EPA Releases MOVES2014a Mobile Source Emissions Model: Questions and Answers

What is MOVES, and why is EPA releasing MOVES2014a?
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 level for criteria pollutants, greenhouse gases, and air toxics. EPA announced the release of MOVES2014 in October 2014 (79 Federal Register 60343).

EPA is now releasing MOVES2014a to allow MOVES users to benefit from several improvements to the model. MOVES2014a does not significantly change the criteria pollutant emissions results of MOVES2014 and therefore is not considered a new model for SIP and transportation conformity purposes.

What has changed from MOVES2014 to MOVES2014a?
MOVES2014a incorporates significant improvements in calculating nonroad equipment emissions. It adds volatile organic compounds (VOCs) and toxics to the list of pollutants that can be directly estimated for nonroad equipment. It updates the gasoline fuels used for nonroad equipment to be consistent with those used for onroad vehicles. It also provides users with more flexibility in how nonroad model output is organized. The change in default fuels leads to a small increase in nonroad NOx emissions in some locations.

For onroad emissions, MOVES2014a adds new options requested by users for the input of local vehicle miles traveled (VMT), includes minor updates to the default fuel tables, and corrects an error in MOVES2014 brake wear emissions. The change in brake wear emissions results in small decreases in PM emissions, while emissions for other criteria pollutants remain essentially the same as MOVES2014. MOVES2014a also corrects an error in the way hydrocarbon emissions are apportioned into the inputs needed by air quality models such as CMAQ and CAMx.

A more detailed list of the changes in MOVES2014a is provided in the appendix.

How has the speciation of hydrocarbon emissions changed between MOVES2014 and MOVES2014a and who is affected by this change?

MOVES2014 included an option to map total organic gas (TOG) emissions to the chemical species needed as inputs to chemical transport air quality models. In developing MOVES2014a, we learned that these MOVES2014 CB05 and CB6 outputs for calendar years 2013-2030 were incorrect. The magnitude of the error varies by chemical species, county and year. Modelers who have used MOVES2014 CB05 and CB6 output for the affected years should contact the MOVES team for guidance specific to their particular situation. Air quality modelers beginning new projects that need this output should use MOVES2014a.

What needs to be done to switch to MOVES2014a?

Instructions for downloading and installing MOVES2014a are available on the MOVES web page at www.epa.gov/otaq/models/moves/index.htm. EPA is providing a tool within MOVES2014a to convert input databases created for MOVES2014. However, due to changes in default fuel and I/M tables in MOVES2014a, users should export the default MOVES2014a fuel and I/M tables for the county being modeled and make any necessary changes to the default MOVES2014a information rather than using default MOVES2014 fuels or I/M programs.

Users should always specify what version of MOVES was used to create emissions results for state implementation plans (SIPs), conformity and other purposes.

When should MOVES2014a be used for SIPs and transportation conformity analyses?

MOVES2014a is EPA's latest motor vehicle emissions model for state and local agencies to estimate volatile organic compounds (VOCs), nitrogen oxides (NOx), particulate matter (PM$_{2.5}$ and PM$_{10}$), carbon monoxide (CO), and other precursors from cars, trucks, buses, motorcycles, and most categories of nonroad equipment for SIPs and transportation conformity determinations outside California.

In general, EPA believes the states should use the latest version of MOVES that is available (now MOVES2014a) for new SIP development outside of California. However, state and local agencies that have already completed significant work with MOVES2014 do not need to redo or revise that work with MOVES2014a.

