Fuels & Fuel Effects in MOVES2006

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Megan Beardsley

Office of Transportation & Air Quality, EPA

MOVES

Overview

- **Introduction**
- **What Fuel? When?**
- **Fuel Adjustments for MOVES2006**
- **For the Future**

Definitions

- **Fuel Type**
  - The broadest category, considered a fixed characteristic of a vehicle.
- **Fuel Subtype**
  - A subcategory of Fuel Type. Used primarily for GREET calculations.
- **Fuel Formulation**
  - A specific fuel with specific properties.
  - Each Fuel Formulation belongs to a Fuel Subtype.
- **Fuel Adjustment**
  - A multiplicative factor applied to emission results.
  - Each Fuel Formulation has a set of Fuel Adjustments.
- **Fuel Supply**
  - A mapping of Fuel Formulations to county, month & year.
- **GPA status**
  - "Geographic Phase-in Area" accounts for high sulfur in some counties

Fuels in MOVES2006

Fuel Type	Fuel SubTypes	Number of Fuel Formulations
Gasoline	CG, RFG, E10	146
Diesel	Diesel, Biodiesel, FT	69
CNG	CNG	1
LPG	LPG	1
E85	E85	1
M85	M85	1
H2 Gas	H2 Gas	1
H2 Liquid	H2 Liquid	1
Electricity	Electricity	1

Fuel Characteristics in MOVES2006

- **Gasoline**
  - RVP
  - Sulfur level
  - ETOH volume
  - MTBE volume
  - ETBE volume
  - TAME volume
  - Aromatic content
  - Olefin content
  - Benzene content
  - e200
  - e300

- **Diesel***
  - Sulfur level

*   MOVES allows input of Biodiesel & Fischer-Tropsch diesel fuels, but currently has no fuel adjustments for them

What fuel? When?

- **FuelSupply table lists Fuel Formulations for each county, month & "Fuel Year."**

  – Fuel Years are 1990, 1999-2011

- **May have multiple Fuel Formulations for a given county, year & month.**

  – Market shares must sum to one for each Fuel Type.

- **When database lists no fuel formulations for a Fuel Type, MOVES uses default value.**

  – This feature is currently used for alternative fuels

MOVES2006 Fuel Supply

- **1990**
  - "Clean Air Act Baseline Fuel" adjusted to account for local ASTM RVP and local sulfur levels made proportional to 1999.
- **1999-2003**
  - NMIM values (from survey data) with RVP adjustments consistent with RFS NPRM baseline.
- **2004-2006**
  - NMIM values for sulfur. Other values consistent with RFS NPRM baseline.
- **2007-2011+**
  - Consistent with RFS NPRM scenario: 7.2 Billion Gallons ethanol used with maximum use in RFG areas.

Fuel Binner

- **Original Fuel Supply had 7915 gasoline formulations**
  - Many with nearly identical characteristics
- **"Fuel Binner" grouped into 145 gasoline formulations**
  - Gasolines grouped by:
    - Fuel SubType (CG, RFG, E10)
    - RVP (0-7.2, 7.21-8.2, 8.21-9.5, 9.51-11.5, >11.5)
    - Sulfur level (0-80, 81-110, 111-140, 141-210, 210-300, >300)
    - ETOH volume (0, .001-6, 6.001-8, >8)
    - MTBE volume (0, 0.001-3.5, 3.501-7, 7.001-10, >10.001)
    - TAME volume (0, 0.001-0.03, 0.0301-0.6, > 0.601)

Fuel Adjustments for MOVES2006

- **Multiplicative factors applied to emission estimate**
- **Vary with**
    - Fuel Formulation
    - Emission Process (Start, Running, etc*)
    - Pollutant (HC, CO & NOx)**
    - SourceType
    - Model Year Group
- **For MOVES2006, calculated using MOBILE6.2**

* Fuel Effects for evaporative emissions will be discussed later today

* *Sulfate emissions are calculated directly from fuel consumption & fuel sulfur content.

Reference Gasoline

- **FuelAdjustment = 1.**
  - All other fuel adjustments indicate emission changes in proportion to the reference fuel.
- **FuelFormulationID 1126.**
  - RFG with RVP = 6.9 psi, Sulfur = 120 ppm, 11% MTBE.
- **Selected because it most closely matches fuel used during NYIPA test program.**
  - New York data initially planned to populate LD "with I/M" emission factors in MOVES2006.
- **Subject to change if needed.**

Generating Fuel Adjustments

- **JAVA program & MYSQL scripts**
- **Generated thousands of MOBILE6.2 input files.**
  - Fuel parameters from MOVES
  - Sulfur levels for both GPA & non-GPA areas.
  - July runs for 14 calendar year groups.
  - Specified running & start emissions for 8-year-old vehicles.
- **Ran MOBILE6.2 for each input file**
- **Calculated ratios of emissions for each fuel formulation to reference fuel emissions.**

Fuel Adjustment Values

Pollutant/ Process	Min	Mean	Max
HC Running	0.78	1.10	2.42
HC Start	0.85	1.12	1.51
CO Running	0.70	1.21	2.84
CO Start	0.66	1.18	1.87
NOx Running	0.67	0.97	1.17
NOx Start	0.67	1.00	1.16

For the Future

- **MOVES2006**
  - Continue testing, debugging & documentation
- **MOVES2007**
  - Respond to feedback on MOVES2006
  - Add Mobile Source Air Toxics
  - Create code to compute fuel adjustments "on-the-fly" from fuel properties and a table of coefficients.
  - Consider updating fuel adjustments to account for post-MOBILE6 data
- **MOVES2009**
  - Major update of fuel adjustments to account for new data & EPACT-required work on "updated complex model"

For the Future

- **To meet 2009 EPAct requirements EPA needs a major fuel-effects testing program**
- **Current data is mostly for 1992-and-earlier**
- **Need to address wide-range of fuel use:**
  - On-road & Off-road
  - Summer & Winter
  - Evap & Exhaust
  - Gasoline & Diesel
  - Matrix of most important fuel parameters
- **Funding for such testing is limited & currently uncertain**
- **Stakeholder involvement would be welcomed**