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

Welcome and Introductions

Ed Nam welcomed the FACA workgroup and presented the agenda. Mr. Nam reminded the participants that this is the last of the workgroup meetings for 2013; however, another round of meetings may be initiated in the future. 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.

David Brzezinski summarized comments submitted by Connecticut and EPAs responses. Refer to the presentations posted at the above link for the full comments and EPA responses. Connecticut asked if EPA planned to use state MOVES 2011 Emission Inventory System (EIS) submittals to update the MOVES2013 default database, and if there would be an opportunity for states to submit updates to the MOVES2013 default database. The EPA responded that they use the state submitted county databases with county specific information when creating national emission inventories. There is currently no process developed other than the EIS for states to formally submit proposed changes to the default MOVES database, and there is no process for states to submit changes intended for future calendar years that are not yet included in the National Emission Inventory (NEI). Other comments addressed use of the SMOKE model, and data used to estimate the effect of Stage II refueling and Inspection and Maintenance programs on emission estimates.

Mr. Brzezinski also addressed Phil Heirigs' comment from the previous MOVES meeting concerning temperature effects on fuels in MOVES2013. EPA is still investigating a resolution to this suggestion and would welcome any data that might be available on this topic.

Presentation: MOVES Review Workgroup, Reporting to the Mobile Source Technical Review Subcommittee – Matt Barth, University of California Riverside

Mr. Barth stated that while workgroup members coordinate within their organizations to solicit specific comments on EPA proposals prior to the meeting, another function of the workgroup process is to develop general recommendations to be submitted to the MSTRS. The goal is to develop a report that includes a list of workgroup members, specific comments, and general recommendations, which must be completed before the fall MSTRS meeting. Mr. Barth

reviewed recommendations from the previous MOVES report, and suggested that some of the recommendations could be modified and reused for the current report. One potential recommendation is that MOVES is very data dependent and it is important to continue funding tests and acquiring additional data. In addition, CARB acquires large amounts of data and the EPA should continue to use their results.

Mr. Barth asked the workgroup to provide general recommendations and he will compile the list and work with Ed Nam to develop the report. Mr. Nam confirmed that EPA is tracking all specific comments submitted through the workgroup process, including EPA responses, and will develop this list in Microsoft Word format.

Discussion

One workgroup member asked how frequently EPA plans to release new versions of MOVES, such as every two years (i.e., the next MOVES version would be 2015). EPA responded that MOVES updates would be released at larger than one year intervals, however a schedule has not been developed and it would be premature to answer this question.

There was some discussion about who is on the MSTRS, and when the next MSTRS meeting will be held. The exact date of the MSTRS meeting was not known but is expected to occur in late October.

One workgroup member provided a recommendation concerning heavy duty vehicles. The member agreed that EPA should collect additional data and conduct more studies; however, the issue of data variation between labs needs to be resolved. EPA should standardize how data are collected. Different labs use different chassis dynamometers that can result in anomalies and errors in the dataset. The same vehicle can produce different results if tested in different labs with different chassis dynamometers. EPA summarized this comment, stating that they are always looking for diversity in the dataset, but must be careful how the data are characterized.

Another workgroup member recommended that the issue of fuels and fuel changes needs to be carefully observed, especially considering the increase of natural gas in the heavy duty fleet.

Michael Rodgers recommended that EPA consider the potential for future MOVES versions to include drop in biofuels, which is not a current strategy.

Ed Nam thanked Mr. Barth for his presentation and stated that the EPA appreciates feedback and is happy to add non EPA presentations to the agenda.

Presentation: Update to MOVES Vehicle Populations, Andrew Eilbert, EPA/OTAQ

MOVES vehicle populations have been developed through a variety of public and purchased datasets. The current national default population is defined by fuel type, regulatory class (weight-specific), source use type (based on driving patterns), and model year. EPA is proposing 2011 as a new base year for populations, based on recently purchased vehicle registration data, including

RL Polk and Co. and the Vehicle Inventory and Use Survey (VIUS). Calendar years 2000 through 2010 are now historical years. Forecasts for future year populations will be based on sales growth factors and survival/scrappage rates. EPA collected additional information on bus populations from various data sources and presented charts and tables showing the 2011 populations derived for each source/vehicle type.

