Federal Advisory Committee Act
Clean Air Act Advisory Committee

Mobile Sources Technical Review Subcommittee
MOVES Work Group: Meeting Summary

July 31, 2012
U.S. EPA National Vehicle & Fuel Emissions Laboratory
2000 Traverwood Drive
Ann Arbor, MI 48105

Welcome and Introductions

John Koupal and Matt Barth welcomed the participants. A full list of participants is provided as an attachment to this summary. Prior to the meeting a full set of presentations was distributed to the members [now available at http://www.epa.gov/otaq/models/moves/faca.htm].

John summarized the charge and format for the workgroup. The charge is to focus on the next version of MOVES (MOVES 2013); evaluating data sources and analysis methods proposed for use in developing MOVES 2013; and commenting on and/or suggesting new user features and enhancements. This meeting will summarize EPA's proposed updates to MOVES. Following this meeting,

- EC/R (EPA contractor support) will summarize the meeting and distribute the meeting summary;
- members should discuss the information presented within their organizations and with their constituents and submit comments back to EC/R;
- EC/R will compile the comments for discussion at the next workgroup meeting
- Workgroup members will also have the opportunity to review draft MOVES technical reports as they become available
- Workgroup will develop recommendations to the MSTRS

John proposed that the comments on the information presented at this meeting should be submitted to EC/R by Wednesday September 12, 2012 so that they may be collated and distributed prior to the meeting tentatively scheduled for September 25, 2012. John expects the workgroup to meet every other month to discuss updates to the model. He hopes the group will provide good discussions on what to include in future model updates, data needs, etc. The next meeting will start with a review of the comments received in response to this meeting.

MOVES 2010: Experience to Date

Gary Dolce of EPA/OTAQ, presented *MOVES 2010: Experience to Date*. MOVES 2004 was released in 2005, draft MOVES2009 was released in April 2009 and MOVES2010 was released in December 2009. Minor revisions are indicated with a letter, major revisions have a new release year. MOVES2010 is the first official release and is required to be used in State Implementation Plan (SIP) development and in conformity analyses. Gary summarized the changes included in MOVES2010a and MOVES2010b including addition of light duty greenhouse gas (GHG) and fuel economy rules, performance and usability improvements, changes in air toxic estimation (using updated factors to calculate existing air toxics and adding

some air toxics estimates), and new features (e.g., easier multi-county runs at county scale, better functionality for rates option). Additional support provided with the release of MOVES210b included new tools (to convert RunSpecs and user input databases), updated SIP and Conformity Policy Guidance, updated MOVES technical guidance and a spreadsheet converter to ease input of retrofit program data. User feedback has informed the improvements to MOVES. EPA is obtaining this feedback through the FACA workgroup, peer review, guidance documents, training courses, workshops, the MOVES inbox (mobile@epa.gov) and frequently asked questions (FAQ), and through work with air quality agencies (e.g., the regional planning organizations) and transportation agencies. Six peer reviews of MOVES technical reports (light duty emission rates; heavy duty emission rates; evaporative emission calculations; gasoline fuel effects; temperature, humidity, air conditioning, and I/M adjustments; and population and activity data) are available on the web. Many of the guidance documents have been updated. Many training programs (over 46 times) have been provided (often as a joint effort with the Federal Highway Administration (FHA)). EPA held a 3-day workshop in Ann Arbor and EPA continues to respond to questions received through the MOVES inbox. EPA selects and posts frequently asked questions. MOVES is being widely used and researchers are reporting results. There have been international inquiries about MOVES, including from Canada, Europe, Mexico and Asia.

Discussion

Matt Barth asked if EPA is still working with the FHA on interfaces with transportation models. Because there are so many transportation models it is difficult to develop a direct interface, EPA is focusing on the ability to use transportation model outputs as an input to MOVES.

There was a question about providing more training on-line. EPA has provided a couple of webinars on "Introduction to MOVES" and how to do batch level runs. There is a complication because on-line webinars must comply with the Americans with Disabilities Act which requires closed captioning.

MOVES Validation Efforts to Date

John Koupal and David Choi jointly presented *MOVES Validation Efforts to Date*. John acknowledged the work of many researchers whose work was used in the validation efforts. He summarized past validation efforts, the objectives of validation, and the means of evaluation (specifically the comparison of model predictions to independent measurements, and evaluating the models prediction of trends in emissions as well as absolute emissions). John provided examples of the variability in independent data and discussed the scope of the evaluation. He discussed some of the validation efforts in the literature (especially the tunnel studies) and emphasized that MOVES is not designed to predict emissions from individual vehicles, MOVES inputs are generally not sufficiently customized to match the measurement conditions, and tunnel conditions do not match emission modes contributing to regional VOC emissions. John discussed the difficulty of modeling to match measurement conditions, including unknown variables such as driving patterns and age distribution. A wide range of MOVES results are possible and good inputs are needed. John continued to discuss the methods that are used to

evaluate the MOVES2010a predictions, with the emission rates for vehicles under known operating conditions, the core of the evaluation effort.

