



Draft Fuel Supply Updates for MOVES201x

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Overview

- **Introduction to MOVES fuel properties**
- **Regional fuel properties:**
 - Updated through 2015 (including state / local programmatic changes)
- **MOVES Default database:**
 - Historical oxygenates removed from fuel properties
 - No longer includes E15 market share projections for future years
 - Many additional non-default fuel property combinations included
- **Fuel wizard:**
 - Calculation error permanently corrected

Introduction to MOVES Fuel Properties

- MOVES calculates exhaust and evaporative emissions effects (CAPs and select HAPs) for many fuel parameters (aromatics, benzene, sulfur, RVP, distillation) as part of the Complex (Tier 0,1) and EPAAct (Tier 2+) fuel effects models
 - Many properties have complex interactive effects and cannot be easily represented individually
 - Diesel and CNG properties are tracked and modeled as well^a
- Fuel properties are not uniform across the country; states and local regions may have additional fuel programs
- Fuel properties can vary significantly due to nature of how fuel is produced^b
- MOVES fuel supply data is generally contained in FuelSupply, FuelFormulation, and RegionCounty tables^c

CAPs = Criteria Air Pollutants (NO_x, CO, PM, VOC) HAPs = Hazardous Air Pollutants

- Diesel and CNG fuel effects modeling are limited only to fuel sulfur and biodiesel effects. Other non-gasoline properties such as cetane are beyond the scope of the current modeling.
- Due to batch variation, EPA strongly suggests that MOVES default fuel supplies are used unless specific local volumetric and temporal fuel information is available. See technical guidance.
- Some additional tables also contain fuel information such as the E10FuelProperties table, and the AlternativeVehicleFractionTable

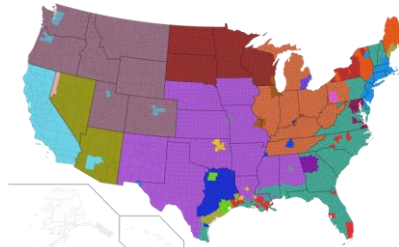
Regional Fuels Update: Fuel Regions

Overall region definitions unchanged from MOVES2014a:

- 15 base regions (CG + RFG), 24 unique local fuel regions, 45 total possible distinct fuel property areas^a
- Fuel regions remain constant through time (2015 reference)^b

- State / local programmatic changes*:

- Atlanta
- Florida
- Maine
- North Carolina
- Alabama
- Tennessee



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CG: Conventional Gasoline RFG: Reformulated Gasoline

a) Base region: regional definition based only on transport networks

Unique fuel region: base region + local programmatic requirements, usually oxygenate or RVP standards

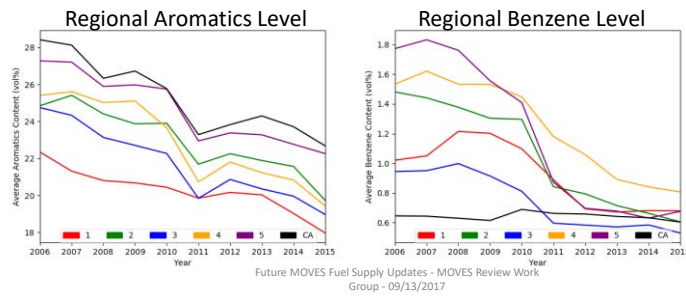
Fuel regions are defined by fuel pipeline distribution networks and fuel availability, and generally closely match the Petroleum Administration for Defense Districts (PADD) definitions, with notable exceptions across the Appalachian area and Gulf Coast.

b) Historical changes to local fuel programs cannot be easily reflected in the MOVES default database due to EPA regulatory modeling requirements. A release of a historically accurate default properties is being considered for the future.

* Some of these states have already or are in the process of changing their fuels programs. These changes are not reflected in the map on this slide. The inclusion of this data in the default database will depend on MOVES201X publication date.

Regional Fuels Update: Fuel Properties

- Updated fuel property data (Aromatics, benzene, sulfur, RVP, olefins, distillation)
 - 2011 – 2015
 - EPA compliance batch reporting^a
 - Fuel properties (except sulfur) are held constant at their regional level 2015+^b



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PADD1: East Coast, 2: Midwest, 3: Gulf Coast, 4: Rockies, 5: West Coast

