

Federal Advisory Committee Act
Clean Air Act Advisory Committee

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

April 30, 2013
U.S. EPA Office of Transportation & Air Quality
2000 Traverwood Drive
Ann Arbor, MI 48105

Welcome and Introductions

Ed Nam and Matt Barth welcomed the participants. A full list of participants is provided as an attachment to this summary. Copies of the presentations from this meeting are available at www.epa.gov/otaq/models/moves/faca.htm.

Mr. Barth reminded the workgroup that one of their charges is to report back to MSTRS with comments and recommendations, including general recommendations about EPA's work. Mr. Barth stressed the value of these recommendations to the MSTRS and stated that any recommendations can be sent directly to Becky Battye or to himself. The next MSTRS will be in the fall and another MOVES workgroup meeting is scheduled for June (now July).

The agenda was presented along with the workgroup charge, which includes a focus on the next version of MOVES (2013) and beyond, evaluating data sources and analysis methods proposed for MOVES, and commenting on or suggesting new user features and enhancements. One comment was also received from the previous MOVES workgroup meeting from the Alaska Department of Environmental Conservation (ADEC). The ADEC commented that block heaters are common in colder climates and asked if a feature could be added that would allow for the input of specific vehicle start data to account for such heaters. The EPA responded that they will continue to review data to support this feature in a future version of MOVES.

Syeda Haque commented that MOVES2010 has the potential to produce negative emission factors, and inquired whether this has been addressed in MOVES2013. Chris Dresser responded that it is possible to get negative emission factors if a specific ratio related to population is adjusted too far from default. This is a normal function of the program and is not considered a bug.

**Presentation: EPA/V2/E-89: Testing, Results & Application in MOVES2013
– Aron Butler, James Warila, EPA/OTAQ**

Section 1506 of the Energy Policy Act of 2005 (EPA/V2/E-89) directed EPA to produce an updated emissions model reflecting fuel property effects. The EPA (in collaboration with DOE and CRC) focused on addressing data gaps with regards to the following fuel properties: ethanol content, aromatics content, distillation parameters, and vapor pressure. The EPA/V2/E-89 program allows for the modeling of multiple fuel property interactions, such as the resulting effects from the blending of

ethanol. The initial pilot test Phases 1 and 2 were completed in mid-2008, and included testing of 3 fuels on 19 vehicles at 75°F (phase 1) and 50°F (phase 2). These data will be added to the docket in the next couple of days. The main fuel matrix was tested in Phase 3, which was completed in mid-2010 and included testing of 27 fuels in 15 Tier 2 vehicles at 75°F. Phases 4 and 5 (funded by DOE), were conducted in mid-2010 and include testing for temperature effects on normal emitters and testing of high emitters, respectively. These data will be published by DOE. The fuel matrix developed by the EPA includes property ranges chosen to allow models to predict emissions for most in-use fuels in the United States. All vehicles tested were new or leased, and all vehicles were high-volume sellers and therefore representative of the general vehicle population. A range of pollutants were tested, including speciation for hydrocarbons. Application of this dataset represents a major upgrade in MOVES capabilities, including updated toxic:VOC fractions for Tier 2 vehicles and fuel effects for several species of interest.

The goal for the analysis and design stage of the program was to estimate fuel effects while limiting the confounding effects of vehicle variability and minimizing uncertainty. The natural logarithm of emissions was taken and the five fuel properties were standardized for modeling, which allows direct comparisons among fuel effects. The EPA concluded that fuel effects do exist and are measurable, even for hot-running emissions. In interpreting and applying the models, however, it must be emphasized that coefficients representing fuel effects cannot be taken individually; they must be taken as a full set. The fuel adjustment ratios and toxic fractions are to be applied in MOVES 2013.

Discussion

Joseph Kubsh stated that the model results seem intuitive with what was expected, and inquired whether the EPA had compared the results with tests conducted on older vehicle models. It was explained, in response, that comparisons with older studies are difficult because they were generally conducted with only 2 or 3 vehicles and only studied one fuel property. The recent studies conducted by the EPA include much more PM data than previous studies, which allowed the EPA to see the effect that ethanol has on increasing PM emissions. A section of the test report attempts to compare the data to past studies.

Presentation: The Effects of Gasoline Sulfur Level on Emissions from Tier 2 Vehicles in the In-Use Fleet, Aron Butler, EPA/OTAQ

The EPA conducted a study to assess the sensitivity of in-use Tier 2 vehicles to fuel sulfur level. Eighty one vehicles from SE Michigan were recruited for the test, including 2007 to 2009 model year passenger cars and light trucks with 20,000 to 40,000 miles. The EPA tested 5-ppm and 28-ppm sulfur fuels, with a focus on three questions –what is the catalyst clean-out effect with 28 ppm fuel, what is the clean out effect with 5 ppm fuel, and what is the effect of the sulfur level with mileage accumulation? Emissions measured in the test were transformed by natural logarithm. Less than 1 percent of the measurements were removed as outliers, and measurements with low concentrations were imputed (occurs in cases where a dilute emission measurement is lower than background). Imputation was performed by using half the minimum of a valid measurement from a given mileage bin for the vehicle with zero values.

