

Policy Guidance on the Use of
MOVES4 for State Implementation
Plan Development, Transportation
Conformity, General Conformity,
and Other Purposes



Policy Guidance on the Use of MOVES4 for State Implementation Plan Development, Transportation Conformity, General Conformity, and Other Purposes

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

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INTRODUCTION

1. What is the purpose of this guidance?

This guidance describes how and when to use the latest version of the MOtor Vehicle Emission Simulator (MOVES) emissions model for state implementation plan (SIP) development, transportation conformity determinations, general conformity determinations, and other purposes. This guidance applies to the current version of MOVES4, as well as any future MOVES4 minor revisions.¹ This guidance supersedes the previous November 2020 version of the MOVES3 guidance (EPA-420-B-20-044).

MOVES4 is the U.S. Environmental Protection Agency's (EPA's) latest motor vehicle emissions model for state and local agencies to estimate nitrogen oxides (NO_x), particulate matter (PM_{2.5} and PM₁₀), volatile organic compounds (VOCs), carbon monoxide (CO), and other pollutants/precursors from cars, trucks, buses, and motorcycles for SIP purposes and conformity determinations outside of California.²

MOVES4 incorporates EPA's regulations that have been finalized as of the model's release, including the *Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards* final rule, which reduces emissions from heavy-duty trucks beginning with model year 2027.³ MOVES4 also accounts for the *Revised 2023 and Later Model Year Light-Duty Vehicle Greenhouse Gas Emissions Standards* final rule.⁴ The model also adds new options for modeling heavy-duty battery electric and fuel-cell vehicles as well as compressed natural gas (CNG) long-haul combination trucks.

EPA will be publishing a *Federal Register* notice to announce the availability of MOVES4 for official purposes. All states other than California should use MOVES4 for future SIPs to take full advantage of the improvements incorporated in this version. However, state and local agencies that have already completed significant work on a SIP with MOVES3⁵ may continue to use it for that SIP. See Questions 6-11 for further information on using MOVES in SIP development. Information on using MOVES4 for vehicle inspection and maintenance (I/M) performance standard modeling for state I/M SIPs for the 2015 ozone NAAQS can be found in Question 11.

EPA intends to include in the *Federal Register* notice a two-year grace period for using MOVES4 for regional transportation conformity purposes and a two-year grace period for project-level conformity purposes.⁶ EPA coordinated with the U.S. Department of Transportation (DOT) on the length of the conformity grace period. MOVES4 will need

¹ Details on MOVES can be found at www.epa.gov/moves.

² In California, a different onroad emissions model, EMFAC, is used for regulatory purposes instead of MOVES. MOVES can also model emissions in the District of Columbia, Puerto Rico, and the U.S. Virgin Islands.

³ 88 FR 4296, January 24, 2023.

⁴ 86 FR 74434, December 30, 2021.

⁵ References to "MOVES3" in this guidance refer to the previously released versions of MOVES3 including MOVES3.1.

⁶ See 40 CFR 93.111(b).

to be used for new regional emissions analyses for transportation conformity determinations begun after the two-year grace period. MOVES4 will also need to be used for new PM and CO hot-spot analyses for project-level conformity determinations begun after the two-year project-level grace period. See Questions 12-18 for further information on using MOVES4 in transportation conformity determinations. In addition, see Question 19 for information on using MOVES4 in general conformity determinations. See below for information on how to access EPA's *Federal Register* notice that will include the specific dates for the conformity grace period for both regional and hot-spot analyses.

EPA has also included information regarding the use of MOVES for estimating mobile source air toxic (MSAT) and greenhouse gas (GHG) emissions in this guidance. Although there are no SIP or conformity requirements for these pollutants, MOVES4 is EPA's best tool for estimating air toxics and GHG emissions from onroad and nonroad mobile sources for regulatory as well as nonregulatory purposes. MOVES4 also may be used for calculating both onroad and nonroad GHG and co-pollutant emission reductions for Bipartisan Infrastructure Law and Inflation Reduction Act programs. See Questions 20 and 21 for further information about using MOVES to estimate GHGs and air toxics. In addition, Question 22 explains how MOVES4 will be used in the 2023 National Emissions Inventory (NEI).

Questions about the application of this guidance to specific SIPs or transportation conformity analyses should be addressed to the EPA Regional Office SIP or transportation conformity contact. Regional contacts for transportation conformity can be found at www.epa.gov/state-and-local-transportation/epa-regional-contacts-regarding-state-and-local-transportation. 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> in Section 16.2, last page. Other questions regarding specific topics should be addressed to the corresponding EPA staff listed on the [Office of Transportation and Air Quality Contacts by Topic](#) webpage.

In addition, the following EPA contacts are available for general questions regarding this guidance:

- for general questions about the MOVES model, email mobile@epa.gov;
- for SIP questions, contact [Rudy Kapichak](#) or kapichak.rudolph@epa.gov;
- for transportation conformity questions, contact Aaron Letterly or letterly.aaron@epa.gov;
- for general conformity questions, contact [Virginia Raps](#) or raps.virginia@epa.gov, and
- for questions about the National Emissions Inventory, contact [Janice Godfrey](#) or godfrey.janice@epa.gov.

A copy of this policy guidance and the *Federal Register* notice can be found at the following website: www.epa.gov/state-and-local-transportation/policy-and-technical-guidance-state-and-local-transportation#emission.

2. How does EPA distinguish model versions?

MOVES4 is a major revision to the MOVES series of models. This model is the fourth major MOVES release – the first three were MOVES2010, MOVES2014, and MOVES3.⁷ As shown in Table 1, future minor revisions would be designated by increments of the number after a decimal point (e.g., MOVES4.1). EPA may also use an additional decimal point to designate minor patches (e.g., MOVES4.0.1).⁸

Table 1: MOVES Naming Convention

Type of Release	Naming Convention	Examples
Major release	“MOVES” followed by a new number in sequence	MOVES4, MOVES5
Minor revision	Addition of a decimal followed by a new number in sequence	MOVES4.1, MOVES4.2
Minor patch, e.g., new user features	Addition of a second decimal followed by a new number in sequence	MOVES4.0.1, MOVES4.0.2

References to “MOVES4” in this guidance refer to “MOVES4” and any future minor revisions to MOVES4. References to “MOVES3” in this guidance relate to all versions of MOVES3.

