OFFICE OF AIR AND RADIATION
WASHINGTON, D.C. 20460

May 22, 2024

Ms. Brenda Head
Vice President of Midstream Products Americas
BP Products North America
30 South Wacker Drive
Chicago, Illinois 60606

Dear Ms. Head:

BP Products North America, Inc. (BP) petitioned the Agency to approve a pathway for the generation of advanced biofuel (D code 5) Renewable Identification Numbers (RINs) under the renewable fuel standard (RFS) program for renewable diesel produced through a hydrotreating process that co-processes carinata oil and petroleum at their Cherry Point refinery in Blaine, Washington (the "BP Cherry Point Carinata Pathway").

Through the petition process described under 40 CFR 80.1416, BP submitted data to the U.S. Environmental Protection Agency to perform a lifecycle greenhouse gas (GHG) emissions analysis of the renewable diesel produced through the BP Cherry Point Carinata Pathway. This analysis involved a straightforward application of the same methodology and much of the same modeling used for the final rule published on March 26, 2010 (75 FR 14670) (the "March 2010 RFS rule") and the federal register notice published on April 24, 2015 (80 FR 22996) (the "April 2015 carinata oil FRN"). The difference between this analysis and the analyses completed for the March 2010 RFS rule and the April 2015 carinata oil RNG was the evaluation of facility-specific data for the BP Cherry Point hydrotreating process.

The attached document "BP Cherry Point Carinata Oil Renewable Diesel Determination under the RFS Program" describes the data submitted by BP, the analysis conducted by the EPA, and our determination of the lifecycle greenhouse gas emissions associated with the fuel production pathway described in the BP petition.

Based on our assessment, the renewable diesel produced through the BP Cherry Point Carinata Pathway qualifies under the Clean Air Act (CAA) for advanced biofuel (D code 5) RINs, provided the fuel satisfies the conditions and associated regulatory provisions discussed in the attached document as well as the other criteria for renewable fuel (e.g., production from renewable biomass, and used to reduce or replace petroleum-based transportation fuel, heating oil or jet fuel) specified in the CAA and in the EPA's implementing regulations.

This approval applies only to the BP Cherry Point facility and to the process, materials used, fuel produced, and process energy sources as outlined and described in the petition submitted by BP.

The OTAQ Reg: Fuels Programs Registration and OTAQ EMTS Application will be modified to allow BP to register and generate RINs for the production of renewable diesel from carinata oil feedstock using the "BP Cherry Point Carinata Oil Process."

Sincerely,

MARY MANNERS

Digitally signed by MARY MANNERS
Date: 2024.05.23 08:42:26 -04'00'

for Byron J. Bunker, Director
Implementation, Analysis and Compliance Division
Office of Transportation and Air Quality

<u>BP Cherry Point Carinata Oil Renewable Diesel Determination under the RFS Program</u>

Office of Transportation and Air Quality

Summary: BP submitted a petition (the "BP petition"), requesting that the EPA approve their generation of renewable fuel (D code 5) Renewable Identification Numbers (RINs) under the Renewable Fuel Standard (RFS) program for renewable diesel produced through a hydrotreating process that co-processes carinata oil and petroleum at their Cherry Point refinery in Blaine, Washington (the "BP Cherry Point Carinata Pathway").

In April 2015, the EPA published a Federal Register Notice inviting comment on our analysis of the greenhouse gas (GHG) emissions attributable to the production and transport of Brassica carinata seed oil (''carinata oil'') feedstock for use in making biofuels such as biodiesel, renewable diesel, and jet fuel (the "April 2015 carinata oil FRN") (80 FR 22996). In the April 2015 carinata oil FRN, we invited comment on our intention to apply the estimated upstream GHG emissions associated with soybean oil feedstock production and transport, including indirect agricultural and forestry sector impacts, to future evaluations of facility-specific petitions proposing to use carinata oil as a feedstock for biofuel production. In June 2022, the EPA responded to a facility-specific petition from Renewable Energy Group (REG) for renewable diesel and co-products produced through their hydrotreating facility in Geismar, Louisiana (the "June 2022 REG Geismar determination").[1] Based on public comments received in response to the April 2015 carinata oil FRN, information submitted in the REG petition, and more recent information on carinata oil production practices, the June 2022 REG Geismar determination included a more specific analysis of the lifecycle GHG impacts of carinata oil than the soybean oil-based approach reflected in the April 2015 carinata oil FRN. We also attached to the June 2022 REG Geismar determination our responses to the public comments on the April 2015 carinata oil FRN.

