

Peer Review of EPA Draft Document:

“Fuel Supply Defaults: Regional Fuels and Fuel Wizard in MOVES201X”

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Fuel Supply Defaults: Regional Fuels and Fuel Wizard in MOVES201X

For many years, the MOVES Model (and its predecessor models) have been key tools in assessing pollutant emissions from in-use vehicles within the U.S. Because of constantly changing vehicle and fuel technologies, as well as evolving modeling capabilities and regulatory policy/planning objectives, it is important to regularly update MOVES. This report describes the methodology used to define regionally-specific fuel properties for use in MOVES201X, and explains updates that have been made to the previous methodologies used in MOVES2014.

In general, the approaches used by EPA in determining fuel supply inputs for MOVES201X are appropriate, and are based on the most current and relevant information sources. This report provides a reasonably clear explanation of the analytic methods and procedures that were used, as well as the underlying data sources, although the clarity and thoroughness could be improved in certain areas, as described below. Additionally, the methods and procedures being used appear technically sound and appropriate with respect to both basic scientific disciplines and the practical realities of fuel production and distribution.

Where data are limited, the approaches and assumptions used by EPA to derive useful information appear to be reasonable. One broad area, however, where additional information and discussion would be helpful involves the variability and uncertainty of data sources. Specific examples of this, and other recommendations for general improvement of the report, are provided below.

Section 1. Executive Summary

To provide greater context for the reader, it should be mentioned that the fuel quality database tables used in MOVES pertain to gasoline, diesel, and natural gas fuels that are used in both on-road and non-road applications. However, the Fuel Wizard only applies to gasoline fuels, and only addresses changes in three properties: ethanol content, sulfur content, and RVP. In addition, perhaps a brief statement should be provided to explain why the projection of E15 usage beyond the year 2015 has been removed.

Section 2. Introduction

No comments on this section.

Section 3. Background

This section introduces the problem of how to define appropriate sets of fuel properties that accurately represent actual marketplace fuels. This is complicated by seasonal and regional variations in fuel specifications. For gasoline, this is further complicated by the fact that much (maybe most?) product batches from refineries are blendstocks for oxygenate blending (BOBs), not finished, marketplace gasoline.

In view of this, Figure 1 may give a somewhat misleading depiction of the variability of E200 in realistic fuels, as this figure appears to include BOBs as well as finished gasolines, and it appears to include both summer and winter fuels. Segregation of the fuels into conventional gasoline (CG) and reformulated gasoline (RFG) may be useful, as these categories have slightly different specifications,

and may be treated separately in MOVES. Segregation by grade (Regular and Premium) may not be as useful, as these categories do not have different regulatory specifications. Nevertheless, it would be of interest to indicate what fraction of U.S. gasoline is RFG vs. CG, and what fraction is Regular vs. Premium. Presumably, the fuel properties shown in Appendix A represent volume-weighted averages of all gasoline types (i.e., Regular and Premium grades of both CG and RFG).

To get a more realistic picture of variability of fuel properties, it would be better to limit the data to only finished, marketplace gasolines for a single season (summer or winter). It would be quite instructive to show such data in graphical form similar to Figure 1 for a few gasoline properties that are regulated (e.g., RVP, sulfur content, and benzene content) and for a few properties that are not regulated (e.g., E200, olefins content, and aromatics content).

Section 4. Regional Fuels

This section describes the approach used by EPA to aggregate fuels and their properties into a relatively small number of geographic regions. It is curious why the numbering of the eleven base fuel regions identified in Table 1 are not sequential. To further illustrate these regions, it would be useful to show a larger sized map in Figure 3, and to include a legend to identify the correspondence between the 11 regions and the colors used in the map.

On page 9 it is stated that MOVES201X has 24 regions. Yet, Table 2 identifies only 23 regions. Why the discrepancy? Also, the RFG regions (base regions 11, 12, 13, and 14) all indicate a minimum ethanol volume of 10%. My understanding is that the original ethanol requirement for RFG no longer applies. In fact, there is virtually no difference any longer in ethanol contents of RFG and CG.

Section 5. Fuel Properties

This section describes the information sources used by EPA to develop base fuel properties for different regions, and explains modifications made to these properties to better represent actual marketplace fuels. Table 3 identifies the gasoline properties included in the fuel compliance database. It would be helpful to expand this table to include the units of measurement for each property. It would also be useful to indicate which of these properties are used directly within MOVES.

As pointed out on page 10, the fuel compliance data includes information on fuel batches as they leave their points of production. However, fuels (and BOBs) produced in one region are often transported and used in other regions. This cross-regional transport is facilitated by pipelines, which also serve to homogenize the composition of different batches. Some discussion of these issues should be provided, along with an explanation of the approach used by EPA to account for such transport, and the uncertainties in regional marketplace gasoline compositions that this creates.

