

## **Mobile Sources Technical Review Subcommittee (MSTRS) MOVES Work Group: Meeting Summary**

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September 14, 2016  
U.S. EPA Office of Transportation & Air Quality  
2000 Traverwood Drive  
Ann Arbor, MI 48105

### **Welcome and Introductions**

Megan Beardsley welcomed the FACA workgroup and presented the agenda. Ms. Beardsley noted that she is currently acting for Ed Nam, and he will be back in October after a training detail he is on has ended. Ms. Beardsley reviewed the charter for the workgroup and noted that comments regarding the material discussed today are due by October 12<sup>th</sup> (four weeks after the meeting). She also noted that while the Federal Advisory Committee Act (FACA) process is fairly formal, informal comments about the MOVES model can be sent to the MOVES inbox ([mobile@epa.gov](mailto:mobile@epa.gov)) at any time. A full list of participants is provided as an attachment to this summary. Copies of the presentations from this meeting are available at <https://www3.epa.gov/otaq/models/moves/faca.htm>.

### **Presentation: MOVES2014 Overview and Plans for the Future – David Choi, US EPA/OTAQ**

Mr. Choi began with basic information about MOVES - the MOtor Vehicle Emission Simulator model. The model estimates emissions and energy use from onroad vehicles and nonroad equipment; estimates emissions from different engine activities from these emissions sources; estimates fuel consumption and emissions of many different pollutants; and accounts for many factors that contribute to emissions levels, such as emissions standards, fuels used, meteorology, vehicle populations, and vehicle activity. MOVES is used by the US EPA, states and cities, and in academic research. There are three scales of analysis possible with MOVES, which include national, county, and project scales. When MOVES is updated, there are two types of releases - minor releases that fix minor issues and improve functionality and do not result in significant differences in the model outputs, and there are major releases that involve updates to emissions data and result in significant differences in outputs of emissions estimates. There have been several versions of the MOVES model, with the first major release being the MOVES2010 version. The second major release was the MOVES2014 version that occurred in October 2014. The next version will be released in 2018 at the earliest, and will include new emissions data, new vehicle and population data, the impacts of new regulations and will improve the model's functionality and performance. The process for updating the model will include data collection, prioritization and analysis of potential changes, incorporation and testing of the changes, and model release and evaluation. Several recent studies have suggested that mobile source NOx emissions are too high in certain scenarios. EPA is taking multiple approaches to assess the

sources of discrepancies. Some potential onroad updates for the next MOVES version include using 2007+ heavy-duty diesel emission rates and Tier 2 light-duty PM emission rates, incorporation of the heavy-duty greenhouse gas (GHG) phase 2 program, updates to vehicle population and activity, and improving functional performance.

### *Discussion*

Jim Kliesch asked whether the model was off on the NO<sub>x</sub> estimates by being too high or too low. Ms. Beardsley responded that data from monitors was showing lower NO<sub>x</sub> than the model predicts.

Tim French commented that they were also seeing this in California, and they are working to do better for zero-mile emissions rates, tampering, and in other scenarios.

Mark Janssen was concerned about nonroad also, and he is more concerned about that than he is about the light-duty side.

Ms. Beardsley added that she didn't mean to imply that MOVES is overestimating emissions all the time or in every scenario.

Matt Barth asked whether the new version of the model would be called MOVES2018. Ms. Beardsley replied that the EPA is not sure about the name yet, but not including the year in the name has benefits.

Mr. Barth asked about the amount of input the EPA is looking for. Ms. Beardsley replied that the EPA is soliciting feedback on certain things right away, and they are also curious about larger-scale types of changes users want but that might not be included until the next update.

One workgroup member asked whether project-level analyses were prioritized for this update. Mr. Choi responded that this is something they are considering now, and this would fall under the user needs mentioned on Slide 13 of the presentation.

Gil Grodzinski commented that changes on the regional level should also be investigated at the project level, since the results should not differ due only to using a different scale in modeling. Ms. Beardsley noted that the EPA will be careful to check this when updating the model.

Mr. Barth asked whether any major validation efforts are planned. Mr. Choi replied that the EPA doesn't have any specific plans yet, but validation is considered a part of the ongoing MOVES development process. He also noted that the EPA would be interested in suggestions from any workgroup members on specific data to use in such an effort.

Chris Kite asked whether the EPA would be including some correction factors for Volkswagen. Ms. Beardsley replied that the EPA would be including some types of corrections for issues like that. (Post-meeting clarification from EPA—we do not plan to update light-duty diesel emission rates in the next version of MOVES, but we recognize that we need to prepare for questions on this topic.)

