



MOVES

Motor Vehicle Emission Simulator

MOVES2014

Briefing for AAPCA

August 19, 2014

What is MOVES2014?

- Motor Vehicle Emissions Simulator
- Released July 31, 2014
- A new model that replaces the MOVES2010 series (MOVES2010, MOVES2010a, MOVES2010b)
- Estimates emissions and energy use from all on-road sources at the national, county, and project scales
- Includes new emissions standards and new data for on-road vehicles
- Adds nonroad emission capabilities through the incorporation of NONROAD2008

A Brief History of Recent Model Releases

- The most recent official EPA on-road emission models for SIP and conformity analyses
 - 2004 – MOBILE6.2 (Included Tier 2 and PM emissions)
 - 2009 – MOVES2010 (First Release of MOVES, a major new approach)
 - 2014 – MOVES2014 (Includes Tier 3, and much more)
- We have also made minor/interim model updates to the official public versions
 - MOVES2010a, MOVES2010b

MOVES2014 Changes Based on User Feedback and Peer Review

- Direct feedback on plans for MOVES2014
 - FACA workgroup
 - EPA presented details of technical updates on six, ½ day meetings
 - Reviewers included: Industry Trade Groups, Environmental Groups, Federal/State/Local Government, Research Consortiums, Academia
 - Presented several times to MSTRS
 - Peer review of eight MOVES2014 technical documents
 - Publication in peer reviewed scientific journals
- Feedback on MOVES2010 has informed improvements in MOVES2014
 - User feedback during training courses
 - MOVES workshop in 2011, attended by over 230 stakeholders
 - Support to air quality and transportation agencies
 - Feedback received at research conferences

What's New in MOVES2014

- New OTAQ rules
 - Tier 3
 - HD GHG phase 1
 - LD GHG
- New science
 - Relied on dozens of new test programs and scientific studies
 - Future forecasts (VMT, population, sales)
- Improved functionality

New Rules in MOVES2014

- Heavy-Duty Greenhouse Gas (HD GHG)
 - Decrease in heavy-duty energy consumption rates
 - Decrease in criteria pollutant emissions as a result of improved aerodynamics and rolling resistance.
 - Increase in criteria emissions from auxiliary power units
- Light-Duty Greenhouse Gas (LD GHG)
 - Decrease in light-duty energy consumption rates
 - Decrease in refueling emissions
- Tier 3
 - Decrease in light-duty and medium-duty emission rates
 - Reduction in gasoline sulfur level
 - Significant changes in vapor venting, permeation and evaporative leakage

New Research Test Programs & Data used in MOVES2014

- Fuel Effects
 - EPA Act study on Gasoline fuel effects
 - Effects of E85 on emissions
 - EPA In-Use Sulfur Test Program
 - RFS2 renewable usage and future fuel supply
- Evaporative Emissions
 - CRC E-77 – Ethanol, RVP, leak magnitude study
 - High Evap Field Study – leak frequency
 - Running loss vapor leak study
 - Multiday Diurnal Testing
- PM Emissions
 - Speciation of Kansas City light-duty gasoline study
- Temperature Effects
 - EPA Cold Temperature Study
- Heavy Duty
 - In-Use Compliance Program PEMS data
 - Literature review of CNG Transit bus emissions
- Population and Activity
 - R.L. Polk Vehicle Population
 - AEO Vehicle Sales Projections
 - Updated FHWA VMT estimates
 - Flex-fuel vehicle penetrations
 - National average speed distribution using GPS data
 - Updated truck weights based on Weight-in-Motion data

Other Updates to MOVES Data

• Emission Rates

- Updated toxic emission rates (metals, PAHs, dioxins)
- Updated refueling emissions algorithm
- Updated diesel start emissions
- Updated crankcase emission factors based on the ACES Heavy-duty engine test program
- Updated sulfate emission rates for diesel and gasoline
- Updated impact of 2007 Heavy-Duty Rule on HD gasoline emissions
- Updated light-duty diesel, E85 emission rates
- Updated biodiesel emission effects
- Updated CO2 equivalent factors
- Updated heavy-duty gasoline PM emission rates
- Included motorcycle fuel leaks
- Updated PM10 emission rate for brake and tire wear