Onroad Emissions. Because the differences between MOVES2014 and MOVES2014a are small for onroad emissions, EPA does not consider it a new emissions model for SIP and transportation conformity purposes and there will be no new grace period for either regional or project-level conformity analyses using MOVES2014a. The MOVES2014 grace period for conformity analyses will apply to MOVES2014a as well. The 2-year grace period for MOVES2014 and MOVES2014a ends on October 7, 2016 (79 FR 60343). EPA encourages state and local agencies to use the latest version of the MOVES model available at the time that any conformity modeling begins, since the model framework enhancements included will optimize model performance. The guidance document "Policy Guidance on the Use of MOVES2014 and Subsequent Minor Revisions for State Implementation Plan Development, Transportation Conformity, and other Purposes" (available at www.epa.gov/otaq/models/moves/index.htm#sip) applies to MOVES2014a as well and provides additional details on when and how MOVES2014a should be used. State and local

agencies should consult their EPA Regional Office to resolve any questions for a particular non-attainment or maintenance area.

Nonroad Emissions. MOVES2014 was the first version of MOVES to include nonroad emissions, and the model produced nonroad emission estimates that were equivalent to those from NONROAD2008 and NMIM2008. As a result, EPA's guidance was that either MOVES2014, NMIM2008, or NONROAD2008 could be used for estimating nonroad emissions. However, MOVES2014a adds features that simplify processing of emissions output and includes updated fuel input files that result in small changes in emission results. In addition, NONROAD2008 and NMIM2008 may no longer work with current operating systems and EPA cannot continue to provide technical support for these models. Therefore, EPA recommends that for modeling nonroad emissions, MOVES2014a be used for all new SIP development, although state and local agencies that have already completed significant work with MOVES2014, NONROAD2008, or NMIM2008 can continue to do so in order to allow for timely submission of the SIP.

Air Quality Model Inputs. In addition, because MOVES2014a corrects an error in MOVES2014 that determines how onroad emissions are apportioned into the inputs needed by air quality models such as CMAQ and CAMx, it is possible that some modelers who have already used MOVES2014 output to develop air quality model inputs will need to redo their work. Modelers who have used MOVES output in this way should contact the MOVES Team at mobile@epa.gov for advice specific to their individual situation.

Can MOVES2014a be used to estimate greenhouse gas emissions?
Yes, MOVES is currently EPA's best tool for estimating greenhouse gas (GHG) emissions from the transportation sector. At this time, MOVES2014a is the latest version of MOVES that has been released, and it accounts for all national fuel economy and GHG standards for cars and trucks as of October 2015. In addition, EPA has developed MOVES technical guidance that describes how to use MOVES to estimate GHG emissions and/or energy consumption from on-road vehicles in a state or metropolitan area (see the final question below for a link to this document). State and local agencies estimating GHG emissions in the transportation planning process should consider using the latest version of MOVES for GHG emissions analyses in the future. EPA notes that there are no SIP and transportation conformity requirements for GHGs.

Can MOVES2014a be used to estimate mobile source toxic emissions?
MOVES2014a estimates emissions for all major mobile source air toxics (MSATs) for both onroad and nonroad sources. MOVES is EPA's best available tool for quantifying emissions of these MSATs. State and local agencies, academic institutions, and other parties who are interested in analyzing MSAT emissions from transportation activities are encouraged to use MOVES. EPA notes that there are no SIP and transportation conformity requirements for air toxics.

Will EPA be offering training on MOVES2014a?
EPA will be offering webinars for experienced MOVES users to demonstrate new features of MOVES2014a, and will provide on-site multi-day training courses as needed for new users. Users will be able to find information on training dates and locations by visiting the MOVES web page.

What resources are available for MOVES2014a?

The MOVES web page (www.epa.gov/otaq/models/moves/index.htm) is the source for MOVES2014a software as well as previous versions of MOVES, technical documentation, guidance documents, tools for using MOVES, and information on MOVES training. The following documents provide additional information on MOVES2014 and MOVES2014a:

- The MOVES User Guide (available at www.epa.gov/otaq/models/moves/#user and in the MOVES Help menu) provides detailed instructions for using MOVES and has been updated for MOVES2014a.

