Federal Advisory Committee Act
Clean Air Act Advisory Committee

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

September 13, 2017
U.S. EPA Office of Transportation & Air Quality
2000 Traverwood Drive
Ann Arbor, MI 48105

Welcome from the Chairs

Dr. Sarah Roberts and Dr. Matt Barth welcomed the Clean Air Act Advisory Committee (CAAAC), Mobile Sources Technical Review Subcommittee (MSTRS) MOVES Work Group to its fifth meeting. Dr. Roberts reported that co-chair Ms. Megan Beardsley was unable to attend the meeting and also presented the meeting agenda (see Table 1).

Table 1. MOVES Review Work Group Meeting Agenda:
September 13, 2017 (1 pm to 3 pm)

Topic
Welcome from the Chair
General Announcements
Member Roll Call

Presentations:
    - Updated NONROAD Equipment Population Growth Rates
    - Update on MOVES Model Evaluation: NOx
    - MOVES Future Fuel Supply Updates

Future Meetings/Wrap-up

General Announcements

Dr. 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 by October 11, 2017 at her e-mail address: Roberts.sarah@epa.gov.

Member Roll Call

After the general announcements were made, Dr. Roberts conducted a Work Group member roll call. A list of Work Group members in attendance is presented in an Attachment to these meeting minutes.

Presentation: Updated NONROAD Equipment Population Growth Rates – Sarah Roberts, James Warila, Daniel Bizer-Cox

Dr. Roberts began by noting that the EPA is continuing to update NONROAD's underlying data inputs and model architecture. Compared with onroad sources, there is little data about nonroad equipment population or activity. NONROAD uses a base year for equipment populations and applies growth rate factors to extrapolate to populations in years beyond the base. While the current version of NONROAD uses linear regression of historical engine populations to do this projection, this method is believed to inaccurately predict future equipment populations. For the next version of MOVES, the EPA intends to update the equipment population growth indices to provide more realistic future population and emissions predictions. To project the future populations, the EPA intends to use surrogate data where it is available and use extrapolation of historical data only where other surrogates are not available or feasible. These surrogates include sector-specific energy use, human population, economic projections and activity projections. For each nonroad equipment sector, the EPA has identified a preferred surrogate to use for projecting future growth, which differs between sectors. The EPA will also test the validity of the surrogates by reconstructing historical growth using that data for the years 1996-2014.

To predict future conditions, the new growth indices will be applied to the NONROAD base year populations to estimate equipment populations for 1996 – 2014. They will then also be applied to the estimated 2014 equipment populations to estimate populations through 2040. For years 2040 – 2060, the model will extrapolate linearly from the 2039 and 2040 population estimates. The EPA ran tests of the new growth indices and found that, compared with MOVES2014a, projected nonroad equipment populations are lower in every category except industrial equipment. This, in turn, results in overall projected nonroad emissions of NOx, CO, and PM2.5 being 15% - 22% lower than that projected with MOVES2014a, although there is regional variability.

Discussion

A question was asked about whether the EPA was performing any validation. Dr. Roberts responded that they are doing some validation work.

Mr. Mark Janssen remarked that his organization (LADCO) has found that the current inventory is three to five times too high for some equipment categories, which indicates that the population may be even smaller than what the new EPA growth indices predict. He noted, however, that their own data for marine recreation equipment matches well with the EPA's new predictions.

Mr. David Chou asked whether the EPA can estimate annual sales for a nonroad equipment category. Dr. Roberts replied that they are looking at a dataset of 2014 sales and they have

historical data, but they also need to understand scrappage rates and the rate of equipment leaving the country to have accurate equipment population numbers.

Mr. Chou asked whether the EPA has a set timeframe for updating the growth surrogates in the future. Dr. Roberts noted that the EPA is trying to use publicly-available data where possible because this should allow for more frequent updates, but they have not set a specific update timeline yet.

Mr. Steve Potter commented that for lawn and garden equipment populations, it may be possible to use another statistic, such as housing or maybe area source data could help.

Ms. Rebecca Simpson asked why there is a category for underground mining equipment but not for surface mining equipment. Dr. Roberts responded that they are revisiting the categories, and some mining equipment is categorized as construction equipment, but this assignment could be revised if that is appropriate. Dr. Roberts asked Ms. Simpson to send her an email with her suggestions for mining equipment categorization.

Mr. Matt Thornton noted that his organization (NREL) has been working to obtain some population data and they may also have some fuel data that could be used for validation. He suggested that he and Dr. Roberts discuss this further after the meeting.

Ms. Sally Otterson remarked that there seemed to be a lot of variation year to year where fuel consumption is used to estimate growth rates, and she asked whether the populations were changing or if the fuel usage was changing. Dr. Roberts replied that the model assumes each equipment types uses fuel at the same, constant rate, so activity variability will be seen in the population numbers.