• Population and Activity

- Incorporated state supplied data from the 2011 National Emission Inventory
 - Geographical Allocation
 - I/M Coverage
 - VMT
- Updates sales data for historic years (pre-2011)
- New heavy-duty drive cycles
- Updated ambient temperatures and relative humidities by county
- Added seasonal VMT motorcycle usage
- Updated extended idle calculations
- Improved operating mode assignment for project level analyses

Functional Improvements in MOVES2014

- Improved integration of MOVES with air quality models
- Fuel Wizard
 - Automatically adjust fuel property changes based on user-made fuel property changes (e.g. ethanol)
- Added features for local inputs
 - Hoteling importer for local users to use own hoteling activity
 - Starts importer for local users to import own start activity data
 - Upgraded tool to estimate fleet-wide impacts of retrofit strategies
 - Additional road types to separately account for ramp activity
- GUI improvements
 - Better error checking, regulatory class output option, removal of leap years
- Added existing NONROAD model into MOVES

Other Changes in MOVES2014

- Updated FHWA HPMS (Highway Performance Monitoring System) VMT
 - Past versions of MOVES have relied on this data (best available for the purpose)
 - FHWA updated its methodology since MOVES2010b
 - Has resulted in significant increase in heavy-duty VMT nationally
 - But local trend may be different
- Improved heavy-duty truck extended idle allocations
 - In MOVES2010b, extended idle was based on vehicle population
 - In MOVES2014, extended idle is based on rural highway VMT
 - As a result, MOVES2014 now predicts no extended idle in urban counties with no rural highway VMT
 - Primarily affects PM and NOx emissions
 - MOVES2014 will offer an option to provide local extended idle activity, if available

How Do These Changes Affect MOVES2014 Users?

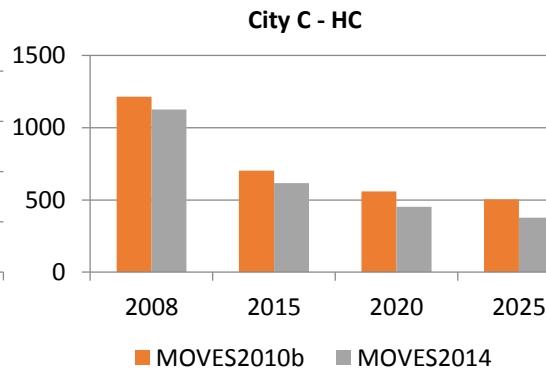
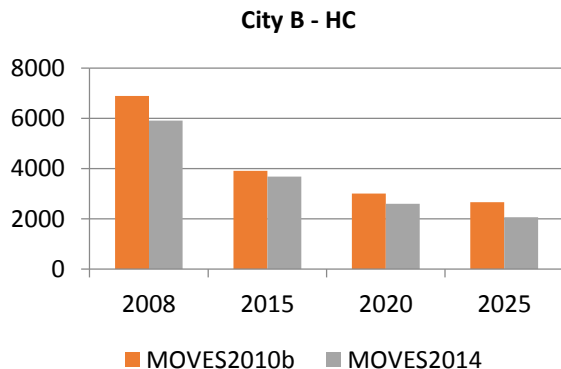
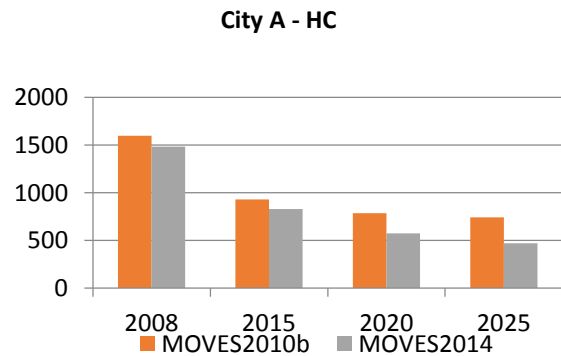
- Structure of MOVES2014 is essentially the same as MOVES2010
 - If you are already familiar with MOVES2010, the learning curve for MOVES2014 will be short
- There are some changes in input table formats
 - We have provided a tool to convert MOVES2010b input files to MOVES2014 format, in the Tools menu of MOVES2014
 - Some additional modifications of certain tables may still be needed
- Output tables have additional columns to handle fields needed for nonroad output
- MOVES2014 Overview for Experienced Users on MOVES web page

