projected program data. Because a biennial performance evaluation covers the span of two years, the compliance factor used in the MOVES "Actual I/M run" should be a weighted average based on the total number of unique vehicles tested[24] in the respective years covered by the biennial program evaluation. See the Appendix for an example of a compliance factor calculation.

6. Who can I contact for more information on this guidance?

For specific questions concerning I/M for a particular area, please contact the appropriate EPA Regional Office. A list of the EPA Regional mobile source contacts can be found at: https://www.epa.gov/transportation-air-pollution-and-climate-change/office-transportation-and-air-quality-contacts Section 16.2, last page.

For general questions about this guidance, please see the *Office of Transportation and Air Quality Contacts by Topic* document available at www.epa.gov/transportation-air-pollution-and-

[23] *Guidance on Vehicle Inspection and Maintenance (I/M) Test Data Statistics as Part of Annual I/M Reporting Requirements* (EPA-420-B-20-030, May 2020); https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P100ZBX7.pdf; p. 4-9.
[24] Ibid. pg. 5.

climate-change/office-transportation-and-air-quality-contacts. A contact person is listed under "Inspection & Maintenance (I/M) programs."

Additional information regarding vehicle emission I/M programs can be found on EPA's website at: www.epa.gov/state-and-local-transportation/vehicle-emissions-inspection-and-maintenance.

For more information on EPA's MOVES mobile source emissions modeling, visit: www.epa.gov/moves.

7. Does this guidance create any new requirements?

No, this guidance is based on CAA requirements, existing associated regulations, and does not create any new requirements. The CAA and EPA's I/M rule at 40 CFR Part 51, Subpart S contain legally binding requirements. This document is not a substitute for those provisions or regulations, nor is it a regulation itself. Thus, it does not impose legally binding requirements on EPA, states, or the regulated community, and may not apply to a particular situation based upon the circumstances. EPA retains the discretion to consider and adopt approaches on a case-by-case basis that may differ from this guidance but still comply with the statute and applicable regulations. This guidance may be revised periodically without an opportunity for public comment.

APPENDIX: Sample Compliance Factor Calculation

Example 1

The example from the MOVES3 Technical Guidance section 1.1.1.1. "Example Compliance Factor Calculation" gives the following scenario: an I/M program that targets trucks less than 8501 lbs GVWR (i.e., EPA weight classes LDT1, LDT2, LDT3, and LDT4) would include some vehicles from two MOVES source types: passenger trucks (sourceTypeID 31) and light commercial trucks (32). Users should first determine the compliance rate, waiver rate and failure rate for the trucks covered by that program. For this example, we will assume that the compliance rate is 95%, the waiver rate is 0.25, and the failure rate is 0.20.

The user would then determine the regulatory class coverage adjustment by summing the percentages of those regulatory classes less than 8501 lbs GVRW separately for source types 31 and 32 using the information in Table A-1 in Appendix A of the MOVES3 Technical Guidance. For source type 31, the regulatory class coverage adjustment is 0.9612. For source type 32, the regulatory class coverage adjustment is 0.7526.

Using these results, the compliance factor for source type 31 is:

$$CF = CR \times (1 - WR \times FR) \times RCCA$$
$$86.7483\% = 95\% \times (1 - 0.25 \times 0.20) \times 0.9612$$

The compliance factor for source type 32 is:

$$CF = CR \times (1 - WR \times FR) \times RCCA$$
$$67.92215\% = 95\% \times (1 - 0.25 \times 0.20) \times 0.7526$$

These values would be entered as compliance factors of 86.7483 for source type 31 and 67.92215 for source type 32.

Example 2

This example details the weighting calculation for the compliance factor to be used in the MOVES "Actual I/M run" to represent the two years covered by the biennial performance evaluation. The following data was collected and calculated for the two years covered by the biennial performance evaluation for source type 31:

	Compliance Factor	Number of unique vehicles tested
Year 1	93%	1,600,000
Year 2	91%	1,540,000
Total	-	3,140,000

The calculation of a weighted compliance factor is as follows:

$$\textit{Compliance Factor} = \left(\textit{Year 1 Compliance Factor} \times \frac{\textit{Year 1 Number of unique vehicles}}{\textit{Total number of unique vehicles tested (Year 1 + Year 2)}}\ \%\right) + \left(\textit{Year 2 Compliance Factor} \times \frac{\textit{Year 1 Number of unique vehicles}}{\textit{Total number of unique vehicles tested (Year 1 + Year 2)}}\ \%\right)$$

$$= \left(93\% \times \frac{1{,}600{,}000}{3{,}140{,}000}\ \%\right) + \left(91\% \times \frac{1{,}540{,}000}{3{,}140{,}000}\ \%\right)$$

$$92.0191\% = \left(93\% \times 50.9554\%\right) + \left(91\% \times 49.0446\%\right)$$

Thus, for the MOVES "Actual I/M run" rows in the IM Coverage table input for source type 31, the value for the compliance factor column should be "92.0191". A similar calculation should be performed for each source type covered by the I/M program.