The 2000-2010 populations will be updated to replace the current sales projections with actual sales data from Oak Ridge National Laboratory's Transportation Energy Data Book (TEDB). These data will be adjusted to be consistent with base year populations. The 2012 to 2050 populations will be updated with new sales growth factors from the US Energy Information Administration's Annual Energy Outlook (AEO) projections. The updates to vehicle populations will be added to MOVES documentation and will be peer reviewed. The EPA welcomes newer or alternative data sources.

There were no questions or comments following this presentation.

Presentation: Update to MOVES Vehicle Activity, David Brzezinski, EPA/OTAQ

The new base year for vehicle activity, including vehicle miles traveled, is 2011. Data sources for VMT include the federal highway administration highway statistics and projections from the US Energy Information Administration AEO early release. A graph was presented showing that future year total VMT will be lower in MOVES2013 than the projections in MOVES2010b. The EPA purchased GPS data to calculate average speeds by road type and hour of day in order to update average speed distributions. Because the Federal Highway Administration does not track motorcycle VMT separately, passenger car VMT fractions by month are used for motorcycles in MOVES. However, motorcycle VMT is expected to vary more than cars on a seasonal basis; therefore, Bureau of Transportation (2010) crash statistics were used to develop seasonal allocations for motorcycle VMT. The new data shows a rise in motorcycle VMT during the summer months.

MOVES2013 will include a separate ramp emission calculation for each of the 16 average speed bins, and ramp emissions can now be reported separately in the output by road type and average speed bin. Emissions are calculated for each of the 16 average speed bins using driving schedules. Driving schedules for heavy duty trucks were added at the low and high end to allow for explicit calculation; however, operating modes were not extrapolated, rather, the nearest available schedule was used. MOVES will now calculate multi-day diurnal evaporative emissions from parked cars that do not take trips for multiple days. A recent Georgia Tech study suggests that 8% of passenger vehicles are not driven for at least 5 days at a time.

MOVES is designed to use county specific values provided by users. State supplied county databases are being used for calculating national inventories in support of EPA rules. The state supplied information can be used to update and validate default MOVES data.

Discussion

Matt Barth questioned EPA using the existing freeway driving schedule at 72 mph to represent the freeway driving schedule at 5 mph higher. By adding a flat 5 mph without adjusting for acceleration you are putting more power into the cycle. When you model higher speeds but use the same acceleration as before you are overestimating power. Mr. Brzezinski responded that EPA did not have a schedule for above 75 mph, and this is an issue they struggled with during the development of MOVES. Mr. Barth stated that when doing eco-driving studies, they use vehicle specific power (VSP) distribution and see how VSP distribution changes when looking at lower speeds; the accelerations are not as sharp. Mr. Brzezinski asked if Mr. Barth was referring to filtering so that there are lower power demands at lower speeds, and commented that the VMT is likely small for heavy duty vehicles traveling at 70 mph. Mr. Barth commented that the Air resources board is looking at different cycles, and suggested the EPA collaborate with them.

One workgroup member asked about the creep cycle schedule. EPA responded that a driving cycle was needed at less than 5 mph for vehicles in ports and yards that are operating at low speeds but still emit NO_x. The model works on the basis that driving behavior depends on the area that you are modeling. The EPA uses high speed emissions to model low speed emissions, but a more realistic low speed scenario is needed. Gary Dolce commented that this may be important on a project level, at border crossings or hotspots, but would likely not be as important on a regional or whole county level. Any effort to get additional data on this topic would be welcome by the EPA; however, this issue would require additional time and effort that will not be available for MOVES2013. One workgroup member stated that they have used these cycles on port vehicles, and there are data available that the member will send to the EPA.

Another workgroup member commented that they would like to see Inspection and Maintenance (I&M) updates submitted by states incorporated into the default MOVES database, and asked the EPA which group they should be involved with to ensure that this happens. EPA responded that there is no system for submitting to the MOVES default database; however, users can send data to the EPA's mobile inbox at mobile.epa.gov. Terry Goldstein commented that EPA can improve incorporating state submitted data into the model; however, for SIP conformity, states still have to examine the model and determine whether the data they are using is the best and latest that is available. States can provide EPA with the latest data but they are still responsible to have the latest data themselves during the SIP conformity process, especially if the state's data changes years after it was originally submitted to the EPA. The workgroup member agreed and wanted to ensure that the communication lines are open, and that it would be very helpful to states if the data were included in MOVES.