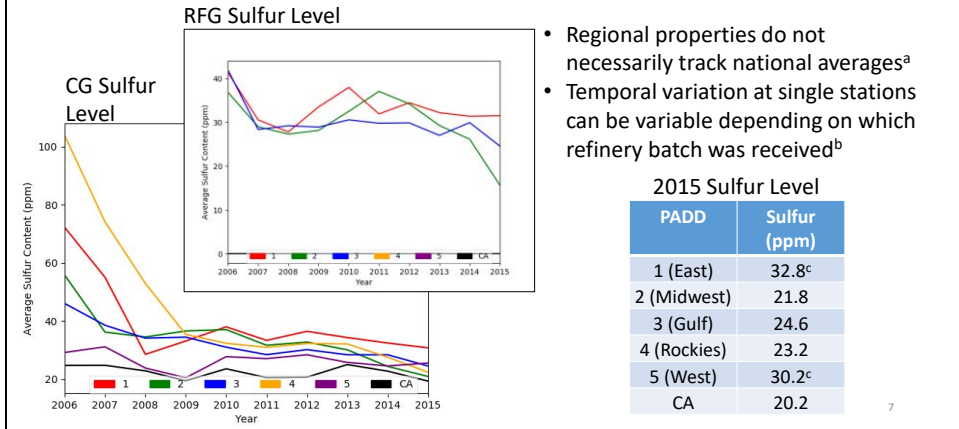
- Compliance batch data is reported to EPA by entities with fuel property requirements (refiners, blenders, oxygenate producers, additive producers, etc...) for purposes of certification under fuel regulations. This data is reported by fuel batch (generally between 1,000 and 25,000 gallons), with the fuel properties for each batch under regulatory monitoring. Due to the sensitive nature of this data, EPA cannot release the full compliance dataset publicly (under Confidential Business Information requirements). A yearly summary of compliance batch data is provided at: <https://www.epa.gov/fuels-registration-reporting-and-compliance-help/gasoline-properties-over-time>. A regional summary for this compliance batch data from 2005-2016 is forthcoming. For more information on how the compliance batch reports are used to create MOVES default fuel properties, please refer to the MOVES Fuel Supply Technical Documentation <https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P100PUK5.pdf>
- All monitored fuel properties have been updated through 2015, major fuel property changes with significant temporal variation are shown here.

Regional Fuels Update: Tier 3 Sulfur and ABT

- Tier 3 sulfur program reduces sulfur average from 30 to 10 ppm^a
 - Phase-in 2017 – 2020
- Averaging, banking, and trading program allows generation of sulfur compliance credits, including ‘early credits’ which can be used to offset compliance deficits until 2020^b
- Is it possible to project when / where ABT credits will be used?
 - 986,783,177,319 total active credits in 2016 (1 credit = 1 ppm-gal)
 - Burst: Increase the national average by 6.9 ppm for one year (= 16.9 ppm)
 - Spread: Increase the national average by 2.3 ppm until 2020 (= 12.3 ppm)
 - **Reality:** Some blend of credit usage and/or generation on a per-refinery basis depending on refinery equipment status, business case and crude availability

- Refinery cap remains at 80 ppm, downstream cap at 95 ppm. Applies to refiners, importers, oxygenate producers, additives.
- Refiners can generate credits to comply with either Tier 2 (30 ppm, 2012 - 2016) or Tier 3 (10 ppm, 2017+). Credits can be transferred to another refinery, or banked for up to 5 years (e.g., a credit generated in 2012 would expire in 2017). “Early Credits” generated in 2014, 2015 and 2016 expire by 3/31/2020 if unused. A credit deficit in 2017 can be carried forward for one year, but must comply with a two year average (10 ppm) in the subsequent year.

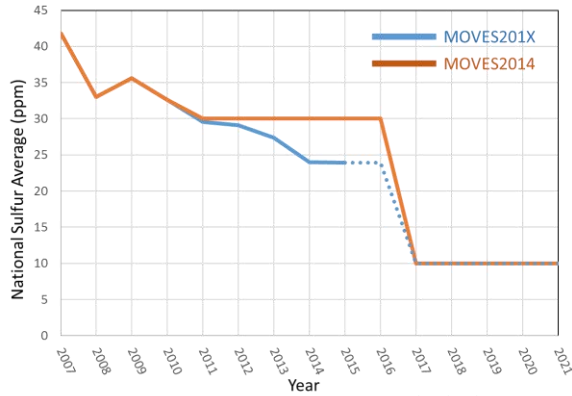
Regional Fuels Update: Sulfur



- Regional properties do not necessarily track national averages^a
- Temporal variation at single stations can be variable depending on which refinery batch was received^b

- EPA MOVES Technical Guidance strongly suggests not altering the default fuel formulations unless precise local volumetric and temporal fuel property data is available. Batch to batch variation precludes point sampling being used for compliance purposes.
- Variation precludes sulfur prediction at a particular location or particular time. A single retail station could see a delivery of 8ppm fuel one week, and a delivery of 17ppm fuel the next week. Using the national average, or single-point sampling, is not sufficient to predict this behavior (for modeling, or compliance).
- Higher than regulatory average is likely due to ABT credits being spent in this region.

Regional Fuels Update: Sulfur (cont.)