3. What is MOVES4, and how does it compare to MOVES3?

MOVES is EPA’s state-of-the-science model for estimating emissions from onroad mobile sources. MOVES4 also models most nonroad emissions sources.

MOVES4 is a major revision to the MOVES series of models and is the latest emissions model for SIP and conformity purposes. MOVES4 includes many changes, including new vehicle standards, new emissions and activity data, and new features. As a result of these changes, estimates of emissions from MOVES4 may be different from versions of MOVES3, including MOVES3.1.

The structure of MOVES4 is fundamentally the same as MOVES3, but, as described below, certain emissions rates and activity updated in MOVES4 differ from MOVES3. The net impact of these changes on calculated emissions will depend on many factors, including the specific area being modeled and the inputs used.

MOVES4 incorporates several important updates, including:

⁷ For more information, see EPA’s [Previous MOVES Versions and Documentation](#) website.

⁸ When EPA releases minor revisions or patches, the changes are described in the [MOVES4 Update Log](#), found on the Latest Version of the MOTO Vehicle Emissions Simulator webpage.

- The emission impacts of the EPA heavy-duty low NO_x rule for model years 2027 and later⁹ and the light-duty greenhouse gas rule for model years 2023 and later.¹⁰
- The ability to model heavy-duty battery-electric and fuel-cell vehicles, as well as CNG long-haul combination trucks.
- Improved modeling of light-duty electric vehicles.
- New tools to make the model easier to use and updates for compatibility with newer software.
- Updated data and forecasts on vehicle populations (including electric vehicle fractions), travel activity, and emission rates, as well as updated fuel supply information at the county level.
- The latest data on ammonia emission rates for light-duty and heavy-duty vehicles.
- A number of limited-impact updates to specific emissions rates and adjustments.

For additional information on the updates included in MOVES4, please refer to the *Overview of EPA's Motor Vehicle Emissions Simulator (MOVES4)*, found at EPA's MOVES website: <https://www.epa.gov/moves/latest-version-motor-vehicle-emission-simulator-moves>. Specific information about MOVES4 inputs and algorithms can be found in EPA's MOVES onroad and nonroad technical reports, found at EPA's websites <https://www.epa.gov/moves/moves-onroad-technical-reports> and <https://www.epa.gov/moves/nonroad-technical-reports>, respectively.

MOVES is a flexible model using an array of input and output options, allowing more than one way to use MOVES to develop emissions estimates. Like its predecessors, MOVES4 includes the capability to estimate vehicle exhaust and evaporative emissions as well as brake wear and tire wear emissions for criteria pollutants and precursors. However, like previous versions, MOVES4 does not include the capability to estimate emissions of re-entrained road dust. To estimate emissions from re-entrained road dust, practitioners should continue to use the latest approved methodologies.¹¹

EPA performed a comparison of emissions from MOVES4 to emissions from MOVES3 using default information in MOVES4 at the national level, and for three sample urban counties with different local travel patterns and ambient conditions. In general, compared to MOVES3, MOVES4 will produce notable decreases in NO_x for future years due to the emissions reductions of new regulations and small decreases in most other pollutants. While the overall quantity of ammonia emissions that MOVES4 produces is still

⁹ 88 FR 4296, January 24, 2023.

¹⁰ 86 FR 74434, December 30, 2021.

¹¹ See EPA's Notice of Availability, "Official Release of the January 2011 AP-42 Method for Estimating Re-Entrained Road Dust from Paved Roads," published in the *Federal Register* on February 4, 2011 ([76 FR 6328](https://www.federalregister.gov/documents/2011/02/04/76-fr-6328)).

relatively small, ammonia emissions increase significantly because real-world emission measurements show ammonia emissions from both gasoline and diesel vehicles are much higher than MOVES3 predicted.

Evaporative hydrocarbon emissions from refueling increase in the near-term due to algorithm improvements and new data. These emissions decrease in later years because of HD2027 rule requirements for gasoline vehicle refueling emission controls.¹² Similarly, nitrous oxide (N₂O) emissions have increased due to new data for heavy-duty diesel vehicles. This increase is small compared to the expected decrease in other greenhouse gases, namely carbon dioxide and methane. Note that results will vary based on the pollutant selected and that area's local inputs.

Based on our testing, modelers who do very large runs may expect slower run time with MOVES4 compared to MOVES3; we recommend breaking up large runs into smaller runs, and otherwise configuring MOVES to improve run time.¹³

4. What resources are available to assist in implementing MOVES4?

In addition to this guidance document, EPA has developed technical guidance to assist in implementing MOVES4:

- *MOVES4 Technical Guidance: Using MOVES to Prepare Emission Inventories in State Implementation Plans and Transportation Conformity* (available on EPA's transportation conformity [Policy and Technical Guidance for State and Local Transportation](#) website) provides guidance on how to set up a MOVES run and add local data using the County Data Manager for SIPs and regional transportation conformity analyses.

Other existing MOVES guidance documents generally apply to using MOVES4, including:

- *PM Hot-Spot Guidance: Transportation Conformity Guidance for Quantitative Hot-spot Analyses in PM_{2.5} and PM₁₀ Nonattainment and Maintenance Areas* explains how to use MOVES to complete hot-spot analyses required for projects of local air quality concern in PM_{2.5} and PM₁₀ nonattainment and maintenance areas. The latest version is available on EPA's [Project-Level Conformity and Hot-Spot Analyses](#) website.

¹² See EPA's final rule, "Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards," published in the *Federal Register* on January 24, 2023 ([88 FR 4296](#)).