EPA calculated percent reduction in emissions before and after clean-out with 28-ppm sulfur fuel and determined that catalyst efficiency loss due to sulfur loading is occurring in the Tier 2 in-use fleet. EPA also studied the differences in the effectiveness of the clean-out procedure between 28-ppm and 5-ppm fuel sulfur levels. EPA determined that the effectiveness of high speed/load procedures in restoring catalyst efficiency is limited by fuel sulfur level. EPA studied the percent reduction in emissions from changing from 28-ppm to 5-ppm sulfur fuel, and expects that reducing fuel sulfur levels will bring significant reductions in NO_x, NMHC, and other pollutants of interest in the in-use fleet. A new sulfur correction equation has been included in MOVES to account for lower sulfur fuels.

Discussion

Mr. Kubsh asked if there were any fuel effects observed in the EPAAct study that had as large an impact as the effects observed in the sulfur study. It was explained, in response, that the effects of ethanol and other properties studied in EPAAct are generally smaller than sulfur effects. Further, in newer vehicles, more heavy lifting is being done by the catalyst to keep the vehicle clean; but while the catalyst is effective on gaseous pollutants, it does not have a large effect on PM emissions.

Presentation: Modeling E85 in MOVES2013, David Choi, EPA/OTAQ

Flexible fuel vehicles are designed to use higher levels of ethanol in gasoline, up to 85%, known as E85. The production of flexible fuel vehicles has been steadily increasing in the US over the past fifteen years. MOVES2013 will be the first MOVES model with the capability of modeling E85 fuels. Four separate studies were conducted on higher ethanol fuels; including the EPAAct test program (EPA with DOE and CRC), the NREL E40 program, the CRC E-80 project, and the PM Speciation program (EPA). All of the available datasets were combined to examine the effect of E85 on emissions compared to E10. The analysis showed that there are no statistically significant differences in emissions between E10 and E85 for THC, CO, NO_x, PM, NMOG and VOC. The analysis did show a statistically significant increase in methane and a decrease in NMHC emissions with E85 compared to E10. Limited E85 emissions data were available for PAH, dioxins, furans, and metals. A new methane to THC ratio was developed for E85. The E10 to E85 adjustment factor is applied in the general fuel ratio expression table.

Presentation: The General Fuel Ratio Expression Table (GFRE) – Jarrod Brown, EPA/OTAQ

The GFRE provides an updated, flexible table for fuel effects for MOVES2013 and will override ratios generated by the complex and predictive models inside MOVES. For criteria pollutants, the GFRE will include a scaling factor for fuel adjustment based on the MOVES base fuel. For toxics, the GFRE will include toxic ratios representing the fraction of a toxic multiplicatively from MOVES VOC. The flexibility of the GFRE allows the EPA to update the ratio equations as more data becomes available in the future.

Discussion

One workgroup member asked if the EPA had any plans to further update the GFRE as more data becomes available. It was explained, in response, that the EPA did not have any plans currently but the flexible design of the GFRE will make it easier to accommodate more data in the future.

Phil Heirigs asked if EPA has investigated temperature effects on vapor pressure (RVP) and exhaust emissions in MOVES. These effects were included in MOBILE, where RVP effects on exhaust emissions were turned off around 40 to 45 degrees Fahrenheit. Mr. Heirigs asserted that a decrease in RVP at very low temperatures may not result in a decrease in emissions. Utah had included RVP as a potential hydrocarbon control, but there is not much benefit in the winter. Mr. Heirigs inquired whether EPA planned to build temperature impacts back into MOVES2013. Ed Glover stated that based on the way the GFRE is currently designed, it cannot handle temperature as a parameter; however, temperature could possibly be added. Mr. Glover stated that he is not aware of any data related to temperature effects on fuel parameters, but new data suggests that carbon canister purge is well controlled. There was agreement that additional test data is needed and Mr. Heirigs stated that he could possibly put a data package together. Mr. Heirigs stressed the importance of this issue as MOVES2010 gives the same emissions impact regardless of temperature. Mr. Heirigs asserted that the EPA should include temperature effects on fuels in MOVES2013. The EPA acknowledged Mr. Heirigs' comment and cautioned that the model is currently near completion, and only a certain number of updates planned for MOVES2013 can be incorporated. Some comments may need to be addressed in the future, after the MOVES2013 release. However, Mr. Butler agreed to look into the issue further and determine whether it could be included in MOVES2013.