Mr. Gil Grodzinsky stated that the EPA's results are similar to the spot-checking his organization (NACAA) has done. However, he said that states should use their own data when it is available, rather than using the national defaults, as there are regional differences that would not be accounted for when the national defaults are used.

Presentation: Update on MOVES Model Evaluation -NOx – Darrell Sonntag, David Choi, James Warila, et al.

Mr. Sonntag reported that since the March 2017 MOVES Work Group meeting, the EPA has conducted additional work on the light-duty NOx evaluation. Further evaluation of light-duty NOx emissions was conducted because air quality models have over-predicted NOx compared to monitored concentrations, and researchers have suggested that this over-prediction may be due to estimates for on-road light-duty vehicles.

To evaluate light-duty emission rates, three sets of data were studied, including tunnel data, inspection/maintenance (I/M) program data, and remote sensing data. In comparing these data to the MOVES predictions, MOVES generally predicts higher emissions than the California tunnel study data, MOVES predicts higher emission rates for Tier 1 passenger cars (1996 to 2000 model years) and lower emission rates for Tier 2 cars and trucks (2010-2016 model years) compared

with the emission rates calculated from the Denver I/M data, and MOVES project-scale predicts slightly lower emissions than the remote sensing data, but MOVES predictions are generally within the variability of the data. Although the comparisons using MOVES national scale show clear over-prediction, it is not appropriate to use the MOVES national-scale for comparing to independent data because they do not account for the measurement conditions. Based on this evaluation, the EPA has not concluded that MOVES light-duty NOx rates are too high, and they are continuing to investigate.

EPA also evaluated the sensitivity of predicted ambient levels of NOx by modifying uncertain inputs, such as temporal allocation of heavy-duty running emissions and growth/temporal allocation of nonroad equipment, using CAMx. They have found that these nonroad uncertainties affect nighttime NOx emissions to some extent, but they have not found a single factor that can be adjusted to solve the NOx bias issue. It is believed that there are likely multiple compounding factors, with each contributing to a portion of the bias. Moving forward, the EPA is continuing to evaluate hypotheses that could lead to the overestimate of NOx, is comparing MOVES NOx light-duty gasoline emission rates to other vehicle emission studies, is continuing efforts to update nonroad population estimates and spatial and temporal allocation surrogates, and is evaluating and improving the MOVES inputs used in the National Emissions Inventory (NEI).

Discussion

Mr. Dale Wells noted that humidity should be corrected for, noting that testing done in Ann Arbor would reflect humidity at a certain level, which would be different than that experienced around the country. Mr. Wells also suggested that rate mode be used. It was noted in response that the Denver data used base rates as a test, and humidity was considered. It was also noted that a NOx adjustment was incorporated in the Denver data. The EPA also noted that for comparisons to real world measurements, the rates-mode is not as straight-forward as inventory-mode and that there are some differences in how you would process the results from rates- and inventory-mode.

Ms. Alison Eyth noted that the EPA uses rates mode for the CAMx modeling presented.

Mr. Chris Kite commented that for Tier 2 fleets, it seemed passenger cars and trucks should be more similar in emissions than what was presented. The EPA responded that the two types of vehicles do harmonize in the later years, really starting after 2016, but in 2010 they are still different. The degree of separation depends on the Tier 2 bin examined, with earlier bins exhibiting different emission rates.

Mr. Steve Vander Griend commented that MOVES predicts increases in NOx when ethanol volume in gasoline increases from zero percent (E0) to ten percent (E10) and noted that ethanol actually decreases NOx. Mr. Steve Vander Griend also suggested that the EPA study future NOx rates for Tier 2 vehicles.

Presentation: Draft Fuel Supply Updates for MOVES201x – Jarrod Brown

To begin, Mr. Brown provided an introduction to the MOVES fuel properties. He noted that fuel properties are not uniform across the country and can vary significantly depending on how the fuel is produced. The fuel supply data is contained in several tables within MOVES. The fuel

regions have not changed for this version of MOVES, but some regions are changing their fuels programs, which may be included in the default database, depending on the MOVES201X publication date. Fuel properties have been updated through 2015 based on compliance data. While sulfur content will be going down in the future due to the Tier 3 program, due to averaging, banking and trading (ABT) credits, the amount of sulfur in the fuel at any particular location is expected to vary depending on which refinery batch was received. Therefore, MOVES201X sulfur values for 2017+ are unchanged from the MOVES2014 values. The MOVES201X default database will contain 100% E10 market share for calendar year 2012 and later, since the EPA is no longer predicting E15 market penetration. However, MOVES201X will include non-default E0 and E15 fuel parameters in the default fuel supply database, so that local areas with non-zero E0 or E15 penetration can model those fuel supply cases. The default fuel supply in MOVES201X will also include non-default Reid vapor pressure and biodiesel percentage choices that can be selected for each region. The new version of MOVES will remove historical oxygenates (i.e., MTBE, ETBE and TAME) that are no longer used from the fuel properties table. The code for MOVES201X has also addressed and fixed a bug in the fuel wizard, and the fuel wizard calculations are expected to be used less often in the future since non-default fuel formulations will now be included in the database.

