

Federal Advisory Committee Act
Clean Air Act Advisory Committee

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

June 13, 2018
U.S. EPA Office of Transportation & Air Quality
2000 Traverwood Drive
Ann Arbor, MI 48105

Welcome from the Chairs

Dr. Matt Barth and Ms. Megan Beardsley welcomed the Clean Air Act Advisory Committee (CAAAC), Mobile Sources Technical Review Subcommittee (MSTRS) MOVES Review Work Group to the meeting. Ms. Beardsley presented the meeting agenda (see Table 1).

**Table 1. MOVES Review Work Group Meeting Agenda:
June 13, 2018 (1 pm to 4 pm)**

Topic
Welcome from the Chairs
Member Roll Call
General Announcements
Presentations: <ul style="list-style-type: none">• MOVES2014b Plans and Comparisons• Heavy-Duty Vehicle Activity in MOVES: Idle, Starts, Soaks, and Hoteling• Update: Revising Start/Soak Relationships for Light-Duty Gaseous Emissions• Utilizing MOVES for Evaluating Shared, Electric, Connected, and Automated Vehicles
Future Meetings/Wrap-up

Member Roll Call

Ms. Beardsley conducted a Work Group member roll call. A list of Work Group members and others in attendance is presented in an Attachment to these meeting minutes.

General Announcements

Dr. Sarah Roberts made general announcements regarding meeting procedures, including how participants should signal when they had questions (i.e., by using the raised hand feature in Adobe Connect). Dr. Roberts stated that the meeting minutes will be submitted to the Work

Group members for review before posting to the website and that any additional questions about the technical content of today's presentations should be sent to her at her e-mail address: Roberts.sarah@epa.gov.

Dr. Barth provided a brief summary of the recent MSTRS meeting, including a review of the discussion topics, the presentations given, and the general reception to the presentation he gave regarding the MOVES Review Work Group and the EPA's progress in developing the updated version of MOVES.

Presentation: MOVES2014b Plans and Comparisons – EPA Staff: Megan Beardsley, Darrell Sonntag, Sarah Roberts, Jaehoon Han, Jarrod Brown

Ms. Beardsley stated that the EPA is planning a minor model update, which will be called MOVES2014b. She noted that this is a minor update that will improve the nonroad emissions estimates but does not impact onroad inventories. The specific updates include updated growth, fuels, and nonroad Tier 4 engine populations and emissions rates. Other updates include revisions to the chemical mechanisms used in air quality modeling, an improved interface for post-processing scripts, and updated technical guidance. This update is not a comprehensive nonroad update, which the EPA is still working on. The EPA has completed comparison runs for the updates, which were at the national scale, used default inputs, included exhaust and evaporative emissions for all processes, and included January and July results as well as weekend and weekday results. In these comparisons, MOVES2014b results in a decrease in emissions results over MOVES2014a for NO_x, PM_{2.5}, VOC, benzene, and CO₂ at the national scale.

The EPA is continuing work on the next major update to MOVES, including changes to the onroad inventory and activity. The release date for this major update is still being determined but will be in 2019 at the earliest.

Discussion

Mr. Gil Grodzinsky noted that the MOVES comparisons presented went out to the year 2028 and asked whether the EPA had also investigated beyond 2028. Ms. Beardsley replied that the EPA did not examine beyond 2028, but they do not expect any major changes in the trends beyond that year. Mr. Grodzinsky stated that he had seen changes in trends beyond 2030 due to the Tier 4 emissions standards, and he suggested that the EPA may want to investigate the trends further into the future.

Mr. Tom Darlington asked what the EPA considered to be a mid-level blend of ethanol. Ms. Beardsley replied that anything over E-15 was considered to be mid-level.

Mr. Mark Janssen asked whether there would be black-out dates for the new release of MOVES to cover the dates close to State Implementation Plan (SIP) deadlines. Ms. Beardsley said the EPA would take SIP deadlines into account in determining when the new version is released.

Ms. Julie McDill asked what would be included in the comprehensive nonroad update. Ms. Beardsley responded that it would include a code update, updated population and activity data, and possibly some updated emission rates for select engine categories.