Presentation: Regional Fuels and the MOVES Default Fuel Supply – Jarrod Brown, EPA/OTAQ

The current MOVES default fuel supplies are based on fuel survey data and single point county data, which includes large variations and may show fuel supply differences where none actually exist. As an alternative, EPA plans to use certification data from batch-by-batch refinery gate reports on fuel properties to develop a regional fuel supply map. The regional fuel supply map will reduce the number of unique fuels from approximately 280 to 40. In the new method, fuel properties are the average of batches for a given month and are explainable across a region rather than point by point. The regional fuels will become the default fuel supply for MOVES2013 and later versions. The Fuel Wizard is also planned for future versions of MOVES, and will allow users to take advantage of refinery modeling data in making fuel property changes. The Fuel Wizard will provide an interface to allow users to make fuel property changes and will automatically adjust fuel properties related to those changed by the user.

Discussion

David Lax inquired why the EPA plans to model emissions based on fuel properties at the refinery gate rather than where the fuel is being used. EPA responded that they are aware of

changes being made to the fuel downstream, such as fuel blending, and these changes are accounted for by applying adjustment factors to the RVP, sulfur, and benzene content of the fuel.

One workgroup member asked if the EPA has compared the MOVES model using the fuel wizard to a retail fuel. EPA responded that the fuel wizard has not been developed, and it is expected that the wizard will be completed this summer.

Karin Landsburg asked what data will be used for Alaska. EPA responded that they plan to use the Alliance of Automobile Manufacturers (AAM) survey data; however, this is not the only data they will be using.

Presentation: Data Gathering Efforts & Partnerships to Support Models & Rulemaking – Carl Fulper EPA/OTAQ

Mr. Fulper summarized the data gathering efforts for light-duty vehicles, heavy-duty vehicles and engines, nonroad vehicles and engines, and other research areas. Data gathering efforts include studies of evaporative emissions, sulfur and PM fuel effects, heavy duty greenhouse gas emission standards, and hybrid vehicle emissions. A separate document with additional information on each of the studies will be posted online with the presentations.

Discussion

Susan Collet noted that CRC has a lot of ongoing projects and test programs related to data gathering efforts. Ms. Collet described a PM generator test program that was started by EPA and a project with the California Air Resources Board on testing measurement accuracy. The PM generator test program seeks to better understand where and under what conditions PM is formed.

WRAP-Up

Syeda Haque asked about the release date for MOVES2013. The plan is to release the model at the end of this year. The model and documentation will be released at the same time. Some of the model documentation will be going through a peer review process very soon. There will not be a draft release of the model (straight to final). EPA has not yet determined a grace period for SIP conformity (after MOVES2013 is released) as this is determined in consultations with the department of transportation and must take into account the learning curve of users and other factors that cannot be resolved until EPA is closer to having a final model developed. Although MOVES2013 has new features and data, it is fundamentally similar to the existing model as the structure is generally the same; therefore, the transition is expected to be less severe than the transition from MOBILE to MOVES.

Mr. Nam stated that the proposed date for the next meeting is July 9, 2013. Comments on this meeting should be submitted to Mrs. Battye no later than June 14th. Mr. Nam presented the topics for the next meeting and urged workgroup members to give feedback on the topics and date of the next meeting. Mr. Nam asked more workgroup members to attend the meeting in person, if possible, as this will be the final meeting for the work group.

Attachment - Work Group Meeting Attendance List

Name	Organization	Attendance
Giedrius Ambrozaitis		Webinar/teleconference
Sarah Amick		Webinar/teleconference
Matthew Barth	UC Riverside	Webinar/teleconference
Marc Bennett	Massachusetts DEP	Webinar/teleconference
Susan Collet	Toyota	X
Rich Denbow		Webinar/teleconference
Chuck Gebhardt	NAPC	Webinar/teleconference
Syeda Haque	North Central Texas Council of Governments	Webinar/teleconference
Philip Heirigs	Chevron	Webinar/teleconference
Kathy Jaw	CARB	Webinar/teleconference
Olga Kemenova	Georgia Tech	
Joseph Kubsh	MECA	X
Karin Landsberg	Alaska DEC	Webinar/teleconference
David Lax	API	Webinar/teleconference
Jeff Long	CARB	Webinar/teleconference
Bob Maxwell	Global Automakers	Webinar/teleconference
Marcelo Norsworthy	EDF	Webinar/teleconference
George Scora		Webinar/teleconference
Mike Sheehan	NY	Webinar/teleconference
Chengfeng Wang	California Air Resources Board (CARB)	Webinar/teleconference
Craig Woleader		Webinar/teleconference
EPA Observers and Presenters		
William Aikman	EPA/OTAQ	X
Jarrold Brown	EPA/OTAQ	X
David Brzezinski	EPA/OTAQ	X
Aron Butler	EPA/OTAQ	X
David Choi	EPA/OTAQ	X
Gary Dolce	EPA/OTAQ	X
Chris Dresser	EPA/OTAQ	X
Carl Fulper	EPA/OTAQ	X
David Hawkins	EPA/OTAQ	X
Paul Machiele	EPA/OTAQ	X
Ed Nam	EPA/OTAQ	X
Darrell Sonntag	EPA/OTAQ	X
James Warila	EPA/OTAQ	X
EPA Contractor Support		
Rebecca Battye	EC/R Incorporated	X
Alden West	EC/R Incorporated	Webinar/teleconference