Discussion

Mr. Vander Griend noted that the data on slide 5 for the regional fuel aromatics and benzene levels do not agree with industry data and asked if there was any logic in the difference. Mr. Brown replied that the levels shown in this presentation are based on the data reported to the EPA.

Mr. David Kall suggested that it could be useful to push out the update of the MOVES default database to include the updated fuel data that will be coming in from the regions. Mr. Brown responded that the EPA has considered updating the fuels databases on a more frequent schedule to include updated data, but they need to weigh the benefits of the change frequency against the need for stability in how the model is used at the regulatory level.

Wrap-Up

In closing, Dr. Roberts thanked the meeting participants and informed them of the tentative topics for the next meeting, which is planned for December 6, 2017. Dr. Roberts also reminded attendees that additional comments are to be sent to her at Roberts.sarah@epa.gov by October 11, 2017.

Dr. Barth stated that the chairs are looking for feedback from the workgroup members about the current workgroup process. He suggested and asked for feedback from members about whether there should be presentations from people outside the EPA at these meetings, whether quarterly is the best meeting frequency, and whether half-day meetings represent the optimal time allowance for the workgroup meetings. He also suggested that meeting in conjunction with Transportation Research Board (TRB) meetings could be a possibility. He also asked for feedback about whether keeping a running list of long- and short-term recommendations for the model would be helpful.

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

2017 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
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)
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
Joseph 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)
Lubna Shoaib	East-West Gateway Council of Governments	Association of Metropolitan Planning Organizations (AMPO)
Matt Thornton	National Renewable Energy Laboratory (NREL)	National Renewable Energy Laboratory (NREL)
Steven Vander Griend	ICM Inc.	Energy Future Coalition/Urban Air Initiative
Christopher 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)

Non-Work Group Attendees

Name	Home Organization	Representing Organization
Daniel Bizer-Cox	Environmental Protection Agency	Environmental Protection Agency
Chris Bovee	Wisconsin Department of Natural Resources	Wisconsin Department of Natural Resources
Christopher Boyd	Shelby County Health Department	Shelby County Health Department
David Chou	California Air Resources Board (CARB)	California Air Resources Board (CARB)
Marc Corrigan	Tennessee Department of Environment and Conservation	Tennessee Department of Environment and Conservation
Denise Cormier	Maine Department of Environmental Protection	Maine Department of Environmental Protection
Louis Corsino	Connecticut Department of Energy and Environmental Protection	Connecticut Department of Energy and Environmental Protection
Robert d'Abadie	Michael Baker International	Michael Baker International
Laurel Driver	Environmental Protection Agency	Environmental Protection Agency
Yuan Du	Sonoma Technology	Sonoma Technology
Alison Eyth	Environmental Protection Agency	Environmental Protection Agency
David Kall	Federal Highway Administration (FHWA)	Federal Highway Administration (FHWA)
Majid Khalilikhah	Tennessee Department of Transportation	Tennessee Department of Transportation
Jaehoon Kim	Tennessee Department of Transportation	Tennessee Department of Transportation
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)
Sally Otterson	Washington Department of Ecology	Washington Department of Ecology
Steven Potter	Connecticut Department of Energy and Environmental Protection	Connecticut Department of Energy and Environmental Protection
Dr. Sarah Roberts	Environmental Protection Agency	Environmental Protection Agency
Yue Shan	Michael Baker International	Michael Baker International
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
James Smith	Tennessee Department of Environment and Conservation	Tennessee Department of Environment and Conservation
Kimi Smith	Idaho Department of Environmental Quality	Idaho Department of Environmental Quality
Collin Smythe	Vermont Department of Environmental Conservation	Vermont Department of Environmental Conservation
Matt Spears	EMA	EMA
Lesley Stobert	SC&A, Inc.	EPA Contractor
Hideharu Takemoto	Honda	Honda
Vivek Thimmavajjhala	North Central Texas Council of Governments	North Central Texas Council of Governments
Brian Timin	Environmental Protection Agency	Environmental Protection Agency

Jeff Vukovich	Environmental Protection Agency	Environmental Protection Agency
Guihua Wang	California Air Resources Board (CARB)	California Air Resources Board (CARB)
James Warila	Environmental Protection Agency	Environmental Protection Agency
Wei Zhang	Idaho Department of Environmental Quality	National Association of Clean Air Agencies (NACAA)