¹³ EPA has provided tips for faster MOVES runs with MOVES installation. For those with MOVES installed, see file found at: "\\docs\TipsForFasterMOVESRuns.md". These same tips can be found at the EPA GitHub site, https://github.com/USEPA/EPA_MOVES_Model/blob/master/docs/TipsForFasterMOVESRuns.md.

- *Using MOVES3 in Project-Level Carbon Monoxide Analyses* describes how to use the MOVES emissions model to estimate CO emissions from transportation projects. The latest version is available on EPA's [Project-Level Conformity and Hot-Spot Analyses](#) website.
- *Performance Standard Modeling for New and Existing Vehicle Inspection and Maintenance (I/M) Programs Using MOVES Mobile Source Emissions Model* describes when and how to conduct performance standard modeling to demonstrate in an I/M SIP that a vehicle emission I/M program meets the applicable performance standard as defined within the I/M regulations. The latest version is available on EPA's Vehicle Emissions I/M: Policy and Technical Guidance website.
- *Port Emissions Inventory Guidance: Methodologies for Estimating Port-Related and Goods Movement Mobile Source Emissions* describes state-of-the-science methodologies for preparing an emissions inventory for the mobile source sectors found at ports and freight terminals, including ocean-going vessels, harbor craft, recreational marine, cargo handling equipment, onroad vehicles, and rail. The latest version of this guidance is available at <https://www.epa.gov/state-and-local-transportation/port-emissions-inventory-guidance>.
- *Using MOVES for Estimating State and Local Inventories of On-Road Greenhouse Gas Emissions and Energy Consumption* describes how to use MOVES to estimate greenhouse gas emissions and/or energy consumption from onroad vehicles in a state or metropolitan area. EPA is in the process of updating this guidance to reflect MOVES4. The latest version is available on EPA's [Estimating Greenhouse Gas Emissions](#) website, which has resources for estimating these emissions from the on-road transportation sector.

Additional training materials, examples, and MOVES technical information are available at the EPA [MOVES website](#) and at the [Transportation Conformity Training and Presentations website](#). MOVES users are urged to check the MOVES website regularly and subscribe to EPA's [mobile source emissions model listserv](#) to receive EPA email announcements related to MOVES.

5. Does this guidance create new requirements?

No. The discussion in this document is intended solely as guidance. The statutory provisions and EPA regulations discussed in this document contain legally binding requirements. This document is not a regulation itself, nor does it change or substitute for statutory provisions and regulations. Thus, it does not impose legally binding requirements on EPA, the DOT, states, or the regulated community. 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 regulations. Any decisions regarding a particular SIP or conformity determination will be made based on the statute and

regulations. This guidance may be revised periodically without an opportunity for public comment.

USING MOVES4 IN SIPs

6. How does the release of MOVES4 affect SIPs that are currently under development?

MOVES4 should be used in ozone, CO, PM, and NO₂ SIP development as expeditiously as possible, as there is no grace period for the use of MOVES4 in SIPs. The Clean Air Act (CAA) and implementation rules for the NAAQS require that SIP inventories and control measures be based on the most current information and applicable models that are available when a SIP is developed.¹⁴ However, EPA recognizes the time and level of effort involved in SIP development. The interagency consultation process must be used to develop any SIP revision based on MOVES4 (40 CFR 93.105(a)(1) and (b)). States should consult with their EPA Regional Office if they have questions about how MOVES4 affects SIPs under development in specific nonattainment or maintenance areas. Early consultation can facilitate EPA's adequacy finding for transportation conformity purposes or for the SIP approval process.

States should use the latest version of MOVES that is available at the time that a SIP is developed. All states other than California should use MOVES4 for SIPs that will be submitted in the future so that they are based on the most accurate estimates of emissions possible. States that have adopted California regulations under CAA section 177 should use MOVES4 when modeling any such regulations that have been issued a waiver by EPA.¹⁵ However, state and local agencies that have already completed significant work on a SIP with MOVES3 (e.g., attainment modeling has already been completed with MOVES3) may continue to rely on MOVES3.

New regional emissions analyses that support transportation plan and transportation improvement program (TIP) conformity determinations and are started after the end of the conformity grace period must be based on the latest emissions model available. (40 CFR 93.111). Therefore, incorporating MOVES4 into the SIP now could assist areas in mitigating possible transportation conformity difficulties in the future after the MOVES4 conformity grace period ends. See Question 12 for more information on using MOVES4 for regional emissions analyses and transportation plan and TIP conformity.

¹⁴ See Clean Air Act section 172(c)(3). Also see the discussion of emissions inventory requirements in the "Fine Particulate Matter National Ambient Air Quality Standards: State Implementation Plan Requirements" rule (81 FR 58029, August 24, 2016) and in the "Implementation of the 2015 National Ambient Air Quality Standards for Ozone: Nonattainment Area State Implementation Plan Requirements" rule (83 FR 63022, December 6, 2018).

¹⁵ Procedures for such modeling are detailed in the MOVES4 Technical Guidance.

7. How does the release of MOVES4 affect SIPs that have already been submitted or approved?

The CAA does not require states to revise submitted SIPs or SIPs that have already been approved simply because a new motor vehicle emissions model is now available.¹⁶ States can choose to update these SIPs with MOVES4, for example, if it is determined that it is appropriate to update motor vehicle emissions budgets (“budgets”) with the model for future conformity determinations.

However, as stated above, states should use MOVES4 where SIP development is in its initial stages or has not progressed far enough along that switching from a previous model version would create a significant adverse impact on state resources.

8. When existing SIPs and budgets are revised with MOVES4, what do states need to submit to show that a SIP continues to meet applicable requirements?

As stated in Question 7, a SIP revision would not be required solely due to the release of MOVES4 for SIPs that have been approved, submitted, or where significant development has already occurred. However, there may be cases where an existing SIP that is based on an older emissions model (e.g., MOVES3 or MOVES2014) is revised with MOVES4. As discussed below, in addressing these cases, EPA is applying the same principles it has in the past when motor vehicle emissions budgets (or budgets) have been revised using a new emissions model.¹⁷ States should consult with their EPA Regional Office prior to submitting MOVES4 SIP revisions. Early consultation can facilitate EPA’s adequacy finding or SIP approval process.

