**California Advanced Biofuels Alliance**
1415 L Street
Suite 460
Sacramento, CA 95814
(916) 743-8935 *phone*

**National Biodiesel Board**
605 Clark Avenue
PO Box 104898
Jefferson City, MO 65110
(800) 841-5849 *phone*

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Sam Wade
Chief, Transportation Fuels Branch
California Air Resources Board
1001 I Street
Sacramento, CA 95814
LCFSworkshop@arb.ca.gov

**Re: Comments for October 19, 2018 Public Workgroup Meeting Regarding Co-Processing of Low Carbon Feedstocks in Conventional Petroleum Refineries.**

Dear Mr. Wade:

Thank you for the opportunity to comment on the October 19, 2018 Co-processing Workgroup meeting. We continue to appreciate opportunities to participate in transparent and public regulatory processes sponsored by the California Air Resources Board (CARB). We have included below comments on several aspects of this issue that we hope you will find of use as CARB proceeds through the regulatory process.

## 14C Testing for Co-processed Fuels

We appreciate CARB staff's work regarding the use of 14C analysis to help quantify the carbon intensity of co-processed fuels. We strongly support 14C over other methods, such as mass balancing, that have severe limitations and are unlikely to provide the assurance of accuracy that CARB requires for other fuel pathways. We agree with the general findings of workshop presenters that 14C analysis represents an accurate, economical, and practical method for quantifying renewable content in finished fuels.

We also support CARB's plan to continue the public process through a public Co-processing Workgroup meeting in early 2019 to discuss regulatory guidance associated with 14C implementation by refiners and the downstream market. As CARB staff begin drafting guidance for discussion purposes, we would like to highlight several issues worthy of consideration:

1. How often will 14C testing be required at the refinery level?
2. Will tested product need to be contained in a certified and sealed tank to ensure accuracy of testing at the refinery level?
3. How will CARB regulate co-processed fuels pipelined into or within California? Will 14C testing be required at the point the fuel is removed from the pipeline?

4. How will CARB know if co-processed fuels leave the state via pipeline?
5. How will product disclosure issues related to bills of lading and pump labeling be managed? Will a 14C certificate of analysis or blend level disclosure information be needed for each load of fuel?
6. How will CARB account for fractionation within the refinery product stream?
7. Will fractionation and yield loss be tested for each feedstock used by refiners?
8. If co-processed fuels imported into the state contain petroleum diesel fuel in addition to renewable content, will the petroleum diesel fuel need to be a CARB certified diesel fuel? And will the co-processed fuels only generate LCFS credits on the renewable portion of the blend imported into the state, as is the case with all other liquid fuels?
9. If refiners are allowed to establish baselines of operational performance for implementation of less intensive 14C testing, how long will baseline data need to be generated and collected and what will constitute a variance from the baseline conditions?

**Lifecycle Analysis (LCA)**

As you know, the GREET and CA-GREET models have not been modified to account for fuels from the various co-processing technologies. In our view, this should be addressed before regular or temporary fuel pathway codes are issued. Without approved models that reside in the public domain, it is unclear how CARB staff or the general public could have confidence in the accuracy of carbon intensity values assigned to co-processed fuels.

Once the issue of 14C testing has been addressed by the Co-processing Workgroup, we recommend hosting a public meeting on life cycle analysis (LCA) issues associated with the various co-processing technologies. In order to help develop appropriate modeling frameworks for these fuels, we have included comments below about key aspects of LCA treatment for co-processing technologies.

However, even with 14C dating, some mass balancing will be required to arrive at certain parameters required for undertaking the LCA. There are two conditions that must be satisfied for mass balancing to provide an accurate assessment of the change in performance:

1. There must be a stable baseline for the petroleum operation;
2. There must be no chemical interactions between the fossil stream and the biogenic stream.

Without 100% compliance of these two conditions, the change in the system performance when co-processing is carried out will not reflect the performance of the biogenic component.

At least four co-processing options are being considered by market participants:

1. Lipids in hydrotreating;
2. Pyrolysis oils in hydrotreating;
3. Lipids in the Fluid Catalytic Cracking unit (FCC); and
4. Pyrolysis oils in the FCC.

The challenges associated with determining the carbon intensity (CI) of the biogenic component are different for each of the four options. Our comments are organized by option.

Co-processing Lipids in a Hydrotreater

This option has been practiced commercially and is arguably the easiest to model. In order to meet the criteria of a stable baseline, there should be some limits placed on its applicability. Hydrogen demand for the petroleum feed will depend on: a) the sulphur content of the feed and the product; b) the olefin and aromatic contents of the feed; c) the degree of saturation of those components; and d) the nitrogen content of the feed[1]. If any of these decrease between the establishment of the baseline and the co-processing operation, the hydrogen demand calculated for the biogenic feed will be underestimated. It is therefore critical that the applicability of the baseline conditions be specified and limited to a narrow range of conditions.