Presentation: – Mapping MOVES TOG to Chemical Mechanism Species for Air Quality Modeling, Harvey Michaels, EPA/OTAQ

OAQPS uses SMOKE with MOVES emission factors to produce gridded hourly emissions ready for air quality modeling. To make the chemistry of air quality models computationally feasible, thousands of actual hydrocarbons are mapped to relatively few Chemical Mechanism (CM) species. Pure chemical species are easily mapped to CM species; however, it is more difficult to map the remaining species in total organic gasses (TOG), which can include one or two hundred

compounds in a sample. The composition of TOG depends on fuel, emission process and technology. A real speciation profile is used to create the CM speciation profile that maps TOG from each fuel-technology-process combination to the CM species needed by the air quality model. In MOVES 2013, the mapping of TOG to CM species is moved from outside of MOVES to inside MOVES. This was done because MOVES already has the model year, technology and fuel information for every emission factor that is necessary to create speciation profiles. By applying the speciation profiles internally in MOVES, the additional approximation previously conducted by SMOKE to create combined speciation profiles is no longer necessary. This also results in simpler and less error-prone emissions processing in SMOKE. The MOVES pure species are now integrated, or mapped to CM species within MOVES separate from the residual TOG species.

Discussion

In response to a question from a workgroup member, Mr. Michaels stated that you only need CM species if you are doing air quality modeling, and you must specify in the model that you want MOVES to map CM species.

Presentation: PM2.5 Speciation in MOVES2013 – Darrell Sonntag, EPA/OTAQ

The PM speciation in MOVES2013 allows differentiation in speciation profiles by technology/regulatory class, model year, fuel type, emission process (running, start, extended idle). The PM species included in $PM_{2.5}$ was revised for MOVES2013 to be consistent with air quality models. The definition of Primary Organic Carbon was revised to be consistent with CMAQ5.0 and new PM species were separated out, including titanium, calcium, magnesium, and others. There are now 18 $PM_{2.5}$ species, which are needed for air quality modeling. The steps performed for $PM_{2.5}$ speciation in MOVES2013 were presented. Various studies used to develop the $PM_{2.5}$ speciation profiles were presented, including the Kansas City light-duty Gasoline Vehicle Study (Coordinating Research Council (CRC) E-69), the HD Vehicle Chassis Dyno Testing for Emission Inventory (CRC E-55/59), and Phase 1 of the HEI and CRC Advanced Collaborative Emissions Study.

MOVES2013 will include a new sulfate calculator that will account for fuel and lube oil contributions. Sulfate emissions are based on $PM_{2.5}$ speciation profiles. An example of how sulfate emissions are calculated in MOVES2013 was presented. MOVES2013 will include a new Crankcase Calculator to account for crankcase emissions for 2007 and later diesel engines. As tailpipe emissions are increasingly reduced in new engines, crankcase emissions become a larger fraction of the total emissions value. Crankcase emissions are included in the regulatory measurements of 2007 and later diesel engines. An example of how crankcase emissions are calculated in MOVES2013 was presented.

Discussion

One workgroup member asked how the EPA split up the speciation for PM. Mr. Sonntag directed the workgroup to slide 6 of the presentation. Separate speciation profiles are provided for source type, fuel type, process ID, etc.

Another workgroup member commented that the EPA should be cognizant of the fact that the speciation profiles are different for different fuels, which will continue to emerge in the future. Higher crankcase emissions and the use of more CNG vehicles should be considered.

The EPA asked the workgroup if any users needed PM_{10} to be speciated in MOVES, as the emphasis was currently on $PM_{2.5}$ speciation. There was no response and the EPA stated that they have not heard that there is a large demand for PM_{10} speciation. The EPA stated that the model still produces PM_{10} emissions, just not the full EC/OC (elemental carbon/organic carbon) breakdown.

