UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

DEC - 8 2016

OFFICE OF
AIR AND RADIATION

Mr. Adam R.F. Gustafson
BOYDEN GRAY & ASSOCIATES PLLC
801 17th Street, N.W.
Suite 350
Washington, D.C. 20006

Dear Mr. Gustafson:

This letter is in response to your Request for Correction (RFC #16003) on behalf of the Energy Future Coalition, Urban Air Initiative, and Governors' Biofuels Coalition, dated April 7, 2016, and received by the U.S. Environmental Protection Agency, regarding the lifecycle analysis (LCA) of ethanol and gasoline under the Renewable Fuel Standard (RFS). Your request cites concerns about the information in the Regulatory Impact Analysis (2010 Lifecycle Analysis) accompanying the EPA's 2010 RFS Rule and in the EPA's 2011 First Triennial Report to Congress on the Environmental Impacts of the RFS, which you believe contains inaccuracies and deficiencies. We have reviewed your request carefully and for the reasons set forth in the enclosed supplemental material have determined that changes are not warranted at this time.

We appreciate the data you have brought to our attention; we will take this information and the entire suite of relevant literature under consideration in future analyses. EPA's Office of Research and Development expects to release the second Triennial Report to Congress by the end of 2017. The EPA remains committed to using the best available science when developing or changing regulations, standards, and reports. If you have corrections to additional reports that you want to bring to our attention, please send your written request to the EPA Information Quality Guidelines Processing Staff via mail (Information Quality Guidelines Processing Staff, Mail Code 2811A, U.S. EPA, 1200 Pennsylvania Ave., N.W., Washington, D.C. 20460) or electronic mail (quality@epa.gov). Additional information about how to submit an RFC is listed on the EPA IQG Web Site (https://www.epa.gov/quality/epa-information-quality-guidelines-requests-correction-and-requests-reconsideration).

Thank you for your interest in this matter.

Sincerely,

Janet G. McCabe
Acting Assistant Administrator

Enclosure

Supplemental Material for Request for Correction (RFC #16003)

The subject matter of the Request for Correction (RFC #16003[1]) is related to new data that have been generated since the lifecycle analysis (LCA) of ethanol and gasoline under the Renewable Fuel Standard (RFS) was conducted as outlined in the Regulatory Impact Analysis accompanying the EPA's 2010 RFS Rule (2010 Lifecycle Analysis). These data address greenhouse gas (GHG) emissions of ethanol, improved agricultural practices, and improved ethanol production practices. The request asserts that newer land-use change (LUC) modeling estimates of corn ethanol lifecycle emissions are lower than those reported in EPA's 2010 LCA.

While a number of recent corn ethanol LUC emissions estimates are lower than the 2010 LCA estimates, LUC results still vary greatly with model structure, assumptions, and target year.[2] Studies published between 2011 and 2015 vary from 6 $gCO2eMJ^{-1}$ to 80.09 $gCO2eMJ^{-1}$.[3,4,5,6,7,8,9,10,11,12,13,14] The EPA's estimate (26.34 gCO_2eMJ^{-1}), is still within the range. The request also refers to historical deforestation data in support of lower LUC projections. However, historical data cannot be easily compared to model-projected effects, since it is difficult to hold all other relevant factors constant.

The request also asserts that soil under corn cultivation sequesters more carbon than previously assumed, and that tillage practices have a significant impact on soil organic carbon (SOC) content. Our review of the broader literature indicates that the recent corn SOC data are inconclusive, due to variation between studies and a dependence on experiment duration. Though Qin et al. (2015) report an SOC content increase after conversion of generic cropland to corn cultivation, the data used by Qin et al. are limited or skewed for several reasons.[15] For example, of the data presented in Qin et al. (2015), only studies lasting fewer than 10 years measured a significant increase in SOC.

Furthermore, the Forest and Agricultural Sector Optimization Model (FASOM), which the EPA used to quantify domestic agricultural sector impacts, takes into account SOC impacts due to a number of land use and production practice changes. For example, FASOM accounts for increased soil carbon due to reduced tillage practices, and recent studies do not indicate a need for further adjustment. Previous

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1 https://www.epa.gov/sites/production/files/2016-05/documents/16003.pdf

2 Literature Review of Estimated Market Effects of U.S. Corn Starch Ethanol. 2016. Food and Agricultural Policy Research Institute, University of Missouri. https://fapri.missouri.edu/wp-content/uploads/2016/02/FAPRI-Report-01-16.pdf

3 Dumortier, J., D. Hayes, M. Carriquiry, F. Dong, X. Du, A. Elobeid, J. Fabiosa, and S. Tokgoz. 2011. Sensitivity of Carbon Emission Estimates from Indirect Land-Use Change. Center for Agricultural and Rural Development, Iowa State University. http://www.card.iastate.edu/publications/dbs/pdffiles/09wp493.pdf

