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[Submitted Electronically]

Mr. Samuel Wade, Chief
Transportation Fuels Branch
California Air Resources Board
1001 I Street
Sacramento, CA 95814

Comments on Low Carbon Fuel Standard "Coprocessing in Petroleum Refineries" – 4th Work Group Meeting held on October 16, 2017.

Dear Mr. Wade:

Chevron appreciates the opportunity to review and comment on the referenced LCFS Work Group Meeting. Chevron is a major refiner and marketer of petroleum products in California. The proposed guidelines under consideration by staff on refinery co-processing of bio-feedstocks directly and indirectly affect Chevron's compliance requirements under the Low Carbon Fuel Standard (LCFS), which in turn impacts our transportation fuel business and customers. Chevron is a member of the Western States Petroleum Association (WSPA). We support and incorporate by reference the joint comments submitted by WSPA in response to this meeting.

Chevron is pleased that the California Air Resources Board (ARB) is preparing to clarify several key provisions on refinery coprocessing. Further, that ARB staff recognizes the potential impact of its decisions on the feasibility of refinery coprocessing as a contributor to LCFS compliance. We believe it is appropriate for ARB to evaluate every possible avenue for attaining the state's environmental objectives and we are looking forward to continuing our work with staff to ensure the co-processing guidelines are practical, cost-effective and do not impose unreasonable compliance burdens on regulated parties. Our detailed comments can be found below:

General Comments:

- Overall, it is our view that the methodology proposed for accounting biofuels volumes and for assessing GHG emissions when coprocessing through hydrotreating are reasonable and generally heading in the right direction. This is largely because of the relatively simple

reaction mechanisms and the co-product streams, as well as few/none upgrading requirements.

- The treatment of product streams from the FCC co-processing is more complex and may require some degree of approximation. We look forward to seeing the new guidance on FCC coprocessing to be released in January 2018.

- Due to the complexity in refinery operations, it may be difficult to detect shifts in material and energy inputs/outputs before and after the introduction of bio-feeds. Approximation using the feed ratio (bio-feed to total feed ratio) or other stochiometric approximation may be necessary to account for some of the less significant inputs in calculating biofuels yields and energy inputs. More detailed comments are included below in specific topic discussions.

- From a refinery planning perspective, to effectively plan for turnaround modifications (when capital enhancements are likely to be implemented), it would be beneficial for staff to specify the percentage allowed for mass and energy balance closure (e.g., +/- 5 percent) over the quarterly monitoring period. Similarly, staff should specify the period (i.e., length of time) over which balances will need to be closed, and clarify whether a less frequent monitoring period may be implemented after the provisional pathway has been issued. This clarification from staff is critical to determine if our current hardware is capable of meeting this target or whether additional/improved equipment is necessary.

- From a terminology standpoint, we recommend that staff define the units of measurement more clearly. For example, when talking about flow rates, CARB should specify whether it is a mass flow rate or volumetric flow rate. For the latter, a density value (or estimate) will be needed to account for mass balance closure.

- We request clarification of the data collection requirements during the initial 3-month of bio-feed injection period (to generate the data needed for a provisional pathway). Specifically, how variable rates of bio-feed injection (e.g., 0-10% bio-feed ratio), or combinations of different vegetable oils and/or animal fats, can be comprehended to capture the greatest amount of data during the period. A possible option: the collection of data over a range of bio-feed type and bio-feed rate combinations, if that can be accomplished without impacting the minimum data requirements for the provisional pathway submission. We believe this would also enable data collection on bio-oils that may not be available in large quantities.

- We request recognition that instrumentation in commercial applications does fail from time to time and, therefore, provide temporary allowance for ruling out instrument or analyzer excursions (i.e. use a backup method if a dedicated meter or analyzer is reading erroneously). Certainly, industry remains obligated to maintain and inspect key meters necessary for monitoring material and energy balances and to expeditiously conduct repairs.

- Gas sample collection presents technical challenges, and in some cases, it may be a safety hazard to refinery workers. For example, fuel gas is typically sent to an amine scrubber to remove sulfur and CO_2. To measure gas compositions in the fuel gas, samples would have to be taken before the amine scrubber. This poses a safety concern due to H2S exposure. We

recommend that an alternate calculation methodology be allowed for this stream, particularly if its overall contribution to the carbon balance is relatively small.

- We recommend that a progressive reduction in the required sampling frequency be allowed when a co-processing application moves through the early stages of development, application, approval, and maintenance/validation. A higher sampling frequency is appropriate in the initial 3-month period, while the data for a provisional pathway is being developed. However, a lower sampling frequency would be appropriate for monitoring steady state operations once a pathway has been established.