EPA cannot approve revisions to existing SIPs and budgets unless the revised SIP and budget meets applicable CAA requirements (e.g., for reasonable further progress (RFP), attainment, maintenance). If a state revises an existing SIP with MOVES4, it must show that the SIP continues to meet applicable requirements with the new level of motor vehicle emissions calculated by the new model.

In addition, the transportation conformity rule (40 CFR 93.118(e)(4)(iv)) requires that “the motor vehicle emissions budget(s), when considered together with all other emissions sources, is consistent with applicable requirements for reasonable further progress, attainment, or maintenance (whichever is relevant to the given implementation

¹⁶ *Sierra Club v. EPA*, 356 F.3d. 296, 308 (D.C. Cir. 2004) (“To require states to revise completed plans every time a new model is announced would lead to significant costs and potentially endless delays in the approval processes.”)

¹⁷ The conformity rule defines the motor vehicle emissions budget: “*Motor vehicle emissions budget* is that portion of the total allowable emissions defined in the submitted or approved control strategy implementation plan revision or maintenance plan for a certain date for the purpose of meeting reasonable further progress milestones or demonstrating attainment or maintenance of the NAAQS, for any criteria pollutant or its precursors, allocated to highway and transit vehicle use and emissions.” (40 CFR 93.101).

plan submission).” This and other regulatory requirements must be satisfied before EPA can find submitted budgets adequate or approve them for use in the conformity process.

The following describes how to meet applicable requirements for existing SIPs that are revised with MOVES4, including ideas for how to streamline these revisions whenever possible.

Use of latest planning assumptions: When SIPs are revised with MOVES4, the motor vehicle emissions inventories for base year, milestone year and attainment/maintenance year will need to be recalculated with the latest available planning assumptions. This should include, at a minimum, the latest information vehicle miles travelled (VMT), speeds, fleet mix, and SIP control measures.¹⁸ Base year and historical year inventories should use the latest data available for those years. Future year projection inventories should also be based on the latest data available.¹⁹ If planning assumptions have not changed since the original SIP was submitted, the state should document this in its new SIP submission.

In addition, states will need to consider and evaluate whether growth and control strategy assumptions for non-motor vehicle sources (i.e., stationary, area, and nonroad mobile sources) are still accurate at the time that the MOVES4 SIP revision is developed to ensure the revised emissions inventories are consistent with the relevant applicable requirement (e.g., RFP, attainment, or maintenance). Such assumptions include population and economic assumptions and any allowable emissions relied upon for stationary or other sources.

If these assumptions have not changed, the state can explain this and re-submit the original SIP with the revised motor vehicle emissions inventories and budgets to meet the remaining requirements as discussed below. The state may also in these cases provide summary emissions information for categories of sources and references to the applicable portions of the original SIP, as long as those portions continue to apply after the SIP revision with the MOVES4 budgets is approved. Otherwise, the emissions categories in the SIP that have changed should be brought up to date to ensure that the emissions inventory is accurate, current, and consistent with the relevant statutory requirements.²⁰ States should consult with their EPA Regional Office to determine what should be included in the SIP revision.

¹⁸ See EPA and DOT’s joint [“Guidance for the Use of Latest Planning Assumptions in Transportation Conformity Determinations,”](#) EPA420-B-08-901, December 2008. This guidance also addresses requirements for using the latest planning assumptions in SIP development. Also see the discussion of emissions inventory requirements in the “Fine Particulate Matter National Ambient Air Quality Standards: State Implementation Plan Requirements” rule (81 FR 58029, August 24, 2016) and in the “Implementation of the 2015 National Ambient Air Quality Standards for Ozone: Nonattainment Area State Implementation Plan Requirements” rule (83 FR 63022, December 6, 2018).

¹⁹ See the discussion of emissions inventory requirements in the “Fine Particulate Matter National Ambient Air Quality Standards: State Implementation Plan Requirements” rule (81 FR 58029, August 24, 2016) and in the “Implementation of the 2015 National Ambient Air Quality Standards for Ozone: Nonattainment Area State Implementation Plan Requirements” rule (83 FR 63022, December 6, 2018).

²⁰ *Id.*

Milestone, attainment, or maintenance demonstration: As discussed above, SIP revisions must continue to show that the SIP still meets applicable CAA requirements (e.g., attainment, maintenance, or interim milestones) when previous motor vehicle emissions inventories are replaced with MOVES4 inventories. The level of analysis and support needed for this demonstration can vary depending upon how MOVES4 affects the level of motor vehicle emissions and whether non-motor vehicle inventories require updating. The modeling and post-processing choices made in the original demonstration could also be a factor.

Areas may be able to revise their motor vehicle emissions inventories and budgets using MOVES4 without revising the entire SIP or completing additional modeling. This could be the case if:

- (1) the SIP meets applicable requirements when the previous motor vehicle emissions inventories are replaced with MOVES4 base year and milestone, attainment, or maintenance year inventories; and
- (2) the state can document that the growth and control strategy assumptions for non-motor vehicle sources continue to be valid and any minor updates do not change the overall conclusions of the SIP.²¹

For example, if an ozone SIP relied on changes in emissions from the base year to an attainment or maintenance year inventory to demonstrate attainment or maintenance, that requirement would be satisfied by demonstrating that the relative emissions reductions between the base year and the attainment or maintenance year are the same or greater using MOVES4 than they were under the model previously used. Similarly, if an ozone attainment SIP relied on absolute model predictions to demonstrate attainment for the future attainment year, that requirement would be satisfied by demonstrating that the MOVES4 estimates are equal to or lower than the previous estimates for the future attainment year. Or, if a CO maintenance plan relied on either a relative or absolute demonstration of maintenance, that requirement could be satisfied by documenting that the relative emissions reductions between the base year and the maintenance year are the same or greater using MOVES4.