Example Inventory Impacts

- We used local data provided by state agencies for 3 urban areas to show differences between model versions
 - Unique fleet mix, I/M program, fuels, temperatures, age distributions
 - Represents what a typical user might see for their own MOVES2014 modeling
- Actual differences between MOVES2010b and MOVES2014 may vary based on other local model inputs
 - Can't reflect the full range of possible outcomes in these examples
 - Includes national HPMS change
 - Based on a single, core, urban county in each city, which may not completely reflect nonattainment area impacts
- MOVES2010b vs. MOVES2014 trends are consistent with our expectations
 - Tier 3, HD GHG phase 1, new data, new HPMS VMT

Hydrocarbons

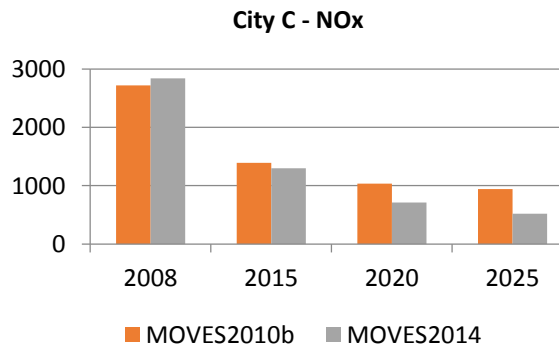
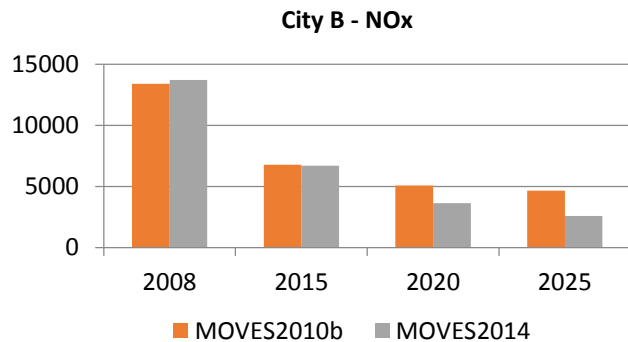
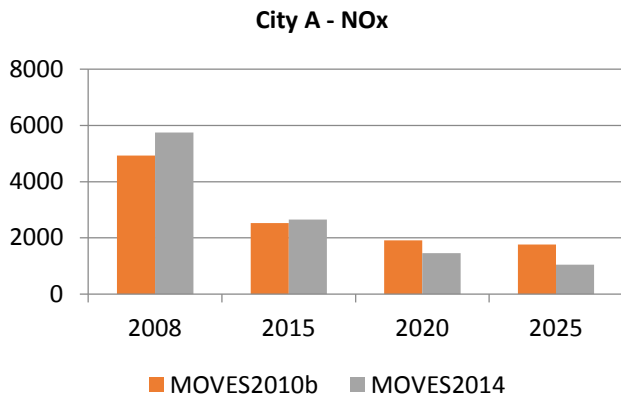
- Tier 3 reductions seen in 2020 and beyond
- Updates to evaporative and fuel effects



	Reduction from 2015 to 2025	
	MOVES2010b	MOVES2014
City A	-20%	-43%
City B	-32%	-44%
City C	-28%	-39%