Detailed Comments:

The monitoring of energy inputs and outputs poses a variety of challenges; we urge staff to provide flexibility for refineries to adopt alternative methods to estimate required values/inputs, based on common sense, engineering judgment, and due diligence. Details are included below:

1. **Refinery data collection and accounting of biofuels volumes:** *CARB proposes to look at shifts in both mass and energy inputs/outputs during the introduction of biomass feedstocks. Data collection periods are 3 months for baseline operations and 3 months for operations that involve bio-feed co-processing with petroleum feeds.*

   There are general concerns with how to establish the refinery baselines due to the many variables associated with refinery operations (crude change, refinery targets, seasonal variabilities, emergency shutdowns, and turn arounds), which could easily overwrite the marginal difference caused by introduction of low concentration of bio-feeds. Despite best efforts to measure material and energy flows, there will be challenges to demonstrate bio-feed content after the bio-feed injection, especially for concentrations that are less than 10%. Staff should provide the flexibility to exclude refinery operating periods from the analyses, if those periods reflect abnormal or transient conditions. In addition, other material and energy accounting methods, such as stochiometric or acceptable empirical estimations, should be allowed to estimate biofuels volumes where appropriate.

2. **Complexity in collecting energy input/output data:** *Staff proposes to require the installation of meters for all energy input and output streams, including NG, electricity, hydrogen, steam, and refinery fuel gas. For secondary energy sources, electricity, hydrogen, and steam, upstream GHG emissions associated with their production processes, sources of fuels are also included within system boundary and should be assessed.*

   The monitoring of energy inputs and outputs poses a challenge. Since it may not be possible to monitor several of the required inputs, staff has requested alternate proposals on how to develop the data needed. Some examples are offered below for illustrative purposes:

- In the absence of dedicated electrical meters at the appropriate location, refinery process engineers could use manufacturer's data and the total run time to estimate how much energy is drawn from the total utility line.
- Steam use/balance calculations can be extremely complex. Many refineries recover waste heat for process heat, and the amount available may vary frequently (on daily basis). We would recommend that some generalization/approximation be allowed to average the percentage of waste heat utilized.

3. **Utilizing PRELIM Model for Refining analyses in LCA modeling: in collecting energy input/output data:** *Staff appears to be utilizing this model for coprocessing modeling (CI calculations) without proper vetting or public review and comment. We have significant concerns that this model is not suitable for this purpose, as outlined in Jacobs Consulting evaluation performed in 2016, as part of the overall Oil Climate Index Model for the Alberta Department of Environmental Quality. Highlights of those observations are outlined below:*

- PRELIM (Petroleum Refinery Life Cycle Inventory Model - developed by Dr. Joule Bergeson of University of Calgary) is a set of spreadsheets that attempts to calculate oil refinery heat and mass balances and associated GHG emissions. Many individual spreadsheet cells contain complicated expressions including multiple levels of nested logical operators and references to data from many worksheets in the workbook. This complexity makes it difficult to follow computations or to check for errors.
- PRELIM is not a refinery model. Most refining models pay close attention to meeting product specifications. PRELIM does not report gasoline properties like octane, RVP, aromatics, benzene, etc. And PRELIM does not report diesel cetane, cold flow etc. Jet from PRELIM does not report smoke point, or freeze point. Hydrotreated gas oils to the FCC unit are over-treated.
- PRELIM simplistically chooses the refinery type for processing crude based on crude API and sulfur. The result is that light sweet crudes go to Hydroskimming refineries and heavy sour crude oils go to deep conversion refineries which have greater refining intensity.
- It is extremely difficult to follow the model. Open source is not synonymous to transparent. There are coding errors in the model.
- The calculated PRELIM refining GHG results (let alone the material and energy balances) are not verified against actual refinery data or other refinery industry-accepted crude oil refining models such as PIMS, GRTMPS, PetroPlan, RPMS, etc.
- In the real world: "Every refinery is different", this means that crude slates, refinery configuration, product mix/markets are different. Crude slates are generally mixtures of crudes chosen by price, availability, and fit to refinery configuration and ability to meet product demand. Crude oil slates are constrained by the refinery processing configuration. PRELIM falls short in coming close to these considerations.

Thank you for the opportunity to comment on these matters. If you have any questions regarding our comments, please contact Nick Economides (Nick.Economides@chevron.com; 925-842-5054) or Don Gilstrap (DGilstrap@chevron.com; 925-842-8903).

Sincerely,

Nick Economides