Presentation: Heavy-Duty Vehicle Activity in MOVES: Idle, Starts, Soaks, and Hotelling – EPA Staff: Jessica Brakora, David Brzezinski, Darrell Sonntag

Mr. Brzezinski began by explaining how MOVES currently models idling and the reasons why updates to the data used by MOVES for idle time are needed. The EPA is planning to add “off-network” idle to MOVES, which is the idle time that is not already included in the driving cycles. To do this, the EPA plans to include a new table in MOVES based on the National Renewable Energy Laboratory (NREL) FleetDNA database and University of California, Riverside College of Engineering Center for Environmental Research and Technology (CE-CERT) data on the average number of vehicle starts per day, the start fraction and the soak fraction. Mr. Brzezinski presented the results for idle fraction by source type, which ranged from about 0.1 to about 0.5 and the average daily starts by source type, which ranged from 1 to over 35, with noticeable differences between source types. He also presented average hourly start and soak fractions for each source type for each weekday and weekend hour. Mr. Brzezinski also presented a comparison of hotelling activity from MOVES2014a, NREL FleetDNA data and data from the University of California, Davis (UC Davis), which showed that both the NREL and UC Davis data estimate lower hotelling rates than MOVES2014a. In summary, Mr. Brzezinski noted that the EPA is proposing to create and update the MOVES tables for workday idle fraction, average daily starts, start fraction, and soak fraction using NREL and CE-CERT data, and the emission impacts from these updates have not yet been determined. The EPA is also proposing to use the NREL data to update the hotelling activity for long-haul trucks.

Discussion

In response to Dr. Barth’s question about where there are existing data gaps in MOVES, Mr. Brzezinski responded that there is a concern about whether rest period data for long-haul trucks is representative of actual use. He noted that it is difficult to discern from the data what is truly hotelling.

Mr. Dale Wells commented that it is difficult to know where rest periods occur, noting that half of all rest periods do not happen at rest stops, and that there is no data on where the other half of the rest periods occur.

Mr. Grodzinsky stated that some data is being gathered by cities, such as Atlanta, and he also remarked that some rest stops are over capacity, so the number of trucks at the stop may not be accurate. He also commented that it is also important to understand what the trucks are doing at the rest stops, such whether they are idling, completely off, using auxiliary power, etc. Mr. Brzezinski responded that it would be useful to have some truck instrumentation data so that rest stop activity could be determined. He added that trucking companies or associations may have some data they could share.

Mr. Wells asked why there was such a large difference in start and soak fractions between midnight and 1:00 am. Mr. Brzezinski replied that some of the data are sparse for those time periods, but the EPA would look into what may be causing the differences.

Mr. Marc Corrigan asked whether telematic data would be helpful for these updates. Mr. Brzezinski responded that some of the NREL data is telematic data, but to get to greater accuracy, targeted data is needed. He noted that global positioning system (GPS)-type data does not reveal whether a truck is idling or not, it just shows that it is stopped. However, there are some studies being conducted, such as one by the University of Arkansas using the electronic logging devices on trucks, that could help with this in the future.

Mr. Chris Voigt noted that there is a truck activity study that is near completion and asked whether the group would want a presentation on the study. Mr. Sonntag noted that he was aware of the study, but the results were not publicly available yet. He replied that the EPA would consider using the data once it was available and would also consider having a presentation on the study.

Ms. McDill noted that on the slide showing the idle fraction results, most vehicle types are in idle 30-50% of the time, but long-haul trucks, source type 62, are in idle only a little over 10% of the time. EPA staff remarked that total idling time includes any time the speed is less than one mile per hour, which could include stop lights or deliveries, and noted that for long-haul combination trucks, this time does not include extended idles, which is defined as idling for over one hour.

Mr. Janssen commented that telematic data for speed includes fleet data and has a fair amount of data on time spent at less than one mile per hour. He suggested that the EPA could use commercial data, such as from StreetLight Data. EPA staff replied that with that data, it would still be unclear what is happening at speeds of less than one mile per hour, and that for MOVES, they are trying to develop total idling times.

Presentation: Update: Revising Start/Soak Relationships for Light-Duty Gaseous Emissions – EPA Staff: James Warila, Carl Fulper, Erin McCurry

Mr. Warila provided background about the start/soak relationships currently in MOVES and the proposed changes. Currently, start emissions are calculated from Federal Test Procedure (FTP) results, where a soak period is defined as an “operating mode” and emission rates vary by soak period. The proposed update uses data from an EPA study using a portable emissions measurement system (PEMS) and dynamometer testing results obtained from the California Air Resources Board (CARB). To develop soak ratios from this data, the EPA took the average emissions mass results by vehicle and operating mode, corrected for running-exhaust emissions by subtracting the result for the 0-6 minute soak period, averaged results across vehicles separately for the EPA and the CARB data sets, normalized all soak periods to “cold start” by dividing by the emissions from a soak period of over 720 minutes, and calculated the final ratios by combining the EPA and CARB results as a weighted average. The EPA is proposing to update the MOVES soak curves for model years (MY) 2004 and later for warm to hot starts.

Discussion

Mr. John German commented that the rise in NO_x varies wildly from vehicle to vehicle, suggesting that the NO_x emissions are calibration-based. He asked if there was any information available on defeat devices, noting that one was found in China. Ms. Warila responded that for this exercise, only the emission rates were gathered. However, EPA compliance staff are investigating the reasons for the differing emission rates.