Based on the data submitted as part of the BP petition and the methodology for evaluating carinata oil lifecycle GHG emissions developed for the June 2022 REG Geismar determination, we estimate that renewable diesel produced at the BP Cherry Point facility from carinata oil feedstock reduces lifecycle GHG emissions compared to the statutory petroleum baseline by approximately 51-61 percent. Based on our lifecycle assessment, renewable diesel produced from carinata oil through the BP Cherry Point Carinata Pathway is eligible for advanced biofuel (D code 5) RINs provided all associated regulatory requirements are satisfied, including the conditions specified in Section IV of this determination document.[2]

This document is organized as follows:

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[1] https://www.epa.gov/system/files/documents/2022-07/reg-geismar-carinata-deter-ltr-2022-06-30.pdf

[2] The renewable diesel produced through the BP Cherry Point Carinata Pathway is not eligible for biomass-based diesel (D code 4) RINs as it is co-processed with petroleum and Section 211(o)(1)(D) of the Clean Air Act states, "renewable fuel derived from co-processing biomass with a petroleum feedstock shall be advanced biofuel if it meets the requirements of subparagraph (B) but is not biomass-based diesel."

- *Section I. Required Information and Criteria for Petition Requests*: This section contains information on the background and purpose of the petition process, the criteria the EPA uses to evaluate petitions, and the information that must be provided under the petition process as outlined in 40 CFR 80.1416. This section includes a general discussion of petitions submitted pursuant to 40 CFR 80.1416.

- *Section II. Available Information*: This section contains background information on the petitioner, the information provided in the petition, and how it complies with the petition requirements outlined in Section I.

- *Section III. Analysis and Discussion*: This section describes the lifecycle analysis done for this determination and identifies how it was unique compared to analyses performed for previous RFS rules. This section also describes how we have applied the lifecycle results to determine the appropriate D code for fuel produced pursuant to the evaluated pathways.

- *Section IV. Conditions and Associated Regulatory Provisions:* This section describes the conditions and regulatory provisions associated with this petition determination.

- *Section V. Public Participation*: This section describes how this petition is an extension of the analysis done as part of previous actions that underwent a public notice and comment process.

- *Section VI. Conclusion*: This section summarizes our conclusions regarding the petition, including the D codes that the petition may use in generating RINs for fuel produced through the evaluated pathways.

I. Required Information and Criteria for Petition Requests

A. Background and Purpose of Petition Process

The RFS program is set out in CAA 211(o). The EPA's regulations implementing this program are published at 40 CFR part 80. The RFS regulations implement the statutory requirements regarding the types of renewable fuels eligible to participate in the RFS program and specify the procedures by which renewable fuel producers and importers may generate RINs for the qualifying renewable fuels they produce through approved fuel pathways.

Pursuant to § 80.1426(f)(1) of the regulations, D codes must be used in RINs generated by producers or importers of renewable fuel according to approved pathways, which are laid out in Table 1 to § 80.1426. Table 1 lists the three critical components of a fuel pathway: (1) fuel type, (2) feedstock, and (3) production process. Each specific combination of the three components, or fuel pathway, is assigned a D code. The EPA may also independently approve additional fuel pathways not currently listed in Table 1 for participation in the RFS program, or a third party may petition for the EPA to evaluate a new fuel pathway in accordance with § 80.1416. In addition, renewable fuel producers qualified in accordance with 40 CFR 80.1403(c) and (d) for an exemption from the 20 percent GHG emissions reduction requirement of the Act for a baseline volume of fuel ("grandfathered fuel") may generate RINs with a D code 6 pursuant to 40 CFR 80.1426(f)(6) for that baseline volume, assuming all other regulatory requirements are satisfied.[3]

The petition process under § 80.1416 allows parties to request that the EPA evaluate a new fuel pathway's lifecycle GHG reduction and provide a determination of the D code for which the new pathway may be eligible.

B. Required Information in Petitions

As specified in 40 CFR 80.1416(b)(1), petitions must include all of the following information, as well as appropriate supporting documents such as independent studies, engineering estimates, industry survey data, and reports or other documents supporting any claims:

- The information specified under 40 CFR 1090.805.
- A technical justification that includes a description of the renewable fuel, feedstock(s), biointermediate(s) used to make it, and production process. The justification must include process modeling flow charts.
- A mass balance for the pathway, including feedstocks and biointermediates, fuels produced, co-products, and waste materials production.
- Information on co-products, including their expected use and market value.
- An energy balance for the pathway, including a list of any energy and process heat inputs and outputs used in the pathway, including such sources produced off site or by another entity.
- Any other relevant information, including information pertaining to energy saving technologies or other process improvements.
- Other additional information as requested by the EPA to complete the lifecycle greenhouse gas assessment of the new fuel pathway.