States should consult with their EPA Regional Office to determine what should be included in the SIP revision. If both 1 and 2 above are met, the state may be able to submit as the needed SIP revision the updated motor vehicle emissions budgets along with summary emissions information for other source categories with references to the applicable portions of the original SIP. However, if emissions from categories in the SIP have changed, those inventories should be brought up to date in order to demonstrate that the SIP submission complies with the applicable statutory requirement for attainment,

²¹ See the discussion of emissions inventory requirements in the “Fine Particulate Matter National Ambient Air Quality Standards: State Implementation Plan Requirements” rule (81 FR 58029, August 24, 2016) and in the “Implementation of the 2015 National Ambient Air Quality Standards for Ozone: Nonattainment Area State Implementation Plan Requirements” rule (83 FR 63022, December 6, 2018).

maintenance, or interim milestones. Any changes in control strategies, including regulations that apply to stationary or area sources and affect those portions of the inventories, will need to be factored in to both base and future year inventories to determine whether the SIP still meets the applicable statutory requirement. However, a state may not need to revise emissions for a non-motor vehicle emissions inventory category if a regulatory change resulted in a reduction in emissions in the attainment or maintenance year relative to the existing SIP. In that circumstance, the SIP could be assumed to continue to demonstrate attainment or maintenance.

Regardless of the technique used, a more rigorous assessment of the SIP's attainment or maintenance demonstration may be necessary if a state decides to reallocate the original SIP's excess emissions reductions to the motor vehicle emissions budget(s) as a safety margin.²² In other words, the state will need to assess how its original demonstration is affected by using MOVES4 and confirm whether excess emissions reductions exist prior to allocating them to the budget(s). The assessment of the SIP's attainment or maintenance demonstration, after onroad emissions are calculated using MOVES4, would need to be sufficiently detailed to allow the state to determine the magnitude of the available safety margin, if any, and to decide how much of the available safety margin to allocate to the motor vehicle emissions budgets for a given year. This assessment is critical to ensure that SIP budgets in the context of all other emissions sources continue to protect public health and meet the conformity rule's adequacy criteria (40 CFR 93.118(e)(4)).

9. If motor vehicle emissions budgets in a SIP need to be redone with MOVES4 or if a state needs to address additional RFP years, should the base year also be remodeled with MOVES4?

Yes, a state should redo the base year inventory with MOVES4 in both of those situations. For example, if the state is revising RFP motor vehicle emissions budgets, and it has an EPA-approved base year inventory completed with an earlier version of MOVES, it should recalculate the base year emissions with MOVES4 so that it can verify that the SIP continues to fulfill RFP requirements. Similarly, if a state is required to address additional RFP years, it should recalculate the base year emissions so that it can verify that the SIP continues to fulfill RFP requirements. If the base year emissions were not recalculated with MOVES4, it would not be possible to tell if RFP requirements were met because the calculations would be using results from different versions of the MOVES model.

²² A "safety margin" is the amount by which the total projected emissions from all sources of a given pollutant are less than the total emissions that would satisfy the applicable requirement for reasonable further progress, attainment, or maintenance (40 CFR 93.101). A safety margin would be calculated for each applicable pollutant and precursor for a given NAAQS. See also 40 CFR 93.124(a) for its application.

10. How will MOVES4 affect the need for emissions reductions in the development of future attainment or maintenance SIPs?

The answer depends upon the unique circumstances of each nonattainment or maintenance area. The emissions comparisons depend on the pollutants of concern, the dates of concern, and on existing local regulations, travel activity patterns, fleet age, and mix of cars and trucks. In some cases, a change from MOVES3 to MOVES4 may result in increased emissions estimates, while in other cases it may result in decreased emissions estimates for the relevant time periods.

Moreover, because of the complex chemistry and meteorology of air pollution, the implications of changes in onroad vehicle emissions may not be clear until multiple years are examined, and the new emissions levels are applied in an air quality model. Relative differences in emissions over time from MOVES3 to MOVES4 may be as important as, or more important than, differences between the models in any one year. Therefore, MOVES4 users should not immediately assume that increases or decreases in emissions in any single year imply the need for more or fewer SIP control measures until those changes in emissions have been applied in the complete SIP context.

An increase in emissions due to the use of MOVES4 may affect an area's ability to demonstrate conformity for its transportation plan and/or TIP. Areas are encouraged to consider, through interagency consultation, if and how MOVES4 will impact their future conformity determinations and discuss any concerns with the appropriate EPA Regional Office.

11. Can MOVES4 be used for vehicle emission inspection and maintenance performance standard modeling for 2015 ozone NAAQS SIPs?

For the 2015 ozone NAAQS, states with urbanized ozone nonattainment areas classified (or reclassified) as Moderate or higher are required to submit an I/M SIP that includes a performance standard modeling (PSM) analysis per 40 CFR 51.372(a)(2). The purpose of a PSM analysis is to evaluate whether a vehicle I/M program meets the applicable performance standard. Procedures relevant to setting up the model, preparing inputs, and processing results can be found in EPA's [PSM guidance](#).²³

As there is no grace period for the use a new emissions model in SIP development, MOVES4 should be used to conduct any new PSM analyses for the 2015 ozone NAAQS. However, as explained above, state and local agencies that have already completed significant work on a SIP with MOVES3 prior to the release of MOVES4 may continue to use it for that SIP, and this includes I/M SIPs. States should consult with their EPA Regional Office if they have questions about how MOVES4 affects SIPs under development in specific nonattainment or maintenance areas.

²³ [Performance Standard Modeling for New and Existing Vehicle Inspection and Maintenance \(I/M\) Programs Using the MOVES Mobile Source Emissions Model](#), October 2022, EPA-420-B-22-034.

Though California generally uses the Emissions Factors (EMFAC) model for onroad mobile emissions modeling, MOVES4 is an appropriate model for PSM applications within California, assuming all inputs and assumptions are consistent with the vehicle regulations and I/M program. EPA will address the use of MOVES for I/M PSM in California in any related action on an I/M SIP.

USING MOVES4 IN TRANSPORTATION CONFORMITY

12. When will the use of MOVES4 be required for regional emissions analyses in transportation plan and TIP conformity determinations?

