Mobile6 to MOVES Model

MOVES: Motor Vehicle Emission Simulator

Sunil Kumar, DEP
Eulalie Lucas, DTP

MWAQC TAC
June 15, 2009

Major Features - MOVES Vs. MOBILE6

MOVES Major Features	MOVES Vs. MOBILE6
Geography	Jurisdiction, regional or state level aggregation possible.
Time Spans	No change. Energy /emission output available by hour of the day, and month for calendar years 1990 and 1999 through 2050, with options to run at more aggregate day, month or year levels. Same as ozone & winter day and seasonal (annual)
Sources	Requires conversion from 28 to 13 vehicle types.
Outputs and Pollutant Emissions	MOBILE6 pollutants VOC, CO, NOx, PM2.5 & PM10, N2O, CH4, CO2, toxics; Plus new pollutants added (e.g., CO2 equivalent, individual components of PM2.5 & PM10, total energy consumption).
Emission Processes	Some change. Running, start, extended idle (e.g. heavy-duty truck (“hoteling”), well-to-pump, brakewear, tirewear, evaporative permeation, evaporative fuel vapor venting, and evaporative fuel leaks. Evaporative emissions characterized differently.

Transition : Mobile6.2 to MOVES
Local Data Needs
(Assume county level application as currently done)

- **Required Local Datasets for County Level Analysis**
  - Fuel Characteristics
  - Meteorology
  - I/M Program
  - Age Distribution (Registration data)
  - Population of MOVES Vehicle Types
    (for each county in a calendar year)
  - Total Base Year VMT for HPMS Vehicle Types
    (for each county in a calendar year)
  - VMT Fraction across (4) MOVES Road Types for (13) individual MOVES Vehicle Types
    (for each county in a calendar year)

Local County Level Data

- **Fuel Characteristics**
  - Local data available. Appropriate fuel formulation can be identified from the list provided with the MOVES model.
- **Meteorology**
  - Local data available. Needs minimal formatting for MOVES application.
- **I/M Program**
  - Local data available. Needs minimal formatting for MOVES application.
- **Age Distribution (Registration data)**
  - Local data available.
  - Two options for MOVES application
    - A. Use EPA tool to convert existing age distribution data available by Mobile6 vehicle types (1-25 years old) into MOVES vehicle types (0-30 years old).
    - B. Develop age distribution data by MOVES vehicle types (0-30 years old).

Vehicle Population
MOBILE & MOVES Vehicle Types

MOBILE6 Vehicle Types		
	Veh Type	**Description (gas and diesel combined)**
1	LDV	Light-Duty Vehicles (Passenger Cars)
2	LDT1	Light-Duty Trucks 1 (0-6,000 lbs. GVWR, 0-3,750 lbs. LVW)
3	LDT2	Light-Duty Trucks 2 (0-6,000 lbs. GVWR, 3,751-5,750 lbs. LVW)
4	LDT3	Light-Duty Trucks 3 (6,001-8,500 lbs. GVWR, 0-5,750 lbs. ALVW)
5	LDT4	Light-Duty Trucks 4 (6,001-8,500 lbs. GVWR, 5,751 lbs. and greater ALVW)
6	HDV2B	Class 2b Heavy-Duty Vehicles (8,501-10,000 lbs. GVWR)
7	HDV3	Class 3 Heavy-Duty Vehicles (10,001-14,000 lbs. GVWR)
8	HDV4	Class 4 Heavy-Duty Vehicles (14,001-16,000 lbs. GVWR)
9	HDV5	Class 5 Heavy-Duty Vehicles (16,001-19,500 lbs. GVWR)
10	HDV6	Class 6 Heavy-Duty Vehicles (19,501-26,000 lbs. GVWR)
11	HDV7	Class 7 Heavy-Duty Vehicles (26,001-33,000 lbs. GVWR)
12	HDV8A	Class 8a Heavy-Duty Vehicles (33,001-60,000 lbs. GVWR)
13	HDV8B	Class 8b Heavy-Duty Vehicles (>60,000 lbs. GVWR)
14	HDBS	School Buses
15	HDBT	Transit and Urban Buses
16	MC	Motorcycles (All)

MOVES Vehicle Types	
11	Motorcycle
21	Passenger Car
31	Passenger Truck
32	Light Commercial Truck
41	Intercity Bus
42	Transit Bus
43	School Bus
51	Refuse Truck
52	Single Unit Short-Haul Truck
53	Single Unit Long-Haul Truck
54	Motorhome
61	Combination Short-Haul Truck
62	Combination Long-Haul Truck

