Incorporation of Speciation into MOVES2014

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SPECIATE
VOC and PM2.5 Speciation Profiles

→

MOVES
Speciated VOC and $PM_{2.5}$ emissions

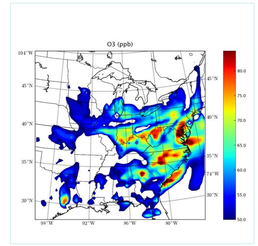
→

SMOKE
Gridded hourly-resolved emissions

→

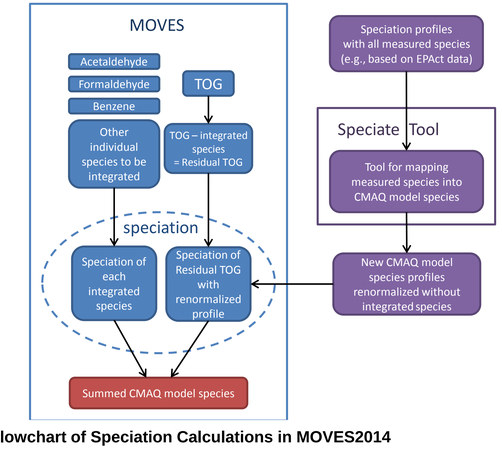
Chemical Transport Model

→



Chemical Mechanism Speciation of Total Organic Gas

- Moved from SMOKE to MOVES for simplicity, accuracy, & flexibility
- Table-driven approach
  - CB05 Chemical mechanism incorporated in MOVES2014
  - Able to incorporate additional chemical mechanisms
- MOVES 2014 produces air quality model ready chemical species
  - Vehicle technologies (e.g., pre-2007, post-2007 diesel)
  - Fuels (e.g., E10, CNG, diesel)
  - Emission processes (e.g., exhaust, evaporative)



Flowchart of Speciation Calculations in MOVES2014

Speciation Profile Assignment in MOVES2014

SPECIATE Profile	Profile Description	Fuel	Vehicles
1001	CNG Exhaust	CNG	All CNG Transit Buses
4547	Diesel Headspace	Diesel	All Diesel
8753	E0 Evap	E0	All Gas
8754	E10 Evap	E10	All Gas
8756	Tier 2 E0 Exhaust	E0	Tier 2 LD Gas
8757	Tier 2 E10 Exhaust	E10	Tier 2 LD Gas
8758	Tier 2 E15 Exhaust	E15, E20	All Gas
8766	E0 evap permeation	E0	All Gas
8769	E10 evap permeation	E10	All Gas
8770	E15 evap permeation	E15, E20	All Gas
8774	Pre-2007 MY HDD exhaust	Diesel	Pre-2007 HD Diesel
8774	Pre-2007 MY HDD exhaust	Diesel	All APU
8774	Pre-2007 MY HDD exhaust	Diesel	Pre-Tier 2 LD Diesel
8775	2007+ MY HDD exhaust	Diesel	Tier 2 LD Diesel
8775	2007+ MY HDD exhaust	Diesel	2007+ HD Diesel
8855	Tier 2 E85 Exhaust	E85	All Ethanol
8869	E0 Headspace	E0	All Gas
8870	E10 Headspace	E10	All Gas
8871	E15 Headspace	E15, E20	All Gas
8872	E15 Evap	E15, E20	All Gas
8934	E85 Evap	E85	All Ethanol
8750a	Pre-Tier 2 E0 exhaust	E0	Pre-Tier 2 LD Gas
8750a	Pre-Tier 2 E0 exhaust	E0	All MC and non-LD Gas
8751a	Pre-Tier 2 E10 exhaust	RFG, E10, E15, E20	Pre-Tier 2 LD Gas
8751a	Pre-Tier 2 E10 exhaust	RFG, E10, E15, E20	All MC and Non-LD Gas

$PM_{2.5}$ Speciation

- Includes 18 $PM_{2.5}$ species included in CMAQ Aerosol Module, version 6, "AE6"
  - Compatible with $PM_{2.5}$ species used in CMAQ AE5, and CAMx5.4
- Developed new $PM_{2.5}$ speciation profiles for MOVES2014

$PM_{2.5}$ Speciation Profiles in MOVES2014

	Light-duty Gasoline Exhaust – Start (8992)	Light-duty Gasoline Exhaust- Hot Stabilized (8993)	Conventional HDD- Idle (8994)	Conventional HDD- Hot Stabilized Running (8995)	2007 and Newer Diesel Exhaust Composite (8996)	CNG transit bus exhaust from a lean-burn engine - no aftertreatment (95219)	CNG transit bus exhaust from a lean-burn engine - no aftertreatment (95220)
Elemental Carbon (EC)	44.37%	14.00%	46.40%	78.97%	9.98%	9.25%	11.12%
Organic Carbon (OC)	42.64%	55.70%	34.74%	14.52%	22.33%	36.99%	37.45%
Non-carbon Organic Matter (NCOM)	8.53%	11.14%	6.95%	2.90%	4.47%	7.40%	7.49%
SO4	0.95%	7.19%	5.27%	1.03%	59.91%	0.64%	1.04%
NO3	0.26%	0.29%	1.25%	0.18%	0.00%		
NH4	0.43%	2.78%	1.74%	0.36%	0.00%		
Fe	0.31%	1.83%	0.34%	0.13%	0.64%	0.25%	0.25%
Al		0.32%	0.06%	0.06%	0.11%	0.89%	0.89%
Si		0.32%	0.30%	0.22%	0.09%	0.46%	0.59%
Ti		0.03%	0.01%	0.01%	0.02%		
Ca	0.39%	1.44%	0.58%	0.35%	0.47%	0.21%	0.44%
Mg	0.02%	0.14%	0.13%	0.01%	0.14%		
K		0.09%	0.26%	0.02%	0.05%		
Na	0.01%	0.04%	0.31%	0.03%	0.99%		
Cl	0.02%	0.10%	0.38%	0.13%	0.04%		
CMAQ5.0 unspeciated (PMOTHR)	2.09%	4.58%	1.28%	1.09%	0.78%	43.90%	40.74%

Documentation

Report available on MOVES webpage:

http://www.epa.gov/otaq/models/moves/moves-reports.htm