4 Overmars, K., R. Edwards, M. Padella, A. Gerdian Prins, L. Marelli. 2015. Estimates of indirect land use change from biofuels based on historical data. European Commission, Joint Research Centre. http://publications.jrc.ec.europa.eu/repository/bitstream/JRC91339/eur26819_online.pdf

5 Dunn, J., S. Mueller, H. Kwon, and M. Wang. 2013. Land-use change and greenhouse gas emissions from corn and cellulosic ethanol. *Biotechnology for Biofuels*. https://biotechnologyforbiofuels.biomedcentral.com/articles/10.1186/1754-6834-6-51

6 Valin, H., D. Peters, M. van den Berg, S. Frank, P. Havlik, N. Forsell, and C. Hamelinck. 2015. The land use change impact of biofuels consumed in the EU: Quantification of area and greenhouse gas impacts. ECOFYS. https://ec.europa.eu/energy/sites/ener/files/documents/Final%20Report_GLOBIOM_publication.pdf

7 Kim, S., B. Dale, and R. Ong. 2012. An alternative approach to indirect land use change: Allocating greenhouse gas effects among different uses of land. *Biomass and Bioenergy*. 46 pp 447-452. http://www.sciencedirect.com/science/article/pii/S0961953412003108

8 Kløverpris J.H. and S. Mueller. 2012. Baseline time accounting: Considering global land use dynamics when estimating the climate impact of indirect land use change caused by biofuels. *The International Journal of Life Cycle Assessment*. http://link.springer.com/article/10.1007/s11367-012-0488-6

9 Laborde, D. 2011. Assessing the Land Use Change Consequences of European Biofuel Policies. ATLASS Consortium. http://trade.ec.europa.eu/doclib/docs/2011/october/tradoc_148289.pdf

10 Laborde, D., M. Padella, R. Edwards, and L. Marelli. 2014. Progress in estimates of ILUC with MIRAGE model. European Commission, Joint Research Centre. http://publications.jrc.ec.europa.eu/repository/handle/JRC83815

11 Marelli, L., F. Ramos, R. Hiederer, and R. Koeble. 2011. Estimate of GHG emissions from global land use change scenarios. European Commission, Joint Research Centre. http://iet.jrc.ec.europa.eu/sites/default/files/documents/scientific_publications/2011/technical_note_eu24817.pdf

12 Plevin, R., J. Beckman, A. Golub, J. Witcover, and M. O'Hare. 2015. Carbon Accounting and Economic Model Uncertainty of emissions from Biofuels-Induced Land Use Change. *Environmental Science and Technology*. http://pubs.acs.org/doi/pdf/10.1021/es505481d

13 Taheripour, F. and W. Tyner. 2013. Induced Land Use Emissions due to First and Second Generation Biofuels and Uncertainty in Land Use Emission Factors. *Economics Research International*. http://www.hindawi.com/journals/ecri/2013/315787/

14 iLUC Analysis for the Low Carbon Fuel Standard (Update). 2014. California environmental Protection Agency Air Resources Board. http://www.arb.ca.gov/fuels/lcfs/lcfs_meetings/iluc_presentation_031014.pdf

15 Searle, S. and C. Malins. 2016. A critique of soil carbon assumptions used in ILUC modeling. The International Council of Clean Transportation. http://www.theicct.org/sites/default/files/publications/ICCT_soil-carbon-assumptions-ILUC_20160613.pdf

studies, even those that sample past 30cm depth, observe varying SOC response to no-till practices.[16]

The request states that fertilizer is used more efficiently due to technological innovation, therefore corn farmers produce less nitrous oxide than estimated in our 2010 LCA. Since our 2010 LCA was based on 2022 projections of yield and fertilizer application rates, our analysis took into account increasing efficiency over time. For example, our analysis assumed a domestic fertilizer application rate of about 0.68 pounds per bushel (lb/bu) by 2022.[17] This value is lower than the most recent USDA estimates (136.5 lb/ac, 162.96 bu/ac, 0.8325 lb/bu for 2010).[18] Therefore, we do not think the nitrous oxide estimates we used in our 2010 analysis require updating.

As stated in the request, innovative technologies and methods have also increased ethanol refinery energy efficiency since 2000. Recent biorefinery energy use estimates are similar to the 2022 projections reported in the 2010 LCA.[19] We acknowledge that individual facilities with more efficient technologies can achieve greater lifecycle GHG emissions reductions than average facilities, and we allow such entities to use the Efficient Producer Petition process (EP3) to take credit for their lower energy use to produce non-grandfathered qualifying renewable fuel. However, for the reasons noted above, we do not believe any corrections to facility emissions estimates for the generally applicable pathways are needed at this time.