Mr. Kite also requested that the EPA complete the model update early in 2018, and Mr. Janssen echoed this sentiment.

Mr. Kite asked whether the in-use effects of the Tier 2 or Tier 3 rules would be considered in this update. Ms. Beardsley replied that the data will likely not be available in the necessary timeframe for this update, so it will probably not be included until the next major model update.

### **Presentation: Options for Simplifying MOVES Onroad Source Types and Ramps, David Brzezinski and Darrell Sonntag, US EPA/OTAQ**

MOVES has become more complex to fulfill user needs, but this complexity has resulted in the need for additional inputs, difficulty in updating with new data, less transparency, and increased run time. To simplify the model, the EPA is suggesting to reduce the number of source use types in the model and to remove freeway ramps from the national and county-scale model modes. To improve run time and because it is difficult for states to allocate vehicle populations among source types, the EPA is suggesting to combine some source types into a single source type. These proposed combinations include combining the passenger truck and light commercial truck source types, combining the refuse truck, single unit short-haul truck, single unit long-haul truck and motor home source types, and combining the combination short-haul truck and the combination long-haul truck source types. The EPA is also suggesting to remove ramps from the national and county-scale for all vehicle types to improve the accuracy of MOVES and to eliminate the need to input the ramp fraction at the county-scale. Ramps would be kept in the project-scale. Based on a ramp study conducted in 2012, the average of on-ramp and off-ramp emission rates are about equal to the MOVES highway rates. Further evaluation of this data with MOVES showed a moderate decrease in predicted emissions, which appears to be more accurate for light-duty exhaust emissions. The EPA is seeking feedback on any reasons why users would need to continue with the current model source types or with ramp output at the county-scale.

#### *Discussion*

Mr. Barth asked whether the EPA could do test runs with source types combined and not combined and compare the results. Mr. Brzezinski replied that it would take a fair amount of work to do that, so the EPA does not want to try this until they can get feedback on whether users would like the suggested combinations. He also noted that the EPA does not expect much effect from the combination on the outputs, if the model defaults are used.

Chris Frey noted that, in research, it has been frustrating that operating mode rates are identical when comparing source types, but drive cycles could be different. He suggested that the emission factors could be changed to fit the regulatory type based on vocation.

Tim French commented that the Phase 2 GHG rule has source type classifications in it, split by drive cycle, and under that rule companies are required to submit annual reports. He suggested that the EPA develop a scheme that matches up with that rule.

Vernon Hughes stated that the EPA also needs to think about fuel type, such as natural gas and biodiesel.

Susan Collet noted that the time it takes to run MOVES is a real concern. She would like to suggest some other source type combinations, such as passenger cars and trucks, noting that the emission standards and activity are similar.

Dale Wells noted that some states use automatic traffic recorder (ATR) data and can only distinguish the highway performance monitoring system (HPMS) classes, so source types within those classes cannot be distinguished.

Gary Dolce (EPA) noted that it is not helpful to have certain source type categories if there is no data available for those categories to put in the model.

Chris Voigt stated that MOVES is used in the implementation stage mostly, but for those using MOVES in project-level, it would be helpful to keep separate long-haul and short-haul categories, or at least be able to differentiate between the two. He also noted that it could be good to include traffic and activity data for freight.

Sam Pournazeri (CARB) commented that CARB is gathering data for different vocations, so data will soon be available for the amount of vehicle miles traveled (VMT) in different cycles.

Chris Frey asked whether project-level would be needed in order to get ramp output Mr. Sonntag replied that it would. Mr. Frey responded that he would still like to have the ability to get county-level ramp data because he uses county-level output to get emission rates and would not want to need to run project-level separately to get that data.

Dale Wells asked whether this change would only impact inventory mode and not emission rate mode. Mr. Sonntag confirmed this. (Post-meeting clarification from EPA—MOVES2014 has the option to provide separate ramp output in inventory mode, but not in emission rate mode. In this respect, removing ramps will only impact inventory mode. However, removing ramps will impact the emission rates and emissions from roadtype 2 (Rural restricted access roadways, including ramps) and roadtype 4 (Rural restricted access roadways, including ramps) for both emission rate and inventory mode.

Gil Grodzinski asked whether removing the ramps from the county and national-scale would improve run time. Mr. Sonntag replied that there would probably not be a significant difference; the primary reason for doing this change would be to improve the model's accuracy.