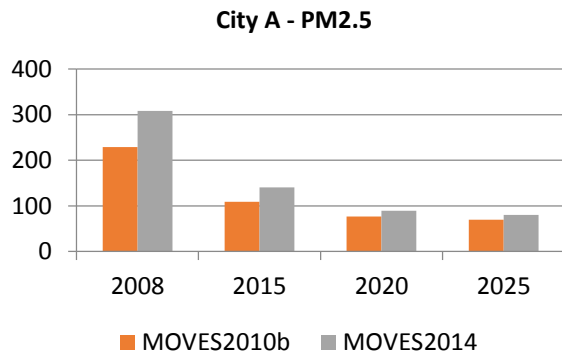
Nitrogen Oxides

- Tier 3 and HD GHG reductions seen in 2020 and beyond
- Greater HD VMT increasing emissions

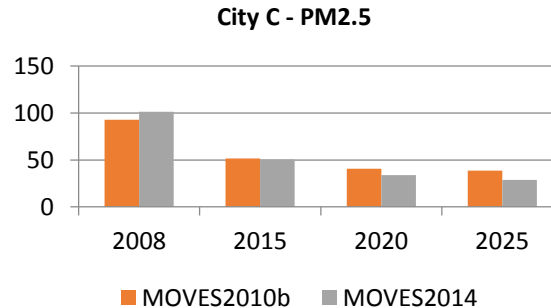
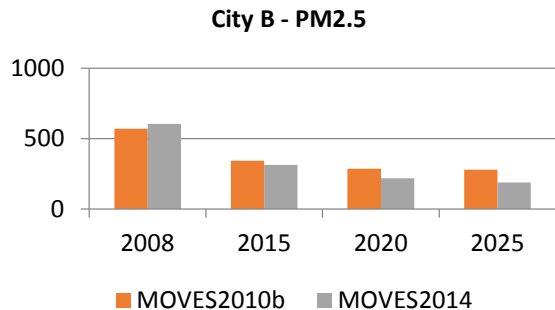


	Reduction from 2015 to 2025	
	MOVES2010b	MOVES2014
City A	-30%	-60%
City B	-31%	-61%
City C	-32%	-60%

PM_{2.5}

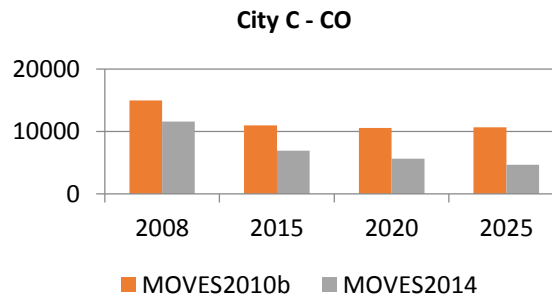
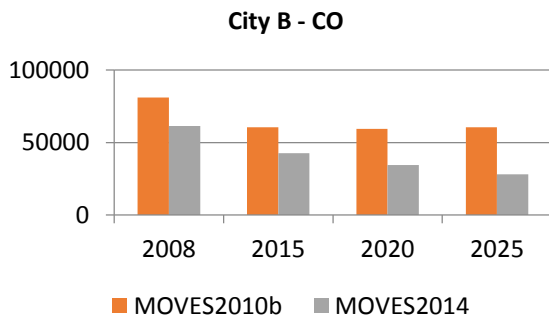
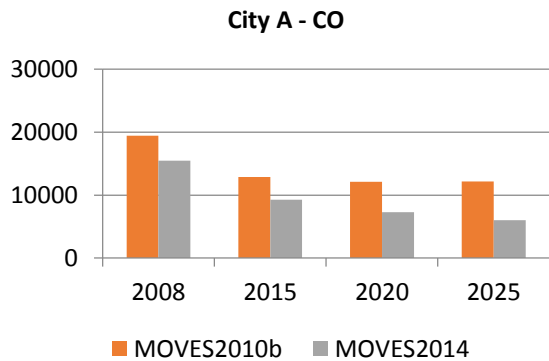


- Tier 3 reductions seen in 2020 and beyond
- Greater HD VMT increasing emissions
- PM running emissions no longer sensitive to temperature (lowers emissions esp. in cold weather)



	Reduction from 2015 to 2025	
	MOVES2010b	MOVES2014
City A	-36%	-43%
City B	-18%	-40%
City C	-25%	-43%