David Choi led the discussion of evaluation studies. He provided a table summarizing studies on emissions rates, localized composite, air quality and fuel use. For light duty emission rate evaluation he summarized the sources of independent data and the comparison to MOVES inputs. He presented graphics on operating mode distributions for three different cities and included I/M, remote sensing data, and dynamometer results and summarized the limitations of the assumptions. He showed graphics of emission rate evaluations of the LDV NOx, CO, and HC emissions from these four studies vs. MOVES. He discussed the differences in the emission estimates (especially for the older cars in the fleet) versus a comparison in the trends in emissions. David Choi summarized results from a recent study conducted by Bin Liu and Chris Frey of NS State University on MOVES predictions and empirical data for NO_X emission factors.

David Choi went on to discuss emission rate evaluation for heavy-duty vehicles. He summarized the studies used in the evaluation (both the compliance data and drayage study are new) and the results of the comparison for HDD NO_X emissions. He presented compliance data for 5 model years. He also presented some data from the Houston Port Drayage Project that used PEMS and PAMS data and compared the Houston Drayage measurements to MOVES estimates. EPA is planning to further analyze the differences between the compliance and drayage data. Except for CO, which had a consistently high trend, they are not seeing an overall trend in bias. They believe the validation looks good.

John Koupal finished the presentation by discussing comparisons of MOVES estimates to tunnel and roadside monitoring studies. He described the studies and itemized some of the uncertainties and then presented the graphical comparisons of the NO_X and $PM_{2.5}$ emissions. John discussed the results of a study on on-road vehicle emissions in a southern California traffic tunnel. He discussed the temperature sensitivity of NMHC emission factors and acknowledged that running loss evaporative emissions are insensitive to temperature. MOVES does not have a temperature correlation for running loss evaporative emissions. He presented a comparison of MOVES NO_X emission factors with driving cycle and LEV adjustments. He also discussed a paper by Brian McDonald and Robert Harley on Changes in On-Road Diesel Vehicle Emissions in California and compared their results with predictions from MOVES. John Koupal went on the discuss some air quality modeling results (using CMAQ and MOVES) versus monitoring data. He concluded that the air quality modeling results are better with MOVES than with MOBILE6. Finally he presented a comparison of MOVES-based Fuel consumption versus tax data.

Discussion

Tom Darlington asked if the conclusion, that light duty emission estimates are okay, will not inform how EPA changes the model for 2013. John responded that they are happy to have the Atlanta data and it did inform the rates. They reduced off cycle emission rates at high power. They are still seeing a bias for CO but are not seeing a bias for NO_X or HC. The next big research effort is the Tier II PEMS study. They expect this study will impact engine specific power (ESP) and start emissions but the study will not be completed in time to be used for the MOVES 2013 update. For the heavy duty diesel analysis they now have 2007-2010 on road

compliance data. Matt Barth asked if the methodology for emission factors and vehicle specific power (VSP) is correct. John Koupal responded that EPA is pretty locked into the structure of the model and the focus is on the correctness of the factors.

MOVES 2013 Plans & Directions

William Aikman is the team leader for MOVES 2013 and presented *MOVES 2013 Plans & Directions*. He outlined the MOVES2013 functional improvements and data updates. He reviewed the changes incorporated in MOVES2010b and discussed the major changes for MOVES2013, including incorporating new functionality, research and emissions standards, and the capability to be applied outside the U.S. MOVES 2013 will be considered a new model for SIP and conformity purposes with a new grace period. He emphasized that there are only 7-8 months of development time remaining. The process for updating moves includes collecting concerns, recommendations, suggestions, etc, analyzing them, and prioritizing changes/enhancements based on impacts, to user, accuracy and impact on results. He described the internal data base that tracks comments and issues. Although the database is internal and not open to the public, common questions end up on the Q & A page. He summarized some of the functional improvements to the model including both improvements to the calculations and streamlining of the performance. EPA is currently running MOVES in the cloud due to the large processing requirements. William highlighted concerns about MOVES running too slowly, and suggested that users can also run moves on purchased cloud space for quicker running times. Ari Kahan discussed updates to the input data, including regulations that have been promulgated since the 2010b release, new test program data and analyses and updates on VMT, population and sales (including updated forecasts). The final list of updates that will be made is dependent upon the actual release date of MOVES2013.

Discussion

David Lax asked if the light duty GHG rule is finalized before the election will it be included in MOVES 2013. John Koupal responded that any rules that are final before the end of the year will be included. EPA does not want to delay the model release because the States need the new model to complete their State Implementation Plans (SIP).Matt Barth asked if EPA has access to local data created by the users. David Brezinski responded that EPA is asking the States to provide their MOVES input data.

