EPA Releases MOVES2014 Mobile Source Emissions Model

What is MOVES and why is EPA releasing MOVES2014?

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.

The Clean Air Act (CAA) requires EPA to regularly update its mobile source emission models. EPA continuously collects data and measures vehicle emissions to make sure the Agency has the best possible understanding of mobile source emissions. This assessment, in turn, informs the development of EPA's mobile source emission models. MOVES2014 is a major new revision to EPA's mobile source emission model and it replaces MOVES2010 and its minor revisions (MOVES2010a and MOVES2010b). It represents the Agency's most up-to-date assessment of on-road mobile source emissions. MOVES2014 allows users to benefit from new regulations promulgated since the release of MOVES2010b, incorporates new and up-to-date emissions data, and has improved functionality compared to MOVES2010b. MOVES2014 also has added the capability to model non-highway mobile sources by incorporating EPA's NONROAD2008 model.

What has changed from MOVES2010b to MOVES2014?

MOVES2014 includes three new emission control programs associated with regulations promulgated since the release of MOVES2010b:

- Tier 3 emission standards that phase in beginning in 2017 for cars, light-duty trucks, medium-duty passenger vehicles, and some heavy-duty trucks, and Tier 3 fuel standards that require lower sulfur gasoline beginning in 2017

- Heavy-duty engine and vehicle greenhouse gas (GHG) regulations that phase in during model years 2014-2018.

- The second phase of light-duty vehicle GHG regulations that phase in for model years 2017-2025 cars and light trucks.

MOVES2014 also includes new and updated emissions data from a wide range of test programs and other sources. The most significant changes in MOVES2014 include new effects of fuel properties such as gasoline sulfur and ethanol, new data on evaporative emissions from fuel leaks and from vehicles parked for multiple days, new analyses of particulate matter (PM) data related to PM speciation and temperature effects on running PM emissions, and new real world in-use emissions for heavy-duty vehicles using data from portable emission monitoring systems. In addition to these and many other updates for emission rates, MOVES2014 also includes substantial new data and updates for default population and activity. These include new vehicle population estimates and sales projections, new vehicle miles travelled (VMT) estimates based on the updated methodology for the Federal Highway Administration's Highway Performance Monitoring System, new national average speed distributions based on global positioning system (GPS) data, new state supplied data from the 2011 National Emission Inventory, and many other population and/or activity related updates.

As a result of feedback from MOVES2010 users, EPA has also made a number of functional improvements to make MOVES more flexible and easier to use. These include a new fuel wizard that automatically adjusts default fuel properties when a user makes changes to a specific fuel property, such as Reid vapor pressure (RVP) or ethanol content, based on local data. EPA has also added the capability for user input of local start and hoteling activity data and made a number of improvements to the MOVES graphical user interface (GUI) that make MOVES easier to use.

One of the biggest functional changes in MOVES2014 is the addition of the existing NON-ROAD2008 model into MOVES. With the MOVES GUI, users can now select whether to run MOVES for on-road or nonroad emission estimation. The nonroad portion of MOVES produces the same results as NONROAD2008 and can be used in place of that model. This is the first step toward the complete integration of on-road and nonroad functions in MOVES, including a complete revision and update of the nonroad code and database in a future release of MOVES.

While MOVES2014 incorporates many improvements compared to MOVES2010b, the basic structure of the on-road portion of the two models is essentially the same. Experienced users of the MOVES2010 series of models should be able to quickly make the transition to MOVES2014. Input requirements are same, although MOVES2014 provides additional input options for start and hoteling activity for users who have access to more detailed local information. There are minor differences in input file formats and EPA is providing a tool to take input files created for MOVES2010b and convert them to MOVES2014 format.

Can MOVES2014 be used for state implementation plans and transportation conformity?

MOVES2014 can be used to estimate air pollution emissions from cars, trucks, motorcycles, and buses, as well as nonroad engines and equipment in official state implementation plan (SIP) submissions to EPA and for transportation conformity analyses outside of California. EPA will be publishing a Federal Register notice of availability in the near future to approve MOVES2014 for official purposes. Upon publication of this notice, MOVES2014 will become EPA's approved

motor vehicle emission factor model for estimating volatile organic compounds (VOCs), nitrogen oxides (NOx), carbon monoxide (CO), direct particulate matter (PM_{10} and PM2.5) and other pollutants and precursors from cars, trucks, motorcycles, and buses by state and local agencies outside of California. EPA intends to include in the notice a two-year grace period before MOVES2014 is required to be used for transportation conformity purposes.

As noted above, the nonroad portion of MOVES is essentially identical to EPA's current standalone NONROAD2008 model. To develop nonroad inventories for SIP submissions or other official purposes, States other than California can use either:

- NONROAD2008,

- the nonroad capabilities of NMIM2008 (which contains NONROAD2008), or

- the nonroad capabilities of MOVES2014.

