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September 27, 2020

Mr. Anil Prabhu
Manager, Fuels Evaluation Section
Industrial Strategies Division
California Air Resources Board
1001 I Street
Sacramento, CA 95814

Subject: Response to Comments
Pathway Applications B007901 and B007902
Kern Oil & Refining Co.

Dear Mr. Prabhu:

Kern Oil & Refining Co. (Kern) is providing responses to comments received following the California Air Resources Board's (CARB) public posting of Kern's application for a Low Carbon Fuel Standard (LCFS) fuel pathway to produce renewable diesel (proposed pathway numbers B007901 and B007902). On September 21, 2020, CARB received one comment letter from the National Biodiesel Board (NBB) providing comments and/or questions in six different areas. Kern's responses in each of these areas are provided in the sections below.

Comment 1: Use of Calculated Versus Measured Data

NBB commented "the primary data that is used in the pathway to determine carbon intensity is calculated rather than metered or measured." Kern would first like to point out that this is not a correct assessment of the data used in the pathway application. Multiple sources and types of metered data were used within the pathway application in providing a robust life cycle analysis.

Kern's methodology for determining hydrogen consumption, Delta T, is based on accepted refining principles of heat release for different reaction pathways and feedstocks. Kern collected metered data specific to the composition of gas streams, flow rates and reactor temperatures to determine hydrogen consumption using heat release and the temperature rise across the reactor catalyst bed.

Uniquely, Kern's source of hydrogen makeup gas is from the Naphtha Platforming and Reforming Units, which both produce the hydrogen as a byproduct of increasing naphtha octane. Unlike most refiners and renewable fuel producers, Kern does not source pure hydrogen from an on-site hydrogen generation unit or purchase it from on outside supplier. The unused hydrogen from the reforming reactions goes into Kern's fuel gas, which as discussed on page 19 of the pathway report, has a typical composition of 50 to 75% hydrogen. Composition of the reactor off-gas showed similarly high concentrations of hydrogen even after the consumption from

renewable diesel production. The source of hydrogen and the quantification method assure an overly-conservative accounting for the reactions taking place, and are necessary considering the amount of hydrogen going into the reactor is several multiples higher than what is required to support the reactions. The presence of excess hydrogen in the fuel gas stream allows Kern to generously feed far more than is necessary for the reaction. Kern understands, but does not share, NBB's concern about metering the source of hydrogen because utilizing the gas for coprocessing is preferential to the alternative of combustion elsewhere in the refinery fuel gas system.

NBB further commented that the R^2 value demonstrated in Kern's data is not a sufficiently strong correlation. While R^2 may be the most well-known of "goodness to fit" measures for regression analysis, it is certainly not the only measure of good fit, nor is a value of 0.80 considered a poor fit. A comprehensive analysis requires one to consider R^2 values in combination with residual plots, other statistics, and in-depth knowledge of the subject area. Referencing Figure 9 from Kern's report, the R^2 value of 0.80 implies that 80% of the variation is characterized uniquely by tallow as a percentage of feed. Kern's Delta T calculations are robust to additional causes of variation that are not included in the plot, such as feed quality, catalyst condition, and reactions influenced by hydrogen partial pressure, which improve the goodness of fit for the holistic model.

Kern understands there may be sensitivities around the use of alternative methodologies beyond direct measurements of a parameter. Kern was sensitive to this as well, which is why Kern personnel had numerous discussions with CARB staff throughout the process to present the methodology, data points, and ensure the Delta T method would be sufficient to meet the requirements in Section 95488.7(a)(2)(A)7 for a "quantitative discussion of the thermal and…energy consumption that occurs throughout all phases of the fuel life cycle" and that "fuels used (natural gas, biogas, coal, biomass, etc.) must be identified and use rates quantified." Ultimately, Kern met this requirement as demonstrated by CARB's approval of the methodology on May 7, 2020 and receipt of a positive validation statement by the third-party verification body.

Kern strongly believes the data provided is robust and appropriate for use moving forward under the terms of the pathway and proposed operating conditions. The regulation contains provisions that require Kern to submit additional operating data over the calendar quarters to follow, and to adjust the carbon intensity and credit balance should that data demonstrate variation from the approved application. Should Kern's Delta T method demonstrate questionable variation at some point in the future, Kern would expect to engage with CARB staff at that time to determine what, if any, changes to the operating conditions, quantification methods, metering, or otherwise, were necessary based on the specific observations at that time.

Comment 2: Inappropriate Mix of C14 Testing and Mass Balance Accounting

NBB's comments expressed concern about the downstream location of Kern's measurement of biogenic carbon content using C14 analysis, specifically that the result would be negatively impacted by the presence of blended biodiesel. Kern samples each batch of finished diesel while the batch tank is locked down for other required certification testing, such that results obtained

from the analyses represent the finished fuel provided to customers. The biogenic carbon content reported by the laboratory is a combination of renewable diesel from co-processing and blended biodiesel. However, Kern's final reported renewable content of biogenic carbon from coprocessing is a conservative approach. Kern uses detailed accounting and product movement records to quantify the amount of biodiesel blended into each batch of fuel. As described in the pathway report, this percentage of biodiesel is then subtracted from the reported laboratory result, without regard for the non-biogenic fraction associated with the blended biodiesel. Biodiesel is widely known to only contain up to 95% biogenic carbon, but Kern's calculation provides for 100% biogenic content of the blended biodiesel. Kern is attributing more of the reported biogenic content to blended biodiesel and less to the co-processed fuel, and is therefore reporting a conservative percentage of renewable diesel. Data provided in support of the application demonstrated this conservative approach to CARB's satisfaction.