Carbon Monoxide



- Tier 3 reductions seen in 2020 and beyond
- Smaller cold start effect – emission reduction
- Less LD VMT reducing emissions

	Reduction from 2015 to 2025	
	MOVES2010b	MOVES2014
City A	-5%	-35%
City B	0%	-34%
City C	-3%	-33%

Impact on SIPs and Conformity

- New control programs in MOVES2014 result in greater reductions in emissions over time, which should make it easier to demonstrate attainment
- If MOVES2014 shows higher emissions than SIP budgets, use the consultation process to determine whether revising SIP budgets or transportation plan is necessary
 - Example inventories indicate this may be necessary in some areas
 - Two-year conformity grace period allows time to make adjustments

Nonroad in MOVES2014

- MOVES2014 incorporates existing NONROAD2008 model
 - Produces same results, but has more limited output options
- For SIPs, states can use either:
 - NONROAD2008
 - NMIM2008 (nonroad portion only), or
 - MOVES2014
- Technical documentation can be found at:
 - www.epa.gov/otaq/nonrdmdl.htm

What is available now?

- MOVES2014 Installer
 - MOVES2014 code, installer, user guide, user interface reference manual
- MOVES2014 SIP and Conformity Policy Guidance
- MOVES2014 Questions and Answers
- MOVES2014 Overview for Experienced Users

SIP and Conformity Policy Guidance

- Posted July 31, 2014
- Use MOVES2014 for SIP development as soon as possible
 - But work already begun using MOVES2010b can be completed
 - Work with your Regional Office if you have questions
- Two-year grace period before MOVES2014 must be used for conformity
 - Grace period begins with publication of Federal Register Notice of Availability
 - FR Notice publication expected September

Coming Soon...

- Database for states that have adopted California Low Emission Vehicle (LEV) standards
- MOVES2014 Technical Guidance
- MOVES2014 Training
- Updated PM and CO hot-spot guidance documents
- Updated greenhouse gas guidance

Technical Guidance

- Expected early September
- Most guidance is unchanged – can continue to rely on MOVES2010 Technical Guidance until release
- New guidance will address:
 - Optional starts and extended idle inputs
 - Use of Fuel Wizard for developing local fuel inputs
 - Option for adjusting age distributions in the future to reflect changing impacts over time of recent recession
- We will work with you if you need immediate help with any of those issues
- PM and CO hot-spot guidance documents will be updated later this fall

Training

- Webinar on new features for users already familiar with MOVES2010
 - We will offer repeat sessions of the new feature webinar
- Updated 2-day hands-on training for new users
 - We will offer this first in Ann Arbor and then in a small number of other locations
 - We want to limit this course to new users only
 - We will begin scheduling this course in September
- Updated 3-day hands-on training for PM hot-spot analysis
- We will announce courses via e-mails to our MOVES Listserv and on our MOVES training page:
 - www.epa.gov/otaq/models/moves/training.htm

Policy and Technical Support

- Model, guidance, Q&A document, links to technical documentation, presentations, and training page are all at:
 - www.epa.gov/otaq/models/moves/index.htm
- For questions about using MOVES in a particular area, please start by contacting your EPA Regional Office
- For general technical questions, including installation issues, use mobile@epa.gov
- MOVES installation requires installation and/or updates of JAVA, MySQL, and the MOVES application
 - Please read and follow the instructions provided carefully
 - We are unable to test all possible configurations of software you may have – check the troubleshooting section of the instructions if you have problems

MOVES2014 Summary

- Includes new data to ensure MOVES is a state-of-the science model to estimate motor vehicle emissions
- Added new control programs (Tier 3, HD GHG phase I, etc.)
 - Most users will see emission reductions in the future as a result
- Other improvements based on user feedback
- Even with changes, structure of the model is fundamentally the same – this should ease the transition
 - But we will continue to provide technical support and training
- Ongoing commitment to continue to collect and analyze data to ensure that the next version of MOVES after MOVES2014 is based on the best science