EPA will be publishing a *Federal Register* notice to announce the availability of MOVES4 for official purposes (outside of California). EPA, in consultation with DOT, intends to establish a two-year grace period before MOVES4 needs to be used for regional emissions analyses in transportation conformity determinations of transportation plans and TIPs.²⁴ Section 176(c)(1) of the CAA requires conformity determinations to be based on “the most recent estimates of emissions.” Additionally, the transportation conformity rule (40 CFR 93.111) requires conformity analyses to be based on “the latest emissions estimation model available,” and further states that this requirement is satisfied if the most current version of EPA’s motor vehicle emissions model is used.²⁵ When EPA announces a new emissions model, such as MOVES4, we establish a grace period before the model is considered the latest version of EPA’s motor vehicle emissions model for transportation conformity purposes (40 CFR 93.111(b)). In consultation with DOT, EPA must consider several factors when establishing a grace period for conformity determinations, including the degree of change in the emissions model and the effects of the new model on the transportation planning process (40 CFR 93.111(b)(2)).

Transportation conformity is a CAA requirement to ensure that federally supported highway and transit activities are consistent with (“conform to”) the SIP. Conformity to a SIP means that a transportation activity will not cause or contribute to new air quality violations; worsen existing violations; or delay timely attainment of the national ambient air quality standards or an interim milestone.

EPA encourages state and local agencies to use the latest version of the MOVES model available at the time that any conformity modeling begins, so that users can take advantage of the latest information and improvements included in the model.

²⁴ The two-year grace period also applies in the case that a regional emissions analysis is done for a project not from a conforming transportation plan and TIP (i.e., a project in an isolated rural area). See the transportation conformity rule at 40 CFR 93.101 for the definition of an isolated rural area and 40 CFR 93.109(g) for how conformity is done in an isolated rural area.

²⁵ EPA notes that in the case of 1997 ozone NAAQS orphan areas, regional emissions analyses are not required for that NAAQS. See the [Transportation Conformity Guidance for the South Coast II Court Decision](#) for additional information.

13. Under what circumstances will the MOVES4 grace period for regional emissions analyses be shorter than two years?

The conformity grace period for regional emissions analyses will end two years after we publish the *Federal Register* notice announcing MOVES4, unless new MOVES4-based SIP budgets become applicable sooner, in which case the grace period will end for specific areas and a specific pollutant once these new MOVES4-based approved or adequate budgets become effective. In this case, the new regional emissions analysis for that pollutant must use MOVES4 if the conformity determination is demonstrating consistency with a MOVES4-based budget per 40 CFR 93.118. The interagency consultation process must be used to develop any SIP revision based on MOVES4 (40 CFR 93.105(c)(1)(i)).

It is possible that areas that are designated nonattainment or maintenance for multiple pollutants may rely on both MOVES4 and MOVES3 to determine conformity for different pollutants during the grace period. For example, if an area revises a previously submitted (but not approved) MOVES3-based PM₁₀ SIP with MOVES4 and EPA finds these revised MOVES4 budgets adequate for conformity, such budgets would apply for conformity on the effective date of the *Federal Register* notice announcing EPA's adequacy finding. In this example, if an area was in nonattainment for PM₁₀ and ozone, the MOVES4 grace period would end for PM₁₀ once EPA found the new MOVES4-based SIP budgets adequate. However, MOVES3 could continue to be used for ozone conformity determinations until the end of the MOVES4 grace period for regional emissions analyses.²⁶

In addition, in most cases, if the state revises previously approved budgets based on an earlier EPA emissions model with MOVES4, the revised MOVES4 budgets could not be used for conformity purposes until EPA approves them, i.e., approves the SIP revision. In general, submitted SIPs cannot supersede approved budgets until the submitted SIP is approved. See 40 CFR 93.118(e)(1).

However, 40 CFR 93.118(e)(1) allows an approved budget to be replaced by an adequate budget if EPA's approval of the initial budgets specifies that the budgets being approved may be replaced in the future by new adequate budgets. This flexibility has been used in limited situations in the past. In such cases, the MOVES4-based budgets would be used for conformity purposes once they have been found adequate, if requested by the state in its SIP submission and if specified in EPA's SIP approval. States should consult with their EPA Regional Office to determine if this flexibility could be applied to their situation.

²⁶ In this example, such an area would use MOVES4 to develop a regional emissions analysis for comparison to the revised MOVES4-based budgets (e.g., PM₁₀ and NO_x budgets in the PM₁₀ SIP). The regional emissions analysis for ozone could be based on MOVES3 for the VOC and NO_x budgets in the ozone SIP for the remainder of the conformity grace period.

14. How will the MOVES4 conformity grace period be implemented for regional emissions analyses?

During this two-year grace period, areas should use interagency consultation to examine how MOVES4 will impact their regional emissions analyses and future transportation plan and TIP conformity determinations. Isolated rural areas should also consider how future regional emissions analyses will be affected when MOVES4 is required, if such an analysis is anticipated. Areas should carefully consider whether the SIP and budget(s) should be revised with MOVES4 or if transportation plans and TIPs should be revised before the end of the conformity grace period, since doing so may be necessary to ensure conformity in the future.

The conformity rule provides flexibility for analyses that are started with MOVES3 before the *Federal Register* Notice of Availability for MOVES4 is published or during the grace period. Regional emissions analyses that are started during the grace period can use either MOVES3 or MOVES4 (40 CFR 93.111(c)). Interagency consultation should be used if it is unclear if a MOVES3-based analysis was begun before the end of the grace period.

When the grace period ends, MOVES4 will replace MOVES3 as the current EPA motor vehicle emissions model for transportation conformity purposes in states outside California. In general, this means that all new regional emissions analyses started after the end of the grace period must be based on MOVES4, even if the SIP is based on a previous EPA emissions model (40 CFR 93.111). As discussed above, the grace period for new regional emissions analyses would be shorter for a given pollutant if an area revised its SIP and budgets with MOVES4 and such budgets were approved or found adequate for conformity purposes prior to the end of the grace period. Also, when the grace period ends, conformity determinations cannot rely on a previous emissions analysis, per 40 CFR 93.122(g), that was prepared using MOVES3 because of the requirement in 40 CFR 93.111.

