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

DEC - 8 2016

OFFICE OF
AIR AND RADIATION

Dr. Steffen Mueller
Energy Resources Center
The University of Illinois at Chicago
1309 South Halsted Street
Chicago, Illinois 60607

Dear Dr. Mueller:

This letter is in response to your Request for Correction (RFC #16004) on behalf of the Energy Resources Center, The University of Chicago, dated April 11, 2016, and received by the U.S. Environmental Protection Agency, regarding the lifecycle greenhouse gas emissions analysis of ethanol and gasoline under the Renewable Fuel Standard. Your request cites concerns that the lifecycle modeling described in the Regulatory Impact Analysis (2010 Lifecycle Analysis) accompanying the EPA's 2010 Renewable Fuel Standard (RFS) Rule is out of date. 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. 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 you would like 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 #16004)

The subject matter of the Request for Correction (RFC #16004[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 lifecycle greenhouse gas (GHG) emissions of ethanol, including updated land use change (LUC) model parameters, improved agricultural practices, and improved ethanol production practices. The request asserts that newer land-use change (LUC) modeling estimates are lower than those reported in the EPA's 2010 LCA.

While a number of recent corn ethanol LUC emissions estimates are lower than the 2010 LCA estimates, results still vary greatly with model structure, assumptions, and target year.[2] Results reported in 2011 through 2015 range 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 Babcock and Iqbal's work in support of lower LUC projections.[15] However, historical data cannot be easily compared to model-projected effects, since it is difficult to hold all other relevant factors constant.

The request asserts that updates to the Yield Price Elasticity (YPE) parameter has contributed to lower, more accurate projections of LUC. However, this parameter still contributes significantly to uncertainty in LUC estimates.[16] Sources of uncertainty in YPE include a lack of international data, variation in results from the same methodology, a lack of data from the current timeframe for biofuel production, and limited data for double-cropping practices. LUC models, GTAP-BIO in particular, are very sensitive to changes in the yield price elasticity, so small uncertainties greatly increase the uncertainty of resulting

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[1] https://www.epa.gov/sites/production/files/2016-05/documents/16004.pdf

2 Literature Review of Estimated Market Effects o 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 Babcock, B. and Z. Iqbal. 2014. Using Recent Land Use Changes to Validate Land Use Change Models. CARD Staff Reports. Paper 5 http://lib.dr.iastate.edu/cgi/viewcontent.cgi?article=1000&context=card_staffreports

16 Golub, A. and T. Hertel. 2011. Modeling Land Use Change Impacts of Biofuels in the GTAP-BIO Framework. Purdue University. http://web.ics.purdue.edu/~hertel/data/uploads/publications/golub-hertel-climate-change-economics.pdf

LUC estimates.[17,18]

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.

Therefore, based on a 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.

17 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

18 Prabhu, A., J. Courtis, and S. Wade. 2015. Calculating Carbon Intensity Values from Indirect Land Use Change of Crop-Based Biofuels, Appendix I: Detailed Analysis for Indirect Land Use Chagne. State of California Air Resources Board. http://www.arb.ca.gov/regact/2015/lcfs2015/lcfs15appi.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