Ms. Debbie Wilson asked whether MY 2004 and later were grouped together or whether each MY was investigated separately. Mr. Warila replied that Tier 2 standard vehicles were treated as an aggregate, and other factors, including age and MY, were not considered. The focus of this work was on the soak ratio, which is applied proportionally.

Mr. Wells commented that emissions could differ depending on whether there is enrichment at the start or not.

Presentation: Utilizing MOVES for Evaluating Shared, Electric, Connected, and Automated Vehicles – Matthew Barth, University of California, Riverside

Dr. Barth began by stating that transportation is undergoing four major revolutions – shared mobility, electrification, connectivity and automation. Each of these changes in transportation may individually impact environmental quality, and coordinated development of each of these may have the potential to enhance environmental quality. The general components of an emissions inventory include emissions/energy factors, vehicle activity data and fleet composition data. For emissions modeling, there are also general parameters used, depending on the geographic scale of the transportation area being studied. Data from connected and automated vehicles, in combination with electric and shared vehicles, can be used in Intelligent Transportation Systems, which reduce congestion and enable platooning, to reduce on-road energy and emissions. Modeling efforts have shown that some applications made possible through these innovations, such as Eco-Approach and Departure from signalized intersections, can reduce fuel use. However, MOVES tends to underestimate the effects of traffic smoothing, and all currently used modeling approaches tend to miss the effects of reduced aerodynamic drag. The inability of these models to capture these emissions differences will also affect the quality of the emissions inventories for which they provide input. In the future, a physical modal or instantaneous emissions model could be developed for connected and automated vehicle scenarios and other traffic smoothing effects.

Discussion

Mr. Wells commented that congestion is a transportation enemy and getting people to use realistic speeds and account for congestion is a problem. Dr. Barth agreed with his comment.

Mr. Warila asked about the vehicles used for the CMEM model. Dr. Barth replied that they used a “typical” Tier 2 car for their modeling efforts.

Mr. Voigt commented that improvement to MOVES for eco-driving would also help resolve several other issues for project-level analyses.

Mr. Mike Geller asked how the models currently treat the energy required to run the sensors and other electronics needed for connected and automated vehicles. Dr. Barth responded that about 20 kilowatts is needed for all the sensors, which is three to four times as much as a vehicle air conditioner. He noted that due to this energy use, the fuel economy of an automated vehicle will inherently be less than a conventional vehicle, even if they become more efficient.

Ms. Wilson asked how signal timing will affect idle time. Dr. Barth responded that eco-traffic signals would allow vehicles to adjust the signal time rather than having the signals do this, which should increase traffic flow and reduce idle time.

Wrap-Up

In closing, Dr. Roberts informed the meeting attendees that the next meeting will be in the fall, but a specific date has not yet been set. Dr. Roberts also noted that Work Group members are invited to give presentations that might help the EPA shape the MOVES model.

Ms. Beardsley thanked the meeting attendees for their participation.

A full list of participants is provided as an attachment to this summary. Copies of the presentations given during this meeting will be available at <https://www.epa.gov/moves/moves-model-review-work-group>.

Attachment – Work Group Meeting Attendance List

June 2018 MOVES Review Work Group Attendees

Name	Home Organization	Representing Organization
Giedrius Ambrozaitis	Alliance of Automobile Manufacturers	Alliance of Automobile Manufacturers
Matt Barth	University of California, Riverside (CE-CERT)	University of California, Riverside (CE-CERT), Work Group Co-chair
Megan Beardsley	U.S. Environmental Protection Agency (EPA)	EPA; Work Group 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)
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	Association of Air Pollution Control Agencies (AAPCA)
Cecilia Ho	Federal Highway Administration (FHWA)	FHWA
Britt Holmen	University of Vermont	University of Vermont
Mark Janssen	Lake Michigan Air Directors Consortium (LADCO)	Lake Michigan Air Directors Consortium (LADCO)
Jim Kliesch	Honda	Honda
David Lax	American Petroleum Institute (API)	American Petroleum Institute (API)
Lubna Shoaib	East-West Gateway Council of Governments	Association of Metropolitan Planning Organizations (AMPO)
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)