### **Presentation: MOVES-NONROAD Model Plans and Data Updates, Sarah Roberts, US EPA/OTAQ**

To improve the accuracy of nonroad inventories, the EPA plans to develop a new NONROAD model that combines new data with a user-friendly software platform. In the near term, the plan is to update population and activity data and population growth data. Other data updates, including equipment scrappage and emission and load factors, as well as model design updates,

would be incorporated in future MOVES versions. For growth factors, the current model uses population estimates from 1989 to 1996 and extrapolates that data into future years using a linear regression. The EPA is proposing to update these factors, basing growth on surrogate data indices, with the use of different indices for different equipment sectors. The plans to use this data involve starting with existing base year populations (varies depending on equipment type), applying the updated growth factors for the period of 1996-2014 to arrive at the estimated 2014 population, and then also applying the updated growth factors to the period of 2014-2040. The EPA plans to update the equipment populations to 2014 using historical growth data in the next model release. For this next MOVES release, the EPA is also planning some minor updates, including updates to the counties to reflect county changes made in some states, streamlining the metal and dioxin calculator to remove a redundant calculation, and providing guidance to assist users in importing the best available local data.

### *Discussion*

John German asked whether NONROAD has been updated to incorporate the effects of regulations. Ms. Roberts replied that it had. Mr. German also noted that he has time-to-failure data that could be used for the scappage curves.

Susan Collet asked whether NONROAD included evaporative emissions. Ms. Roberts replied that the model includes some assumptions about evaporative emissions.

Matt Barth asked about consolidation of equipment. Ms. Roberts responded that this type of update had not yet been discussed. It was added that the EPA would want the menus of categories to be intuitive and descriptive. If the existing categories are too close to each other, they could be combined, especially if the categories use the same emission factors and are similar in use.

Chris Frey asked whether engine rebuilds and retrofits would be on the list of things to update in the future. Gary Dolce noted that the model has the capability now to factor in retrofits, but the EPA would like to make this function easier to use and provide more guidance for it.

Chris Frey noted that equipment could be used in different ways and have different duty cycles, and he asked whether the EPA intended to address this. He also asked about deterioration factors. Ms. Beardsley said these issues could be considered in the future but would not be included in this update.

Dale Wells stated that altitude effects should be considered and also requested that the output be kept at the fine-level that is currently available.

Chris Kite asked when the changes to NONROAD would be included in MOVES. Ms. Roberts replied that NONROAD is already in MOVES.

David Chou (CARB) noted that private gardeners have huge amounts of activity, at least in California, and use older equipment, but there is no information available for this population. CARB is conducting surveys to get some data about this population. Ms. Roberts responded that

there were currently no plans to address this activity, but asked that this data be shared with the EPA.

Chris Wolfe noted there is interest in using models like NONROAD to estimate port emissions. Ms. Roberts responded that the EPA is studying cargo-handling equipment and hopes to use the data they are getting from port inventories about useful life and other factors to update the NONROAD model.

Mark Janssen noted that LADCO tries to capture activity to estimate equipment populations or use, rather than the other way around, such as using the amount of fuel it takes to grow an acre of corn to estimate how much farm equipment is used. He commented that this type of analysis could be done for lawn and garden equipment and construction equipment, or could at least be used to verify the population estimates. Ms. Roberts responded that the EPA agrees and is the reason the agency is seeking fuel consumption data. She also noted that this data is sometimes easier to find than activity data.

Joe Jakuta commented that non-road will take the same form as on-road, which would be burdensome. Ms. Beardsley noted that NONROAD is already in MOVES, and the results go into SMOKE-MOVES, but it is done differently because not all the data is the same between non-road and on-road. She also noted that the EPA is not planning to change the NONROAD output from what it is now.

Tim French asked about updating the emission factors for NONROAD. Ms. Beardsley replied that the EPA accounts for standards in the model, but long-term, they would like to perform some testing to update the emission factors.

## **Presentation: HD GHG Phase 2 in MOVES, David Choi, US EPA/OTAQ**

Heavy-duty (HD) vehicles account for about 20% of the GHG emissions from transportation sources and are the fastest growing transportation sector. The HD GHG Phase 2 rule will be fully phased-in by 2027 and will reduce carbon and fuel emissions from medium- and heavy-duty engines and vehicles. Some reductions in air toxics and criteria pollutants are also expected. MOVES already accounts for Phase 1 standards and needs to be updated for Phase 2. These adjustments to energy use, road loads, and hoteling, will be in the “emissionrateadjustment,” the “sourceusetypephysics,” and the “hotellingactivitydistribution” tables within the model. Other updates to extended idle and auxiliary power unit (APU) rates, based on new data gathered, will be presented in future FACA meetings.