The request states that corn ethanol processing is also less carbon intensive than previously assumed because refineries produce more co-products, such as dry distillers' grains and solubles (DDGS) and corn oil, than they did previously. We note that the paper cited in the request for correction related to DDGS actually provides two sets of substitution rates – one that is higher and one that is lower than the rates used by the EPA in the 2010 LCA.[20] Although potential substitution rates for DDGS may be higher than what the EPA assumed in the 2010 LCA, it is important to note that our analysis is meant to reflect average conditions across the industry. Actual substitution rates are likely to be lower than the theoretical maximum, given a number of factors such as variability in the quality of distiller grains, regional variation in diets, and whether dry or wet distiller grains are used.[21] Therefore, we do not believe it is appropriate to update our DDGS assumption at this time. The request also asks that the EPA update our analysis to reflect the GREET assumption that corn oil gets a one-to-one displacement credit to account for the displacement of soy oil. However, the EPA's analysis does not rely on a displacement credit when evaluating the lifecycle GHG emissions of corn ethanol. Instead, the system boundaries of the EPA's analysis includes the increase in production of corn oil due to an increase in corn ethanol production, and the market-mediated impacts of this increase in corn oil production are reflected in the lifecycle GHG emissions estimate.

The request asserts that gasoline lifecycle emissions have increased significantly since the EPA's LCA was finalized for corn ethanol in 2010. However, EISA requires that the EPA compare biofuel emissions to a 2005 petroleum baseline. Therefore, the EPA does not have the discretion to take these recent petroleum market changes into account when calculating the LCA of biofuels. Furthermore, there are

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16 Blanco-Canqui, H., and R. Lal. 2008. No-tillage and soil-profile carbon sequestration: An on-farm assessment. *Soil Science Society of America Journal* 72(3):693-701.

17 Renewable Fuel Standard Program (RFS2) Regulatory Impact Analysis. 2010. Assessment and Standards Division, Office of Transportation and Air Quality, U.S. Environmental Protection Agency. https://www.epa.gov/sites/production/files/2015-08/documents/420r10006.pdf pg. 323 or 338

18 Gallagher, P., W. Yee, and H. Baunes. 2016. 2015 Energy Balance for the Corn-Ethanol Industry. United States Department of Agriculture. http://www.usda.gov/oce/reports/energy/2015EnergyBalanceCornEthanol.pdf

19 Gallagher, P., W. Yee, and H. Baunes. 2016. 2015 Energy Balance for the Corn-Ethanol Industry. United States Department of Agriculture. http://www.usda.gov/oce/reports/energy/2015EnergyBalanceCornEthanol.pdf

20 Hoffman, L. and A. Baker. 2011. Estimating the Substitution of Distillers' Grains for Corn and Soybean Meal in the U.S. Feed Complex. United States Department of Agriculture. http://www.ers.usda.gov/media/236568/fds11i01_2_.pdf

21 Klasing, K. 2012. Displace ratios for US corn DDGS: informed by regionally specific least-cost diet formulation for all major livestock types. The International Council on Clean Transportation. http://www.theicct.org/sites/default/files/publications/ICCT_US-DDGS_May2012.pdf

factors that are causing U.S. petroleum emissions to increase (e.g., increased consumption of crude from oil sands and depleted fields), but other factors that are leading emissions to decrease (e.g., higher share of domestically produced tight oils and reduced imports of Central and South American heavy crudes).

The request also states that tailpipe emissions with climate-forcing properties, specifically black carbon, should contribute to biofuel GHG reductions in the LCA. Though EPA's 2010 LCA tracks particulate matter as a non-GHG "criteria" pollutant, it does not project emissions of black carbon (BC) as a climate-forcing agent because it is not released in significant amounts, relative to the major GHGs, during the lifecycle of renewable or petroleum fuels.[22] BC is particularly negligible when comparing corn ethanol and gasoline lifecycle emissions because a majority of BC comes from diesel tailpipe emissions.[23]

Therefore, based on this review of the broad set of biofuel LCA literature, we do not believe a correction to the 2010 LCA for corn ethanol is appropriate at this time.

22Renewable Fuel Standard Program (RFS2) Regulatory Impact Analysis. 2010. Assessment and Standards Division, Office of Transportation and Air Quality, U.S. Environmental Protection Agency. pp 313-314. https://www.epa.gov/sites/production/files/2015-08/documents/420r10006.pdf
23 Report to Congress on Black Carbon. 2012. United States Environmental Protection Agency. pp 64. https://www3.epa.gov/blackcarbon/2012report/fullreport.pdf