Annual VMT - DTP Vs. MOVES Allocation

Annual VMT by Facility Types (DTP Allocation)
Freeways
Major Arterials
Minor Arterials
Collectors
Expressways
Local and Ramps

Annual VMT by HPMS Vehicle Types (MOVES Allocation)
Motorcycle
Passenger Car
Other 2 axle-4 tire vehicles
Single Unit Trucks
Bus
Combination Trucks

VMT Fraction across MOVES Road Types for Individual MOVES Vehicle Types

Current COG/DTP VMT Fractions Allocation by:

- Network traffic
- Local Roads
- Auto Access to transit

** VMT fractions not developed for individual vehicle types

MOVES Road Type Definition
Rural restricted - roadways with restricted access for vehicles (i.e. rural interstates)
Rural unrestricted – roadways with unrestricted access for vehicles (i.e. rural arterials, collectors, and local)
Urban restricted - roadways with restricted access for vehicles (i.e. urban expressways, freeways and interstates)
Urban unrestricted – roadways with unrestricted access for vehicles (i.e. urban arterials, collectors, and local)
Off-Network – Parking lots, Driveways

Summary : Local Data Needs (County Level Analysis)

MOVES Inputs	Local Data	EPA Default
Fuel Characteristics	Local data available. Appropriate fuel formulation can be identified from the list provided with the MOVES model.	Fuel formulations
Meteorology Data	Local data available	County data
I/M Programs	Local data available. Needs formatting for MOVES.	County data
Ramp Fraction (portion of roadway assigned to ramps)	Local data available	National data
VMT Fraction	VMT fraction across MOVES road types for each MOVES vehicle types. VMT fractions across FHWA facility types available, need to be converted in the format above (using NEI assumptions ?)	National data
Vehicle Population	Vehicle population data available by Mobile6 vehicle types can be converted to MOVES types	National data
Total Annual VMT	Need annual VMT by HPMS vehicle types. Local data available by FHWA facility types need to be converted (using NEI assumption ?)	National data
Age Distribution	Mobile6 based local data conversion to MOVES format possible. Direct local data development in MOVES format preferred	National data

Feedback from Air Agency Staff

- VDEQ:

  ➢The MOVES format for input files is definitely very different from that used for MOBILE6. It will take some time to become comfortable with the new format and confident in the results produced

  ➢Created database containing locality-specific input data for 3 counties in various parts of the state. Used 3 separate databases and 3 separate RunSpecs since MOVES only allows you to generate emissions for one county at a time. (EPA plans to add batch processing in the final model.)

  ➢Encountered issues with emission calculations using different time aggregation options in the model. Emissions generated using the hourly time aggregation are considerably lower than those generated using a monthly time aggregation. Comments and sample files to EPA and their contractor is working through the issue.

- MDE:

  ➢Tested 'National' run (MOVES default) for Baltimore County (2005 PEI). NOx emission estimates show the same increased pattern as described in MOVES release. VOC numbers were also higher contrary to the belief.

  ➢Testing the more important 'County' run (with area specific inputs). The challenge is in converting MOBILE6 inputs into the MOVES-based databases. There is not adequate guidance at this point. Trial runs yield un-reasonable estimates for lack of accurate mapping of various data elements. Technical Guidance is the key to the whole process.

2009 Draft Work Plan and Schedule

1. Review MOVES model inputs and discuss with agencies – **April - September**

1. Test model using default values – **June/July**

2. Form a joint transportation and air technical/policy group to decide on technical and policy items as they relate to MOVES implementation and application - **June/July**

3. Develop inputs using local data (with help from task force and EPA technical guidance documentation) – **July/August**

4. Apply model using local data – **July/September**

5. Compare MOVES results by pollutant with MOBILE6 runs - **September**

6. Develop transportation and air agency agreement on MOVES inputs and overall process - **Pending MOVES model approval by EPA**

Benefits gained from Mobile6 Task Force

- Inter-agency (Air Agency and DOTs) consultation on both transportation and environmental model inputs.
- Staff from COG DEP and DTP represented.
- Consultant assistance: inputs were reviewed, tested and documented.
- Documentation used in Air Quality Conformity and SIP reports to EPA and USDOT.

Closing Comments

June 29 & June 30th, 2009

MOVES training scheduled (EPA/FHWA sponsored)

Location: MWCOG

MOVES website

http://www.epa.gov/otaq/models/moves/index.htm