- MOVES201X sulfur values 2016+ remain unchanged from MOVES2014 values (10ppm)
 - Regional / temporal variation cannot be easily predicted
 - ABT program credit use introduces more uncertainty
 - National averages are not adequate to represent local areas
- Fuel compliance data and trends will be available publicly
 - 2006 – 2016 Fuel Trends Report³

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a) The EPA 2006 – 2015 Fuel Trends Report is currently in the review process, and will be released publicly after completing that review. Please see: <https://www.epa.gov/fuels-registration-reporting-and-compliance-help/gasoline-properties-over-time>

Future E15 market share projections

- Renewable Fuel Standard (RFS2) 2016 annual rulemaking held renewable volumes nearly constant from previous years^a
- EIA Annual Energy Outlook 2016 (AEO2016) has reduced E15 penetration projections compared to AEO2015
- EPA is no longer predicting E15 market penetration values regionally or nationally^b
 - Default database will contain **100% E10 market share 2012+ for all regions**^c
 - Fuel properties for E0 and E15 will still be included in the default database (with desired marketshare adjustable in the Fuel Supply table)

- The Renewable Fuel Standard sets an annual compliance target for renewable volumes used in market fuels, including ethanol and biodiesel. Generally, actual renewable production trends closely with these compliance targets. By holding predicted renewable volumes constant, the RFS2016 rulemaking suggests that the E10 – E15 penetration will be similar to previous years.
- EPA is aware that there are local areas with non-zero E15 penetration. There is limited data on the volumes of fuel sold in these local areas. If E15 effects in these areas are desired for study, EPA suggests using non-default E15 fuel parameters as included in the fuel supply database update.
- E0-E10 marketshare in years previous to 2011 varied based on E10 penetration.

Inclusion of non-default fuel properties

- Non-default fuel properties w/ calculated refinery modeling effects^a included in database for combinations generally of interest (w/ market share = 0%^b)

<u>Ethanol</u>	<u>RVP</u>	
E0	7.0	
E10	+ 7.8	= 18 options in database for each region
E15	8.0	
	8.8	
	9.0	
	10.0	

- Biodiesel options at B0, B5, B10, B15 and B20 will also be included as options

- Based on refinery modeling completed as part of the Tier 3 rulemaking. Please see the Tier 3 RIA, Control of Air Pollution from Motor Vehicles: Tier 3 Motor Vehicle Emission and Fuel Standards Final Rule Regulatory Impact Analysis, Chapter 4:
<https://nepis.epa.gov/Exe/ZyPDF.cgi/P100ISWM.PDF?Dockey=P100ISWM.PDF>
- Fuel marketshares can be adjusted to a users desired level as part of the Fuel Supply table in MOVES201X.

Historical Oxygenates

- MOVES2014 included user-adjustable MTBE, ETBE, and TAME marketshare values as part of the fuel property database
- Use of these oxygenates in market fuels has been widely discontinued 2007+
- The EPAAct fuel effects model cannot calculate emissions effects caused by changes in these values
 - This model is used for vehicles MY 2001+^a
- MTBE, ETBE, and TAME have been removed from the Fuel Properties table in MOVES201X^b

- Fuel effects for vehicles MY pre-2001 are calculated using the Complex model.
- Options regarding how MTBE, ETBE, and TAME values will be stored for use regarding historical vehicles modeled using the Complex model fuel effects are still being discussed.

Permanent fix for fuel wizard calculation

- Fuel wizard bug required a patch to MOVES2014a
 - Still required a multiple-step method for areas without a 1-psi RVP ethanol waiver to ensure proper calculations
- MOVES201X code planned to fully address and fix this bug
- Inclusion of non-default fuel properties in the database should reduce the need for fuel wizard calculations

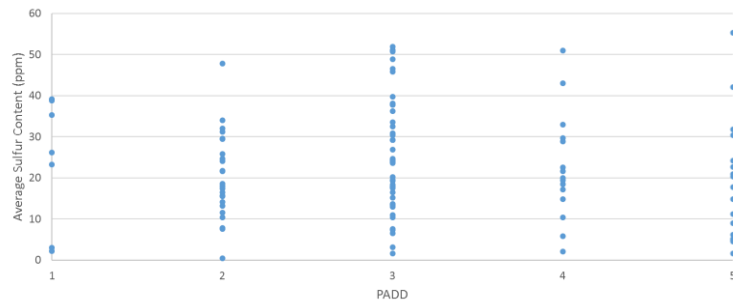
Summary: Draft Updates for MOVES201X

- **Regional fuel properties:**
 - Updated through 2015 (including state / local programmatic changes)
 - Further updates of the database 2016+ may be included depending on data availability, state and local fuel programs, and publication date
- **MOVES Default database:**
 - Historical oxygenates removed from fuel supply
 - No longer includes E15 market share projections for future years
 - Many additional non-default fuel property combinations included
- **Fuel wizard:**
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Appendix Slides

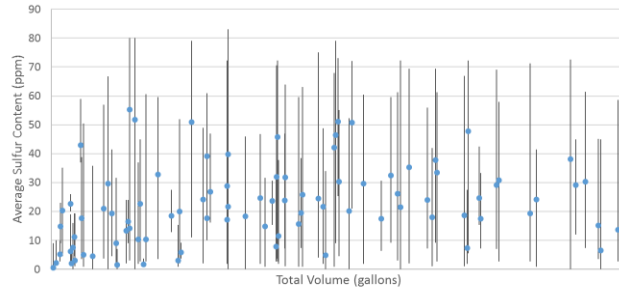
Is Sulfur ABT going to create a regional effect?

- There is no clear regional effect in average sulfur content



Does refinery size have an effect on sulfur?

- There is no clear correlation between refinery size and average sulfur content



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