- "Policy Guidance on the Use of MOVES2014 and Subsequent Minor Revisions) for State Implementation Plan Development, Transportation Conformity, and Other Purposes (available at www.epa.gov/otaq/models/moves/#sip) describes how and when to use MOVES2014 and MOVES2014a for SIP development, transportation conformity, general conformity, and other purposes.

- "MOVES2014 and 2014a Technical Guidance: Using MOVES to Prepare Emission Inventories for State Implementation Plans and Transportation Conformity" (available at www.epa.gov/otaq/models/moves/#sip) provides guidance on creating a Run Specification and adding local data using the County Data Manager for SIPs and regional transportation conformity analyses.

- "Transportation Conformity Guidance for Quantitative Hot-spot Analyses in $PM_{2.5}$ and PM_{10} Nonattainment and Maintenance Areas" (available at www.epa.gov/otaq/stateresources/transconf/projectlevel-hotspot.htm#pm-hotspot) provides guidance on using MOVES for quantitative PM_{10} and $PM_{2.5}$ hot-spot analysis for transportation projects.

- "Using MOVES in Project-Level Carbon Monoxide Analysis" (available at www.epa.gov/otaq/stateresources/transconf/policy.htm) describes how to use MOVES to model CO emissions from transportation projects.

- "Using MOVES for Estimating State and Local Inventories of On-Road Greenhouse Gas Emissions and Energy Consumption- Final" (available at www.epa.gov/otaq/stateresources/ghgtravel.htm#ghg) describes how to use MOVES to estimate GHG emissions and/or energy consumption from on-road vehicles in a state or metropolitan area.

If you have technical questions about MOVES2014a, please contact the MOVES team at mobile@epa.gov. If you have SIP or conformity questions, please contact your EPA Regional Office.

Appendix

Change from MOVES2014 to MOVES2014a	Implication
Allow users to calculate nonroad VOC and other HC species and nonroad toxics	Users no longer have to rely on NMIM2008 to estimate emissions of these pollutants
Allow users to aggregate nonroad output across multiple parameters such as model year and engine technology that MOVES uses to define nonroad equipment	Greatly reduces nonroad output size, simplifies and shortens time need to post-process nonroad output to create an inventory
Updated nonroad gasoline fuel supply to be consistent with onroad	Applies identical fuel characteristics for onroad and nonroad gasoline. Leads to small increases in nonroad NOx emissions
Fuel Subtype ID added to nonroad output	Allows for easier post-processing of chemical mechanisms for air quality modeling
Added nonroad data importers for meteorology and fuels	Easier for users to model effects of local meteorology and fuels on nonroad emissions
Nonroad GUI repairs	Nonroad GUI works more consistently
Added new VMT input options for daily VMT and VMT by MOVES source type	Added flexibility for users, who can now enter VMT data in any of four different ways – annual or daily VMT, by HPMS or MOVES source type
Enables CB6 and improves CB05 chemical mechanisms for onroad emissions. These results are used in air quality modeling	Fixes CB6 and CB05 errors that impact calendar years 2013-2030. Modelers who have used these chemical mechanism results should consult with EPA.
Corrected brake wear emission rates	Results in small decreases in total PM emissions
Installation package improvements	Simplifies installation process and reduces installation failures
Minor updates and corrections to MOVES defaults, including onroad fuel supply, I/M coverage, E85 fuel properties, energy and emission rates.	Results in very small emission changes
Fix error in four tables where distributions did not sum exactly to one	Causes slight decrease in ramp emissions
Fix error in state aggregation at national scale	Improves consistency when running MOVES at national scale for multiple states
Simplify onroad vehicles and fuel selection in MOVES Run Specification	MOVES automatically removes invalid vehicle/fuel combinations

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Fuel wizard improvements	Repairs scaling for non-ethanol fuel parameters, increasing the fuel effects for non-ethanol fuel changes. Also out-of-range fuels are blocked, reducing possibility of user input errors.
Updated software compatibility	Updated to be compatible with JAVA 7/8, MySQL Server 5.5/5.6, and Windows XP/ Vista/7/8/10

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