The adjustment of BOB fuels to account for ethanol blending is mentioned on page 11, but no details are provided to explain what these adjustments are, and how they are made. Adjustments in fuel properties resulting from ethanol blending are complicated, as some properties “blend linearly” (such as sulfur, aromatics, olefins, and oxygen levels), while other properties do not (such as RVP, T50, T90, E200, and E300). Some discussion of these issues should be provided. In addition, it would be useful to show the final fuel properties resulting from these BOB adjustments. Perhaps Appendix B

could be added, which would resemble the existing Appendix A, but show adjusted fuel properties rather than the properties based only on compliance batch data.

The approach by which AAM fuel sampling data are used to validate the adjustments made to compliance batch data should be explained. For example, is it required that the adjusted data match the AAM data within specified tolerance ranges for individual fuel properties? What is done if the compliance data and AAM data don't match?

The adjustments to secondary fuel properties resulting from changes to gasoline ethanol level, RVP, and sulfur level are shown in Tables 4, 5, and 6, respectively. However, the discussion about this is quite brief (page 12) and somewhat confusing. One point of clarification would be to include the units for each fuel property. Table 4 would then more clearly show that when going from E0 to E10 in summer gasoline, not only does RVP increase by 1.0 psi, but also aromatics are reduced by 2.02 vol.%, olefins are reduced by 0.46 vol.%, E200 is increased by 3.11 vol.% evaporated, E300 is increased by 0.39 vol.% evaporated, T50 is decreased by 6.34 °F, and T90 is reduced by 1.77 °F.

Near the bottom of page 15, it is mentioned that the “density, energy and carbon content” of fuels used in MOVES are shown in Table 10. Actually, the carbon contents are shown in Table 9. However, it would be helpful to simply combine Tables 9 and 10 into a single table. Also, the carbon content of each fuel subtype shown in Table 9 is expressed in units of g/kJ. While this is appropriate for the calculation of CO₂ emission rates, it would be helpful to the reader to also express carbon contents in terms of wt.%.

While their current usage levels are very small, there are a handful of other fuels that have a marketplace presence – including renewable diesel (RD), LNG, and H₂. The way in which these minor fuels are treated within MOVES should be explained.

Section 6. Renewable Fuels Market Share and Usage

This section explains the methodology used to estimate the volumes and market shares of various fuels used in MOVES – both in the past and projected into the future. It would be simpler and clearer to the reader if Tables 11 and 12 were combined into a single table. In the current Table 11, why are there two different values for FFV Market Share (Sourcetype 21 and Sourcetype 31)? Also, are the FFV Market Share and Fuel Usage Fraction values shown here the national average default values? How do these values vary regionally, and how is such variability handled within MOVES?

The description of biodiesel usage rates on pages 21-22 is somewhat confusing. Is this saying that all diesel fuel from 1990 to 2013 is assumed to be B0, while all diesel fuel in 2014 and beyond is assumed to be B5?

Section 7. Nonroad Fuel Supply

Are the sulfur levels shown in Table 13 for nonroad diesel and marine diesel supported by fuel survey data? Also, it appears that these sulfur values represent national average levels. How much regional variation is there?

It would be useful to include nonroad diesel (fuelTypeID 23) and marine diesel (fuelTypeID 24) in Tables 9 and 10, along with the other fuel types shown in this table. Are there additional fuel types used in MOVES that are not currently listed in Tables 9 and 10?

Section 8. Fuel Wizard

For clarification, it would be helpful to include a small table that shows the adjustable fuel properties in the Fuel Wizard (ethanol, sulfur, and RVP) along with the range over which these properties can be varied within the Fuel Wizard.

Other Minor Comments

This report version contains a number of minor formatting and typographical errors. The following items should be addressed:

- There are currently two depictions of Figure 1
- Figure numbers are incorrect in a couple places:
 - Page 4, line 24: should be Figure 2, rather than Figure 3
 - Page 5, line 12: should be Figure 3, rather than Figure 4
- Referencing system problems (Error! Bookmark not defined) in a couple places:
 - Page 12, line 9
 - Page 15, line 26
- Other referencing problems in a couple places:
 - Page 14, line 12: missing reference
 - Final dates should be included in reference no's 4, 5, and 16
- A few grammatical issues should be corrected:
 - Page 5, line 7: "Although an area specific region ..."
 - Page 5, line 11: "... each region in the MOVES default ..."
 - Page 13, Last line of footnote: "... in the creation of user-specific E15 fuel blends."
 - Page 15, line 14: "... each of the fuels."
 - Page 19, line 19: "... the fraction of FFVs that are filled ..."
 - Page 22, line 13: delete phrase "is based on"