As discussed in more detail in the MOVES Technical Guidance, MOVES allows for multiple approaches in developing a regional emissions analysis, which may result in small differences in results.²⁷ EPA recommends that the same approach be used in any analysis that compares two or more cases (e.g., the SIP budget and the regional emissions analysis for transportation conformity). Per 40 CFR 93.105(c)(1)(i), interagency consultation must be used to evaluate and choose model(s) and associated methods and assumptions for conformity determinations. If different approaches are used for the SIP budget and the regional emissions analysis for practical reasons, interagency consultation should be used to determine how to address (and minimize) any differences in results. The methods used to develop inventories should be fully documented in the SIP and conformity determination.

²⁷ See Question 4 for reference information for the MOVES Technical Guidance.

15. When will the use of MOVES4 be required for hot-spot analyses in project-level conformity determinations?

EPA, in consultation with DOT, intends to establish a two-year grace period before MOVES4 needs to be used for conformity hot-spot analyses outside of California, i.e., the same period of time as the grace period that will apply for conformity regional emissions analyses. The *Federal Register* notice that announces the availability of MOVES4 for official purposes will establish the grace period for both regional emissions analyses and hot-spot analyses. The structure of MOVES4, including at the Project Scale, is fundamentally the same as MOVES3, although there are new data within the model and new options for fuel types for some vehicles. Hot-spot analyses are required to be included in conformity determinations for all non-exempt Federal Highway Administration (FHWA) /Federal Transit Administration (FTA) projects in CO areas, and for “projects of air quality concern” in PM_{2.5} and PM₁₀ nonattainment and maintenance areas.²⁸

Section 176(c)(1) of the CAA requires conformity determinations to be based on “the most recent estimates of emissions.” Additionally, the transportation conformity rule (40 CFR 93.111) requires conformity analyses to be based on “the latest emissions estimation model available,” and further states that this requirement is satisfied if the most current version of EPA’s motor vehicle emissions model is used. When EPA announces a new emissions model, such as MOVES4, we establish a grace period before the model is considered the latest version of EPA’s motor vehicle emissions model for transportation conformity purposes (40 CFR 93.111(b)). In consultation with DOT, EPA must consider the degree of change in the emissions model and the effects of the new model on the transportation planning process (40 CFR 93.111(b)(2)).

Once EPA announces the availability of MOVES4 in the *Federal Register*, MOVES4 will be the latest EPA motor vehicle emissions model for new conformity hot-spot analyses outside of California and will need to be used in new analyses that begin after the two-year grace period ends. The MOVES4 grace period for conformity hot-spot analyses applies to the use of MOVES4 and any future minor revisions that occur during the grace period.

EPA encourages state and local agencies to use the latest version of the MOVES model available at the time that any conformity modeling begins, so that users can take advantage of the latest information and improvements included in the model.

²⁸ See 40 CFR 93.116 and 93.123 for more information.

16. How will the MOVES4 grace period be implemented for CO, PM₁₀ and PM_{2.5} hot-spot analyses?

EPA intends to establish a two-year conformity grace period for the use of MOVES4 for CO, PM₁₀ and PM_{2.5} hot-spot analyses, as stated above. See Question 12 for more general information about the conformity grace period.

Sections 93.116 and 93.123 of the conformity regulations contains the requirements for when a hot-spot analysis is required for project-level conformity determinations.²⁹ In addition, the conformity regulation provides flexibility for analyses that are started before the end of the grace period. A conformity determination for a transportation project may be based on a previous model if the analysis was begun before or during the grace period, and if the final environmental document for the project is issued no more than three years after the issuance of the draft environmental document (40 CFR 93.111(c)). Interagency consultation should be used if it is unclear if a previous analysis was begun before the end of the grace period.

For CO, PM₁₀ and PM_{2.5} hot-spot analyses that start during the grace period, project sponsors can choose to use MOVES3 or MOVES4 as the current EPA motor vehicle emissions model, since both are available during the grace period. The consultation process must be used to determine which option may be most appropriate for a given situation, per 40 CFR 93.105(c)(1)(i). Any new CO, PM₁₀, or PM_{2.5} hot-spot analyses for conformity purposes begun after the two-year grace period must be based on MOVES4, per 40 CFR 93.111.

EPA guidance on how to use MOVES for CO and PM hot-spot analyses is available (see Question 4). Until EPA updates guidance to reflect the new model, the existing guidance is still largely applicable to MOVES4. See EPA's [Project-Level Conformity and Hot-Spot Analyses website](#) for latest information and guidance documents on how to conduct CO, PM₁₀ and PM_{2.5} hot-spot modeling for transportation conformity purposes.

The length of the grace period for hot-spot analyses would not be affected by an early submission of MOVES4-based SIP budgets. Using the same example as described in Question 13, the two-year grace period would apply for PM₁₀ hot-spot analyses even if approved or adequate MOVES4-based budgets for PM₁₀ are available before it ends.

Please consult with your EPA Regional Office if there are questions about which model should be used in a project-level conformity determination.

17. How will MOVES4 affect FHWA's CO categorical hot-spot finding?

²⁹ In CO nonattainment and maintenance areas, a hot-spot analysis is required for all non-exempt projects, with quantitative hot-spot analyses being required for larger, congested intersections and other projects (40 CFR 93.123(a)(1)). In addition, the conformity rule requires that a quantitative PM₁₀ or PM_{2.5} hot-spot analysis be completed for certain projects of local air quality concern (40 CFR 93.123(b)(1)).

FHWA released an updated CO categorical hot-spot finding for intersection projects in January 2023 that was based on MOVES3.³⁰ During the MOVES4 grace period, a project sponsor may continue to rely on the categorical finding for applicable projects that are determined through interagency consultation to be covered by the finding's parameters. Any new CO hot-spot analyses for conformity purposes begun after the end of the MOVES4 grace period may no longer rely on the January 2023 CO categorical hot-spot finding because the finding was based on MOVES3.