Presentation: Modeling "Additional" Air Toxics in MOVES – Richard Cook, EPA/OTAQ

Information on modeling additional air toxics in MOVES was presented. These are other toxics than the "major" toxics of benzene, formaldehyde, acetaldehyde, acrolein, 1-3, butadiene, and ethanol. The additional air toxics include other gaseous HAP (calculated with toxic to VOC ratios), polycyclic aromatic hydrocarbons (PAH/VOC ratios for gas-phase and $PAH/OC_{2.5}$ ratios for particle phase), metals (emission rates applied to VMT), and dioxins and furans (emission rates in toxic equivalents applied to VMT). MOVES2013 will include E15, E20 and E85 fuels for the first time, and will update data based on gasoline vehicle PAH emissions and gasoline vehicle metal emissions from a 2008 Kansas study. Dioxin emissions will also be updated based on a recent EPA test program.

Discussion

David Lax asked EPA if they had considered using emissions data from the CRC E80 test program on exhaust and evaporative emissions. The dataset is on their website. Mr. Cook responded that EPA used EPAct data for exhaust and evaporative emissions and did not analyze the CRC E80 study, but would look into it.

Joseph Kubsh, in reference to the last slide in the presentation, said that this was the first time he saw a new diesel engine with SCR treated differently than engines with filters. Mr. Kubsh stated that he was aware that EPA had conducted a study on SCR engines but had not yet published the results. Mr. Kubsh asked EPA if they treat heavy duty engines with SCR differently than engines equipped with a filter in MOVES2013. EPA responded that they did not make this distinction for gaseous HAP, PAH, or PM because the test program has not yet been made public. When the data are published they will be dropped into the model. The updates will determine if this becomes a MOVES2013b version.

Presentation: Cold Temperature Measurement of Particulate and Gaseous Emissions from Tier 2 MSAT Vehicles – David Hawkins, EPA/OTAQ

EPA conducted testing to determine the ambient temperature effect on Tier 2/MSAT start emissions, and if ambient temperature affects running PM emissions for Tier2/MSAT vehicles. There was a higher temperature effect on HC start emissions than expected on the tested vehicles. There was a lower temperature effect on CO start emissions than expected. New vehicles no longer have higher CO emissions than older vehicles at low temperatures in MOVES. The effect of temperature on NO_x start emissions was minimal, updates to MOVES are tentative. Testing resulted in the expected temperature effect on PM running emissions and no changes to are planned.

Discussion

Karin Landsburg asked if EPA had information on temperature effects below zero°, such as -20° or -40° degrees. The EPA did not collect this data from the test program; however they do have data from previous tests. The data are extended to below zero° but this was not shown in the presentation. Ms. Landsburg commented that a logarithmic line can result in very high emissions rates at very low temperatures and that Alaska has done their own testing. EPA was not aware of the test data and Ms. Landsburg agreed to send the data to EPA.

Presentation: Proposed Updates to Highway Mobile Source Classification Codes (SCC) – David Brzezinski, EPA/OTAQ

SCC codes are 10 digit numerical values used to classify different types of anthropogenic emission activities. MOVES users can specify output into SCCs, which are also used in SMOKE. Mapping between MOVES inputs and results and current SCCs is difficult. Current SCCs better match vehicle classes and road types used in previous models (MOBILE 6), while available activity data better matches source types and road types used in MOVES. Current SCC vehicle classes by emission standards assist in speciation; however, because speciation will now be done internally in MOVES, vehicle classes no longer need to reflect emission standards for speciation. Therefore, new SCCs can be developed to better reflect the inputs and outputs used by MOVES and the available activity sources. The new SCC codes will have a similar 10 digit format,to specify MOVES fuel types, MOVES source types, MOVES road types, and MOVES emission processes. The SCC codes will also allow for aggregated emission processes, where processes can be combined as long as their activity basis is identical (e.g., VMT). The new SCCs can also explicitly account for fuel types other than gasoline and diesel. There are many potential advantages to updating the mobile source SCCs.

This is the first forum in which EPA has explained the idea of creating new SCCs for MOVES, and the EPA would appreciate any comments by the end of the summer to assist in the development of the new codes for MOVES2013. EPA will prepare a document on the new SCCs to send to stakeholders.