Prior to MOVES2014, MOVES2010b and its precursors MOVES2010a and MOVES2010 were the only on-road models approved for performing SIP and transportation conformity analyses outside of California.

When should MOVES2014 be used for SIP and transportation conformity analyses?

MOVES2014 should be used in SIP development outside of California as expeditiously as possible. The CAA requires that SIP inventories and control measures be based on the most current information and applicable models that are available when a SIP is developed.

Regarding transportation conformity, EPA intends to establish a two-year grace period before MOVES2014 is required for new transportation conformity analyses outside of California. EPA will publish a Federal Register notice of availability in the near future to approve MOVES2014 for official purposes and start this grace period. EPA consulted with DOT on the length of this grace period.

For more information on the requirements regarding the use of MOVES2014 for SIP and transportation conformity analyses, including implementation of the MOVES2014 conformity grace period, see EPA's "Policy Guidance on the Use of MOVES2014 for State Implementation Plan Development, Transportation Conformity, and Other Purposes," available at www.epa.gov/otaq/stateresources/transconf/policy.htm#models.

Can MOVES2014 be used to estimate greenhouse gas emissions?

Yes, MOVES2014 is currently the best tool EPA has for GHG emissions from the transportation sector, and it is a significant improvement over previous versions of MOVES. As described in the second question, MOVES2014 incorporates the effects of three new emission standard rules not included in MOVES2010. EPA notes that there are no SIP and transportation conformity

requirements for GHGs. State and local agencies estimating GHG emissions in the transportation planning process should consider using MOVES2014 for GHG emissions analyses in the future.

EPA will be updating the technical guidance on the use MOVES for GHG analysis soon. In the meantime, EPA's technical guidance for using MOVES2010b to estimate state and local inventories of on-road GHG emissions available at www.epa.gov/otaq/models/moves/ can be applied to MOVES2014.

Can MOVES2014 be used to estimate mobile source air toxics?

Yes, MOVES2014 estimates emissions for mobile source air toxics (MSATs) such as benzene, 1,3-butadiene, formaldehyde, acetaldehyde, acrolein, naphthalene, and ethanol. It is EPA's best available tool for quantifying emissions of these MSATs and is based on data that have been updated since MOVES2010b. State and local agencies, academic institutions, and other interested parties who are interested in analyzing MSAT emissions from transportation projects should consider using MOVES2014 in the future.

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.

How do MOVES2014 on-road emission estimates compare to those of MOVES2010b?

EPA performed a comparison of MOVES2014 to MOVES2010b using local data for several different urban counties, varying the local data used by fleet age distribution, fraction of light- and heavy-duty vehicle miles travelled (VMT), local fuel specifications, meteorology, and other input factors. In general, VOC, NOx, PM, and CO emissions show greater decreases over time compared to MOVES2010b. Differences in total emissions vary by calendar year and location, but in general, VOC and NOx emissions are lower in MOVES2014. PM emissions may be higher in some areas and lower in others. Actual results will vary based on local inputs in a given area, with local variations in fleet age distribution and composition having a significant influence on the final results.

What other resources are available for MOVES2014?

Please visit the MOVES web page (www.epa.gov/otaq/models/moves/index.htm) to download and install MOVES2014 software. Also included on the MOVES website are the MOVES2014 User Guide and the MOVES2014 Reference Manual, which provide basic information about running MOVES2014.

The MOVES web page also provides a link to the MOVES2014 SIP and Conformity Policy Guidance. EPA is working on updates to other MOVES guidance documents including the MOVES Technical Guidance, PM and CO hot-spot guidance documents, and MOVES GHG guidance and will post these documents on the web as soon as they are available. In the meantime, the technical guidance in the MOVES2010b versions of those documents will still be applicable. The MOVES2010b guidance documents are available at www.epa.gov/otaq/models/moves/moves-docum.htm.

EPA is developing separate training courses for new and experienced users of MOVES. New users who are not familiar with any previous version of MOVES will be able to take an updated version of the two-day MOVES hands-on course. For experienced MOVES users, EPA is developing a webinar-based course that highlights differences between MOVES2010b and MOVES2014. Details on those courses will be posted on the MOVES training page (www.epa.gov/otaq/models/moves/training.htm) soon after the release of MOVES2014.

Details on subscribing to the MOVES Listserv in order to get e-mail updates when additional guidance documents are posted, training is scheduled, or as any other new information about MOVES is released, can be found at www.epa.gov/otaq/models//mobilelist.htm.

For general information on the MOVE2014 release including all technical questions and any questions about upcoming guidance documents and training, please contact the EPA MOVES team at mobile@epa.gov.

For SIP policy questions, please contact Rudy Kapichak at kapichak.rudolph@epa.gov.

For transportation conformity questions, please contact Astrid Larsen at larsen.astrid@epa.gov.