### *Discussion*

Mr. Barth asked about the source of the data for the APU penetration rates shown on Slide 16. Mr. Choi replied that this is based on manufacturer’s comments received from the HD GHG Phase 2 proposed rulemaking.

## **WRAP-Up**

In response to a general question about whether the EPA has the budget and staffing to do everything they want to do with the MOVES updates, Ms. Beardsley responded that the EPA will have to prioritize their efforts.

Ms. Beardsley asked workgroup members to send their comments on today's meeting to Sarah Roberts by October 12<sup>th</sup>. The next meeting is planned for December 7<sup>th</sup> and will cover the topics of criteria emission updates and on-road population and activity updates. She also noted that general comments on MOVES can always be sent to the MOVES inbox at [mobile@epa.gov](mailto:mobile@epa.gov).

### Attachment - Workgroup Meeting Attendance List

<b>MOVES Workgroup Members</b>			
<b>Name</b>	<b>Home Organization</b>	<b>Representing Organization</b>	<b>Attendance</b>
Giedrius Ambrozaitis	Alliance of Automobile Manufacturers	Alliance of Automobile Manufacturers	✓
Matthew Barth	University of California, Riverside (CE-CERT)	University of California, Riverside (CE-CERT); Workgroup Co-Chair	✓
Megan Beardsley	EPA OTAQ	US EPA; Workgroup Co-Chair	✓
Susan Collet	Toyota	Coordinating Research Council (CRC)	✓
David D'Onofrio	Atlanta Regional Commission	Association of Metropolitan Planning Organizations (AMPO)	✓
Tim French	Engine Manufacturers Association (EMA)	Engine Manufacturers Association (EMA)	✓
Christopher Frey	North Carolina State University	North Carolina State University	✓
Mike Geller	Manufacturers of Emission Controls Association (MECA)	Manufacturers of Emission Controls Association (MECA)	
John German	International Council on Clean Transportation (ICCT)	International Council on Clean Transportation (ICCT)	✓
Gil Grodzinsky	Georgia Department of Natural Resources	National Association of Clean Air Agencies (NACAA)	✓
Cecilia Ho	Federal Highway Administration (FHWA)	Federal Highway Administration (FHWA)	✓
Britt Holmen	University of Vermont	University of Vermont	✓
Vernon Hughes	California Air Resources Board (CARB)	California Air Resources Board (CARB)	✓
Joe Jakuta	Ozone Transport Commission (OTC)	Ozone Transport Commission (OTC)	✓
Mark Janssen	Lake Michigan Air Directors Consortium (LADCO)	Lake Michigan Air Directors Consortium (LADCO)	✓
Chris Kite	Texas Commission on Environmental Quality	Association of Air Pollution Control Agencies (AAPCA)	✓
Jim Kliesch	Honda	Honda	✓
David Lax	American Petroleum Institute (API)	American Petroleum Institute (API)	✓
Ed Nam	EPA OTAQ	US EPA; Workgroup Co-Chair	
Ross Patronsky	Chicago Metropolitan Agency for Planning	Association of Metropolitan Planning Organizations (AMPO)	✓
Matthew Thornton	National Renewable Energy Laboratory (NREL)	National Renewable Energy Laboratory (NREL)	✓
Chris Voigt	Virginia Department of Transportation	Amer. Assoc. of State Highway and Transportation Officials (AASHTO)	✓
Dale Wells	Colorado Department of Public Health and Environment	National Association of Clean Air Agencies (NACAA)	✓
Chris Wolfe	Environmental Defense Fund (EDF)	Environmental Defense Fund (EDF)	✓



<b>Other Attendees</b>	
<b>Name</b>	<b>Organization</b>
David Brzezinski	US EPA
David Choi	US EPA
David Chou	California Air Resources Board (CARB)
Gary Dolce	US EPA
Jeff Long	California Air Resources Board (CARB)
Sally Otterson	Washington Dept. of Ecology
Sam Pournazeri	California Air Resources Board (CARB)
Sarah Roberts	US EPA
Jolyon Shelton	Delaware Dept of Natural Resources & Environmental Control (DNREC)
Lubna Shoaib	East West Gateway Council of Govt, St. Louis MPO
Darrell Sonntag	US EPA
Lesley Stobert	EC/R Inc. (EPA contractor support to MOVES Workgroup)
Alden West	EC/R Inc. (EPA contractor support to MOVES Workgroup)
Steve Zelinka	California Air Resources Board (CARB)