NBB's comment questioned the location of sampling point within Kern's process, specifically, why Kern does not sample the co-processed intermediate prior to additional handling and blending. Kern considered this in conjunction with CARB staff, but rejected it in favor of the current methodology and sampling location. The co-processed intermediate rundown from the Kerosene Hydrotreater (KHT) flows into an intermediate tank subject to continuous flows into and out of the tank. Accounting for changes in composition and continuous flow movement would add error into the process, making the sampling from discrete diesel batch tanks preferential.

Kern is unsure why NBB notes "complicating issues of the biogenic carbon from the processing stream being combusted as part of the refinery's operations and being reported to reduce the refinery's compliance obligations under the State carbon regulations." Kern reports the production of biogenic propane within greenhouse gas reporting obligations under CARB's Mandatory Reporting Regulation (MRR). The propane molecules liberated from the co-processing reactions are naturally commingled among the entirety of off-gases produced in the hydrotreater and captured within the refinery fuel gas system. All these gases are collected and treated for use in refinery combustion devices. The volume of refinery fuel gas attributed to this biogenic propane is quantified through accepted methodologies, and emissions are calculated and reported accordingly. Kern understands that CARB is investigating ways to ensure consistent approaches to quantifying biogenic content in fuel gas as more facilities look to produce renewable fuels. Kern will continue to work with MRR staff throughout the informal and formal rulemaking process around this topic, and make changes to internal practices as might be necessary in the future.

Comment 3: The Calculation Involving Hydrotreating Catalyst Does Not Account for Switching Catalysts of Changes in Catalyst Activity

Kern agrees with NBB's notation that operating conditions often change between the start and end of a catalyst run. This concept is exactly why the Delta T method of determining hydrogen consumption is appropriate – the method takes this occurrence into account and is robust to changes in catalyst activities. Kern's data was collected across multiple operating conditions,

over an extended period of time, including catalyst changes in both the guard bed and main reactors to sufficiently capture changes in catalyst activity and other operating conditions.

Comment 4: Use of Natural Gas Emissions Factor as a Proxy for Hydrogen Emission Factor

Kern did not use a proxy for the hydrogen emission factor as NBB notes in this comment. Kern used the standard factor for natural gas because this is the source of makeup gas used to supplement refinery fuel gas where hydrogen has been removed.

Comment 5: Inappropriate Redactions

NBB has questions about three specific areas Kern redacted, which are each addressed below. Kern took seriously the task of applying redactions in conformance with CARB's guidance document and in support of transparency and a meaningful review process.

A. Redaction of Site-specific Meter Numbers on Page 10
   Kern considers internally applied meter numbers as confidential business information. Electronic meters, programmable logic controllers, data acquisition systems, and other electronic equipment are all maintained on Kern's secure servers. Although Kern takes prudent and necessary measures to maintain cyber security, revealing these meter numbers or similar equipment names/naming conventions would make Kern needlessly vulnerable in the event a firewall was compromised, phishing scheme executed, or other event involving a system breech. Revealing the meter numbers provides no value to readers of Kern's pathway report, but could potentially be to Kern's detriment if revealed.

B. Redactions in Site-specific Formulas on Pages 20 & 21
   Only small portions of the formulas in question are redacted. These redactions are sufficiently minimal that they do not preclude a reader from determining if the formula is appropriate in concept. The factors are derived from extensive site-specific data collection and analysis, where discussion in the surrounding sections of the pathway report describe the fundamental concepts and constituents supporting the redacted values.

C. Redactions in Site-specific Formulas on Pages 24 & 25
   Similar to comment 5B above, only minor portions of the formulas in question are redacted, and are sufficiently minimal that they do not preclude a reader from determining if the formula is appropriate in concept. Kern has redacted specific horsepower ratings of equipment, electrical demand from each piece, and unit charge rates which are confidential business information. Discussion within each subsection of electricity section the pathway report describes the fundamental concepts and constituents supporting the redacted values.

Comment 6: Question of Renewable Naphtha Production

Kern's report does not mention the production of renewable naphtha because Kern's co-processing does not result in a separate renewable naphtha stream. As described on page 2 of Kern's pathway report, the rundown from the KHT is blended with other petroleum distillate streams to produce finished diesel fuel for sale. The final product is demonstrated to meet CARB diesel specifications prior to distribution into the market.

Kern appreciates the opportunity to stand behind the integrity and validity of our work product, and to assist CARB in responding to comments. If you have any questions or require additional information, please call me or Glenn Fuller at (661) 845-0761.

Sincerely,

Melinda Hicks
Sr. Manager, Renewables & Government Affairs
Kern Oil & Refining Co.