WRAP–Up

Ed Nam thanked everyone on the EPA team and everyone in the FACA workgroup for their time and comments. Although this is the last scheduled face-to-face meeting, there will be more exchanges by e-mail. Mr. Nam asked workgroup members to send their comments on today's meeting by August 16th. Mr. Nam and Mr. Barth will be working on a recommendation document and presentation for the MSTRS for later this year, and are expecting input from the workgroup on these recommendations. Additional phone conferences can be held if needed; however, Mr. Nam expects that all workgroup issues can be resolved through email. Mr. Barth stated that if there are any general recommendations or comments in addition to the specific comments to be sent to Rebecca Battye, please send those recommendations to himself, Ed Nam or William Aikman. Mr. Nam asked the workgroup if there were any additional high level questions.

Mr. Kubsh provided a general recommendation to keep an eye on the potential fuel diversity in the transportation sector. In addition, EPA should pay attention to the diesel sector where there will be a growing diversity in the kinds of emission systems on engines designed to meet standards, including the interim Tier IV requirements. Some trucks will have filters, SCR, or no filters, and all of that diversity in emission control system design will have a significant impact on the speciated PM and HAP emissions in the future. This applies to newer engines in the off-road sector as well.

Another workgroup member responded that if the EPA can convince organizations like the CRC or universities to collect data on new technologies and the changes in emissions from those technologies, then the EPA can make the link to modeling the newly collected data.

Tom Darlington asked when EPA planned to focus on population activity and load factors for nonroad engines. The EPA replied that this question could also apply to all of the updates that have been delayed until the next version of MOVES. After MOVES2013 is released, there will be significant time spent on responding to issues with the new model, outreach, communication, and further testing of the release. Once these activities slow down the EPA will be in production for the next version of the MOVES model. William Aikman estimated that this could happen by the second half of fiscal year 2014. Gary Dolce further stated that the nonroad portion of MOVES2013 is a draft for SIP purposes and could be updated on a shorter timeframe than onroad.

Robert Sawyer commended and congratulated EPA on having done an excellent job with MOVES and with incorporating a lot of data.

Attachment - Work Group Meeting Attendance List

Name	Organization	Attendance
Sarah Amick		Webinar/teleconference
Matthew Barth	UC Riverside	Webinar/teleconference
Marc Bennett	Massachusetts DEP	Webinar/teleconference
Martin Boardman		Webinar/teleconference
Michael Claggett		Webinar/teleconference
Susan Collet	Toyota	X
Tom Darlington		Webinar/teleconference
Rich Denbow		Webinar/teleconference
Yuan Du		Webinar/teleconference
Mridul Gautam	West Virginia University	Webinar/teleconference
Gil Grodzinsky		Webinar/teleconference
Syeda Haque	NCTCOG	Webinar/teleconference
Kevin Smith	Illinois EPA	Webinar/teleconference
Joseph Kubsh	MECA	Webinar/teleconference
Karin Landsberg	Alaska DEC	Webinar/teleconference
David Lax	API	Webinar/teleconference
Eulalie Lucas	MWCOG	Webinar/teleconference
Bob Maxwell	Global Automakers	Webinar/teleconference
Jenny Narvaez		Webinar/teleconference
Marcelo Norsworthy	EDF	X
Sam Pournazeri	CARB	Webinar/teleconference
Michael Rodgers	Georgia Tech	Webinar/teleconference
Bob Sawyer		Webinar/teleconference
George Scora		Webinar/teleconference
Mike Sheehan	NY	Webinar/teleconference
Christopher Voigt		Webinar/teleconference
Chengfeng Wang	CARB	Webinar/teleconference
Craig Woleader	Massachusetts DEP	Webinar/teleconference
EPA Observers and Presenters		
William Aikman	EPA/OTAQ	X
David Brzezinski	EPA/OTAQ	X
David Choi	EPA/OTAQ	X
Richard Cook	EPA/OTAQ	X
Gary Dolce	EPA/OTAQ	X
Andrew Eilbert	EPA/OTAQ	X
Ed Glover	EPA/OTAQ	X
Connie Hart	EPA/OTAQ	X
David Hawkins	EPA/OTAQ	X
Harvey Michaels	EPA/OTAQ	X
Ed Nam	EPA/OTAQ	X
Darrell Sonntag	EPA/OTAQ	X
EPA Contractor Support		
Rebecca Battye	EC/R Incorporated	X
Alden West	EC/R Incorporated	Webinar/teleconference