The operating conditions inside the hydrotreater will change as the catalyst becomes deactivated with age. Therefore, there should also be a requirement to replicate the baseline on a regular basis. We recommend at least once during every month of operation.

The co-processing of lipids in a hydrotreater will generate a diesel stream, a naphtha stream, an LPG stream, and a fuel gas stream just like stand-alone renewable diesel. The 14C testing should be required for each of these streams to determine the overall product and co-product yields. This testing is repeatable, accurate, and reasonably priced. If the testing is not conducted on all the streams, the mass of the streams not tested should be excluded from the CI calculation.

The draft calculator CARB produced for hydrotreating uses emissions factors from multiple models. This is not a good practice because it promotes inconsistencies between similar fuel types. The emissions factors in the hydrotreater calculator should all be generated by CA-GREET 3.0. In addition, the CI for co-processing of lipids should be done in a Tier 1 calculator to allow for public review and input. It is important for CARB to conduct its business in an open and transparent manner so that the public has confidence in the agency's work.

While the product and co-product yields can be determined using the 14C method, and the hydrogen demand can be determined by the incremental hydrogen flow over the baseline (provided the baseline is representative of the feed used for co-processing), it will be a challenge to determine the incremental electricity demand and any natural gas or steam demand when co-processing. Plants will not have separate electrical meters for any of the activities within the refinery such as feedstock unloading, product loading, or blending activities. Therefore, we suggest CARB assign conservative default values for electricity and natural gas used for co-processing. CARB has information on the power demand and the thermal energy requirements

[1] Hydroprocessing: Hydrotreating and Hydrocracking.
https://inside.mines.edu/~jjechura/Refining/08_Hydroprocessing.pdf

from several standalone renewable diesel plants. We recommend that the highest values in the CARB data sets be used as default values for the co-processing of lipids in a hydrotreater.

Co-processing Pyrolysis or Bio-oil in a Hydrotreater

While the concept is similar to co-processing lipids, pyrolysis oil or "bio-oil" will produce a much more diverse range of products, and further downstream processing of some of the streams may be required. Co-processing of bio-oils can produce gasoline, jet, diesel, and heavy oil liquid products as well as gaseous co-products.

The bio-oils are much more reactive than lipids, and it is possible that interactions between the petroleum and bio-oil will occur in the hydrotreater. There is also a much wider range of bio-oil feedstock characteristics than exists with lipids. 14C testing is necessary for each of the product and co-product streams.

Conceptually, the determination of the CI of the hydrotreated streams is the same as with lipids, but the yields will be very different (much lower liquid yield) and the hydrogen demand will be much higher. The potential need for further processing requirements (such as the naphtha fraction requiring a gasoline hydrotreater or the synthesis of the lighter molecules into liquids), complicates the CI determination. Unfortunately, no public data is available to determine if a pathway applicant's power and thermal energy requirements are reasonable.

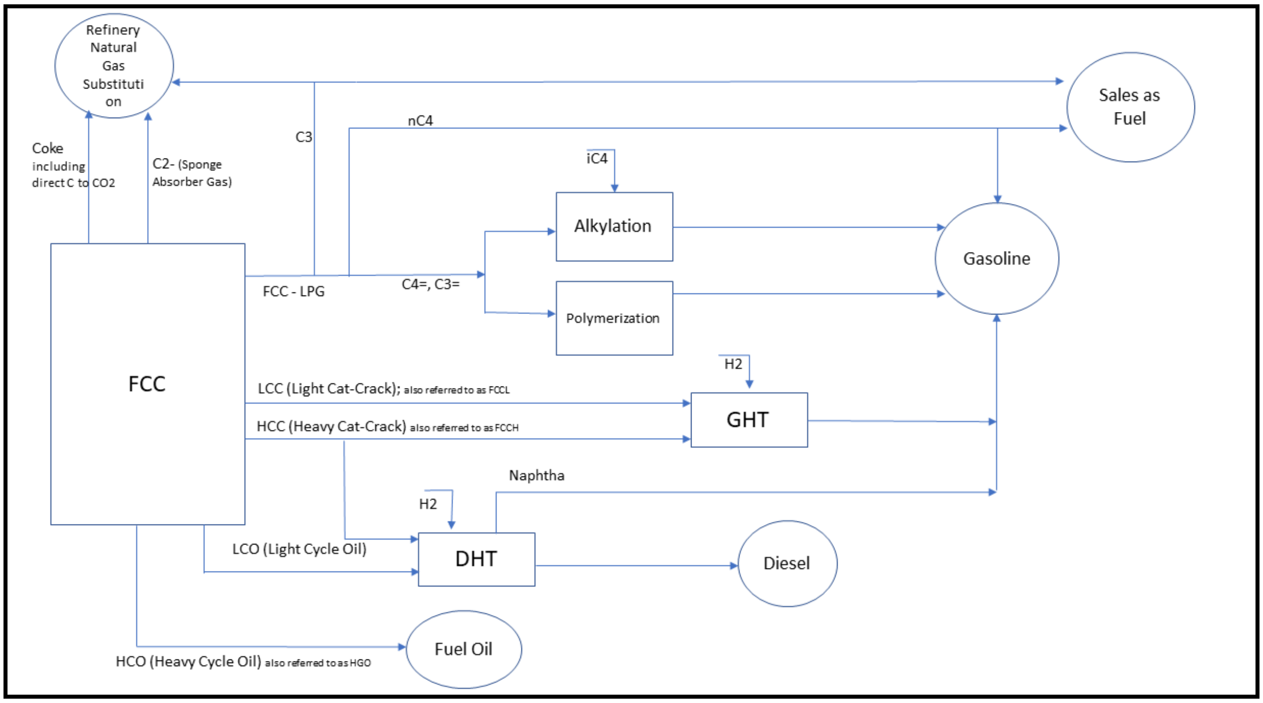
At this time, there are too many unknowns about this co-processing stream to develop any sort of unified or simplified approach to determining the CI of the fuels produced.