David Lax asked what is being done to validate MOVES 2013 besides the new CRC PEMS study. John Koupal responded that the CRC study is the big update for light duty. For the heavy duty sector there is new compliance data. He asked the group to make additional recommendations. Tom Darlington asked for more data on slide 12 “New Data and Data Updates.” EPA went through these updates too quickly and this is the information his clients want. John Koupal responded that these changes are the focus of the groups upcoming meetings – details will be rolled out as they are developed over time. He emphasized that the model has a lot of default data. The data are dynamic and changing over time (e.g, E15 or no E15, RVP, etc.) These defaults are used for national emission estimates and for users without data. EPA does not want to overcommit at this point on changes they can make.

Integration of the NONROAD Model into MOVES

Edward Glover led the last presentation *Integration of the NONROAD Model into MOVES*. He gave an overview of the Nonroad model and emphasized some of the limitations resulting from the age of the computer code and the availability of new data that may allow for some changes in the underlying algorithms (primarily scrappage) and additional factors (emissions are estimated at the national level and allocated to local level; lack of locomotive, commercial marine, and air emissions in MOVES; and air toxic estimates). He summarized the national nonroad sector VOC emissions by category (units on the y axis are tons per year for the nation). Changes will focus on the dominant sectors (recreational equipment, pleasure craft, and lawn and garden equipment). He summarized the national nonroad sector NO_X emissions by category and noted that locomotive and commercial marine emissions dominate but are not in the model. Dominant emissions that are estimated by the model include construction and mining equipment and agricultural equipment. He summarized planned updates in activity data based on available state data for a subset of categories. In addition EPA hopes to purchase some national historical and projected equipment sales data. Finally they will update the computer code by inserting the Nonroad code into the MOVES model and integrate the Nonroad algorithms fully into MOVES. Phase I changes include developing new emission factors and load factors from EPA Nonroad pilot study and other available data (primarily for the construction sector). In Phase 2 (long term) they hope to develop operating mode based emission rates and load factors for Nonroad (this is not currently scheduled for MOVES2013).

Discussion

There was no additional discussion.

WRAP –Up

John Koupal proposed the next meeting for September 25, 2012 (in the afternoon – 1 pm EST start time - to accommodate the west coast participants). The topics for discussion include the heavy duty updates and new features of the model. He proposed future meeting dates of November 27 (evaporative updates); January 29 (fuel updates); and March 26 (NONROAD updates). He asked the members to let him know of any competing meetings for these tentative dates.

John asked the participants to provide comments on the information presented by September 12, 2012 so that the comments could be compiled and distributed prior to the next meeting. Matt Barth emphasized that a lot of model validation was discussed and members should provide comments to EPA. In response to a question David Brezinski clarified that EPA has done testing of multi day diurnal evaporative losses but that information is not currently in MOVES2010b. The evaporative emissions report is almost done. There are some features that were available in MOOBILE that are not in MOVES. Another member asked if altitude and temperature data are available in MOVES. There is no altitude adjustment in MOVES now. They are planning to add an adjustment for evaporative losses at different altitudes.

John Koupal responded to another question that there is probably not time to include the light duty PEMS data in the 2013 model. The data will be used to validate the model. Data are either used to establish the emission rates or to validate the model. Karin Landsberg asked about the

start emissions in cold temperatures. John Koupal responded that EPA is working to validate these estimates down to zero degrees.

Attachment - Work Group Meeting Attendance List

Name	Organization Representing	Attendance
John Koupal	EPA/OTAQ	X
Matthew Barth	UC Riverside	X
Giedrius Ambrozaitis	AAM	X
David Lax	API	X
Bob Maxwell	Global Automakers	X
Tom Darlington	AEM and EMA	X
Rich Denbow	AMPO	Webinar
Susan Collet	CRC	X
Michael Claggett for Cecilia Ho	FHWA	Webinar
Joe Kubsh	MECA	X
Karin Landsberg	NACAA (Alaska DEC)	Webinar
Chuck Gebhardt	NACAA (Illinois EPA)	Webinar
Marc Bennett	NACAA (Massachusetts DEP)	Webinar
Mike Shannon for Steven Flint	NACAA (New York State DEC)	Webinar
Jane Lin	TRB ADC20	Webinar
Michael Rogers	Georgia Tech	Webinar
Mridul Gautam	West Virginia University	Webinar
Tim Sexton	Washington State DOT	
Chengfeng Wang	CARB	Webinar
Robert Sawyer	University of California - Berkeley	
Chris Frey	North Carolina State University	
Other		
Craig Woleander		Webinar
Muhammed Chandasir	AGCO	Webinar
Denise Cormierm	Maine DEP	Webinar
EPA Observers and Presenters		
Priscilla Chang	ORISE Intern	X
Trish Koman		X
Andrew Eilbert	Intern	X
Jim Warila		X
Dave Sosnowski		X
Meg Patulski		X
Connie Hart		X
Lee Cook		X
Ed Gover		X
David Brezinski		X
David Choi		X
William Aikman		X
Chris Dresser		X
Gary Dolce		X
EPA Contractor Support		
Rebecca Battye	EC/R Incorporated	X
Alden West	EC/R Incorporated	Teleconference