June 2018 MOVES Review Non-Work Group Attendees

Name	Home Organization	Representing Organization
Michael Aldridge	U.S. Environmental Protection Agency (EPA)	U.S. Environmental Protection Agency (EPA)
Anna Aleynick	AECOM	AECOM
Kevin Black	FHWA	FHWA
Andy Bollman	North Carolina Department of Environmental Quality	North Carolina Department of Environmental Quality
Kevin Bolon	U.S. Environmental Protection Agency (EPA)	U.S. Environmental Protection Agency (EPA)
Chris Bovee	Wisconsin Department of Natural Resources	Wisconsin Department of Natural Resources
Christopher Boyd	Shelby County Health Department	Shelby County Health Department
David Brzezinski	U.S. Environmental Protection Agency (EPA)	U.S. Environmental Protection Agency (EPA)
Amy Bunker	U.S. Environmental Protection Agency (EPA)	U.S. Environmental Protection Agency (EPA)
Ying-Tzu Chung	Michael Baker International	Michael Baker International
Denise Cormier	Maine Department of Environmental Protection	Maine Department of Environmental Protection
Marc Corrigan	Tennessee Department of Environment and Conservation	Tennessee Department of Environment and Conservation
Lou Corsino	Connecticut Department of Energy and Environmental Protection	Connecticut Department of Energy and Environmental Protection
Angela Cullen	U.S. Environmental Protection Agency (EPA)	U.S. Environmental Protection Agency (EPA)
Robert d'Abadie	Michael Baker International	Michael Baker International
Tom Darlington	Air Improvement Resource, Inc.	Air Improvement Resource, Inc.
Gary Dolce	U.S. Environmental Protection Agency (EPA)	U.S. Environmental Protection Agency (EPA)
Kathryn Dotzel	U.S. Environmental Protection Agency (EPA)	U.S. Environmental Protection Agency (EPA)
Alison Eyth	Environmental Protection Agency OAQPS	Environmental Protection Agency OAQPS
Sara Forestieri	CARB	CARB
Carl Fulper	U.S. Environmental Protection Agency (EPA)	U.S. Environmental Protection Agency (EPA)
Jaehoon Han	U.S. Environmental Protection Agency (EPA)	U.S. Environmental Protection Agency (EPA)
Connie Hart	U.S. Environmental Protection Agency (EPA)	U.S. Environmental Protection Agency (EPA)
Jeremy Heiken	Oak Leaf Environmental, Inc.	Oak Leaf Environmental, Inc.
Joey Huang	UNC	UNC
Aaron Hula	U.S. Environmental Protection Agency (EPA)	U.S. Environmental Protection Agency (EPA)
Dennis Kahlbaum	Air, Inc.	Air, Inc.
David Kall	Federal Highway Administration (FHWA)	Federal Highway Administration (FHWA)

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Name	Home Organization	Representing Organization
Jim Koroniades	New Jersey Department of Environmental Protection	New Jersey Department of Environmental Protection
Sonya Lewis-Cheatham	Virginia Department of Environmental Quality	Virginia Department of Environmental Quality
Jeff Long	California Air Resources Board (CARB)	California Air Resources Board (CARB)
Erin McCurry	Environmental Protection Agency	Environmental Protection Agency
Julie McDill	Mid-Atlantic Regional Air Management Association	Mid-Atlantic Regional Air Management Association
Jeff Merrell	Vermont Department of Environmental Conservation	National Association of Clean Air Agencies (NACAA)
Robin Moran	U.S. Environmental Protection Agency (EPA)	U.S. Environmental Protection Agency (EPA)
Sally Otterson	Washington Department of Ecology	Washington Department of Ecology
Todd Pasley	North Carolina Department of Environmental Quality	North Carolina Department of Environmental Quality
Steven Potter	Connecticut Dept of Energy and Environmental Protection	Connecticut Dept of Energy and Environmental Protection
Sarah Roberts	U.S. Environmental Protection Agency (EPA)	U.S. Environmental Protection Agency (EPA)
Kathryn Sargeant	U.S. Environmental Protection Agency (EPA)	U.S. Environmental Protection Agency (EPA)
Jolyon Shelton	Delaware Dept. of Natural Resources and Environmental Control	National Association of Clean Air Agencies (NACAA)
Rebecca Simpson	Colorado Department of Public Health and Environment	Colorado Department of Public Health and Environment
Collin Smythe	Vermont Department of Environmental Conservation	Vermont Department of Environmental Conservation
Darrell Sonntag	U.S. Environmental Protection Agency (EPA)	U.S. Environmental Protection Agency (EPA)
Lesley Stobert	SC&A, Inc.	EPA Contractor
Hideharu Takemoto	Honda	Honda
Vivek Thimmavajhala	North Central Texas Council of Governments	North Central Texas Council of Governments
James Warila	U.S. Environmental Protection Agency (EPA)	U.S. Environmental Protection Agency (EPA)
Peter Wasko	Minnesota Department of Transportation	Minnesota Department of Transportation
Debbie Wilson	Mid-Atlantic Air Management Association (MARAMA)	Mid-Atlantic Air Management Association (MARAMA)