Lipids or Bio-oils in an FCC Unit

Lipids and bio-oils have been tested in refineries, usually with a test run spanning several days. Very little information has been made public about these tests.

It is highly likely that interactions will occur between the petroleum and biogenic feeds in an FCC unit. This will make traditional mass balancing impossible and will require 14C analysis to demonstrate how much of the biogenic feedstock is in the finished fuel products. Establishing a viable baseline is also more difficult with an FCC unit since crude slates are variable. Even crude oil composition within the same named crude varies significantly.

While using 14C analysis to determine the mass of biogenic feedstock in the final products is feasible, the required downstream processing of each of the FCC product streams will be difficult to determine. The following is one possible scheme for co-processing.




As can be seen from the figure, this is a difficult process to model. It is considerably more complicated than the diagram included in the CARB draft calculator. There are multiple streams from the FCC unit, including gaseous co-products. There are downstream processes that require hydrogen, chemicals, and other fossil reactants. And the downstream processes can produce both gasoline and diesel fuel.

Likely, the best approach to modeling this technology is to apply mass allocation around the FCC unit and then to try and produce a simplified process around each of the products—gasoline, diesel, HFO. The simplified process would have the feed from the FCC as the primary input into the "combined processing unit," and all the individual hydrogen, chemical, and fossil carbon inputs per unit of finished product.

It must be remembered that, depending on where and how the 14C contents are determined, there will have to be some fossil C (from the alkylation unit inputs) to account for during the combustion of the renewable gasoline.

## Temporary Fuel Pathway Codes for Co-processed Fuels

While we understand and support providing temporary pathways under a variety of circumstances, we believe co-processing is not an appropriate application of this process. Neither the NBB nor CABA opposed approval—or the various extensions—of a temporary fuel pathway code for Kern Oil's co-processing operation several years ago because we believed it was reasonable to allow a pilot scale project to proceed while CARB gathered data about the fuel's environmental attributes. However, it appears CARB has made little to no effort to acquire data and therefore expansion from pilot scale approvals to commercial scale approvals for temporary pathway applications is not appropriate at this time. Moreover, if approvals for temporary fuel pathway codes have been made for co-processing technologies, that information should be presented to the public for consideration, especially in light of the vast scale at which petroleum refineries operate.

While no fewer than 12 CARB-sponsored emissions tests and evaluations have been conducted on biodiesel to determine its eligibility for the California market[2], it appears that no work has been done to determine the suitability of co-processed fuels. This includes no emissions testing, no multimedia evaluations, no analysis to determine compliance with the California Environmental Quality Act (CEQA), and no development of publicly available lifecycle analysis tools. Both biodiesel and stand-alone renewable hydrocarbon diesel have undergone extensive testing to provide confidence to California consumers and to meet various regulatory and legal requirements under state law. Now that CARB is considering commercial-scale approvals for co-processed fuels, we recommend that staff host a workgroup meeting to apprise the public of the its progress and views on these issues.

**Concluding Remarks**

Thank you for considering our views on these important matters. Our members have greatly enjoyed the opportunity to partner with CARB to help meet shared climate goals. We look forward to continuing this collaboration for many years to come and hope that you will feel free to contact us if any questions should arise.

Sincerely,

Jennifer Case
Chair
California Advanced Biofuels Alliance

Shelby Neal
Director of State Government Affairs
National Biodiesel Board

[2] https://ww2.arb.ca.gov/our-work/programs/alternative-diesel-fuels/biodiesel-renewable-diesel