18. How will MOVES4 affect CO hot-spot protocols that were previously approved into the SIP?

Section 40 CFR 93.123(a)(1) of the transportation conformity regulation allows areas to develop alternate procedures for localized CO hot-spot analyses, when developed through interagency consultation and approved by the EPA Regional Administrator. Some states have chosen in the past to develop such procedures based on previously approved EPA emissions models.

During the MOVES4 grace period, areas with previously approved CO hot-spot protocols based on MOVES3 may continue to rely on these protocols. Once the MOVES4 two-year grace period ends, new CO hot-spot analyses for conformity purposes will need to be based on MOVES4 and thus may no longer rely on CO hot-spot protocols based on MOVES3 or earlier versions.

USING MOVES4 FOR GENERAL CONFORMITY

19. When will the use of MOVES4 be required under the General Conformity Rule?

Clean Air Act (CAA) section 176(c)(4)(A) requires EPA to establish criteria and procedures for determining conformity for federal activities, which are defined as work (e.g., construction, operations, etc.) not otherwise defined as transportation plans, programs, or projects under 40 CFR subpart A (§93.102(a)). The general conformity provisions are implemented under 40 CFR part 93, subpart B and require federal agencies to work with state, tribal, and local governments to ensure federal activities that cause emissions to originate within nonattainment or maintenance areas will not interfere with (i.e., will conform to) the air quality plans established in the applicable state implementation plan.^{31, 32}

When a federal agency needs to predict motor vehicle emissions to include in its general conformity applicability analysis, the analysis must be prepared in a manner consistent

³⁰ For more information, see the “CO Hot-Spot Analyses: FHWA Categorical Finding” heading on [EPA’s Project-Level Conformity and Hot-Spot Analyses](#) website.

³¹ See 40 CFR 93.155 and 93.156 for General Conformity reporting and public participation requirements.

³² See 40 CFR 93.152 definition of *Applicable implementation plan*.

with general conformity section 40 CFR 93.159(b).³³ When EPA updates its motor vehicle emissions model, a grace period of at least three months applies unless EPA announces a longer grace period for the model, which may be as long as 24 months. EPA intends to specify a two-year grace period for MOVES4 in its *Federal Register* Notice of Availability (NOA) and that same grace period applies for general conformity analyses under 40 CFR 93.159(b).³⁴

If the federal agency considers EPA's most current specified motor vehicle emissions model to be inappropriate for their project, the agency may, at its discretion and as allowed under 40 CFR § 93.159(b), obtain written approval from the appropriate EPA Regional Administrator to use a modified version of the MOVES model or a substitute model. The use of a modified or substitute model will be approved only on a case-by-case basis, or where appropriate, on a generic basis for a specific federal agency program.

USING MOVES4 FOR OTHER PURPOSES

20. Can MOVES4 be used to estimate greenhouse gas emissions?

Yes, MOVES4 is currently the best tool EPA has for estimating GHG emissions from the transportation sector and is a significant improvement over MOVES3. As described in Question 3, MOVES4 incorporates new emissions standards not included in MOVES3, improved emission algorithms and data, updated vehicle activity and population inputs, and new options for fuel types for some vehicles. For example, MOVES4 now includes the ability to model heavy-duty battery electric and fuel-cell vehicles as well as CNG long-haul combination trucks. EPA notes that there are no SIP and transportation conformity requirements for GHG emissions.

State, local, and tribal agencies should consider using the latest version of MOVES for from the transportation sector, such as for GHG analyses related to the transportation planning process or for Bipartisan Infrastructure Law and Inflation Reduction Act grant programs. For example, MOVES is one of several tools available for use for GHG and co-pollutant analyses under EPA's Climate Pollution Reduction Grants program.³⁵

EPA has developed technical guidance³⁶ that describes how to use MOVES to estimate GHG emissions and/or energy consumption from onroad vehicles in a state or metropolitan area.

³³ See 40 CFR 93.152 definition of *Applicability analysis*.

³⁴ See 40 CFR 93.111(b)(1).

³⁵ For more information about these grants, please see EPA's [Climate Pollution Reduction Grants](#) website.

³⁶ The latest version of *Using MOVES for Estimating State and Local Inventories of On-Road Greenhouse Gas Emissions and Energy Consumption* is available on EPA's website at www.epa.gov/state-and-local-transportation/estimating-greenhouse-gas-emissions.

21. Can MOVES4 be used to estimate mobile source air toxics (MSATs)?

Yes, MOVES4 estimates emissions for MSATs such as benzene, 1,3-butadiene, formaldehyde, acetaldehyde, acrolein, naphthalene, and ethylbenzene.³⁷ MOVES4 is EPA's best available tool for quantifying emissions of these MSATs. State and local agencies, academic institutions, and other interested parties who are interested in analyzing MSAT emissions from transportation projects should consider using the latest version of MOVES.

EPA notes that there are no SIP and transportation conformity requirements for air toxics. Regarding the analysis of MSAT emissions in the National Environmental Policy Act (NEPA) process, DOT has responsibility for implementing NEPA for federally funded or approved transportation projects.

22. What role will MOVES4 play in EPA's National Emissions Inventory?

EPA will use the latest released version of MOVES available at the time of the 2023 National Emissions Inventory (NEI) development to compute the 2023 NEI emissions. The NEI is updated with state, local, and tribal submissions once every three years³⁸- the most recent NEI is the [2020 NEI](#). Mobile source emissions for the 2020 NEI were generated with MOVES3 using a mix of EPA and state-provided inputs.

³⁷ More information, including a list of the mobile source air toxics in MOVES, can be found in EPA's report, *Air Toxic Emissions from Onroad Vehicles in MOVES3*, EPA-420-R-20-022, available at www.epa.gov/moves/moves-onroad-technical-reports.

³⁸ NEI on-road emissions for California are based on California's EMFAC model.