[3] "Grandfathered fuel" refers to a baseline volume of renewable fuel produced from a facility that commenced construction before December 19, 2007, and which completed construction within 36 months without an 18-month hiatus in construction and is exempt from the minimum 20 percent GHG reduction requirement that applies to general renewable fuel. A baseline volume of ethanol from a facility that commenced construction after December 19, 2007, but prior to December 31, 2009, qualifies for the same exemption if construction is completed within 36 months without an 18-month hiatus in construction and the facility is fired with natural gas, biomass, or any combination thereof. "Baseline volume" is defined in 40 CFR 80.2.

In addition to the requirements stated above, parties who use a feedstock not previously evaluated by the EPA must also include additional information pursuant to 40 CFR 80.1416(b)(2). The regulations at 40 CFR 80.1416(c)(2) also require that the petition must be signed and certified as meeting all the applicable requirements of 40 CFR 80.1416 by the responsible corporate officer of the applicant company.

II. Available Information

A. Information Available Through Existing Modeling

The pathway described in the BP petition would produce fuel from a feedstock, carinata oil, that the EPA previously evaluated in the April 2015 carinata oil FRN and the June 2022 REG Geismar determination. The type of production process described in the BP petition (i.e., a hydrotreating process with co-processing of renewable biomass with petroleum), was previously evaluated in prior rulemakings including but not limited to the March 2010 RFS2 rule, the March 2013 Pathways I rule (78 FR 14190), and the August 2018 sorghum oil rule (83 FR 37735). Compared to previous rulemakings and Federal Register Notices, BP's petition required the EPA to evaluate the facility-specific hydrotreating process employed at the BP Cherry Point refinery.

This was a straightforward analysis based on existing modeling done for previous rulemakings for the RFS program. Table 1 illustrates the relevant vegetable oil-based fuel pathways using hydrotreating that currently qualify under the RFS program and their respective D codes.

Table 1: Relevant Excerpts of Existing Fuel Pathways from Table 1 to 40 CFR 80.1426

Row	Fuel Type	Feedstock	Production Process Requirements	D code
H	Biodiesel, renewable diesel, jet fuel and heating oil	Soybean oil; Oil from annual covercrops; Oil from algae grown photosynthetically; Biogenic waste oils/fats/greases; Camelina sativa oil; Distillers corn oil; Distillers sorghum oil; Commingled distillers corn oil and sorghum oil; Canola/Rapeseed oil	One of the following: Trans-Esterification with or without esterification pre-treatment, or Hydrotreating; includes only processes that co-process renewable biomass and petroleum	5 (Advanced biofuel)

B. Information Submitted by the Petitioner

BP supplied all the information as required in 40 CFR 80.1416 that the EPA needed to analyze the lifecycle GHG emissions associated with renewable diesel produced through the BP Cherry Point Carinata Pathway. The information submitted included a technical justification describing the requested pathways, modeling flow charts, a detailed mass and energy balance of the processes involved with information on co-products as applicable, and other additional information as needed to complete the lifecycle GHG assessment. The process modeling flow charts, mass and energy balance data and other details about the production process were submitted under claims of confidential business information.

III. Analysis and Discussion

A. Lifecycle Analysis

Determining a fuel pathway's compliance with the lifecycle GHG reduction thresholds specified in CAA 211(o) for different types of renewable fuel requires a comprehensive evaluation of the renewable fuel, as compared to the gasoline or diesel that it replaces, on the basis of its lifecycle GHG emissions. The GHG emissions assessments must evaluate the aggregate quantity of GHG emissions (including direct emissions and significant indirect emissions such as significant emissions from land use changes) related to the full lifecycle, including all stages of fuel and feedstock production, distribution, and use by the ultimate consumer.

In examining the full lifecycle GHG impacts of renewable fuels for the RFS program, the EPA considers the following:

- Feedstock production – based on modeling that includes direct and indirect impacts of feedstock production.
- Biointermediate production (when applicable).[4]
- Fuel production – including process energy requirements, impacts of any raw materials used in the process, and benefits from co-products produced.
- Fuel and feedstock distribution – including impacts of transporting feedstock from production to use, and transport of the final fuel to the consumer.

[4] Provisions covering biointermediates were finalized in the 2020-2022 RFS Standards final rule (87 FR 39600). Revisions to the facility specific petition process defined under 40 CFR 80.1416, finalized under this rule, now require parties to submit for EPA's consideration information related to any biointermediates used in the requested pathways.

- Use of the fuel – including combustion emissions from use of the fuel in a vehicle.

The EPA's evaluation of the lifecycle GHG emissions related to renewable fuel produced through the BP Cherry Point Carinata Pathway under this petition request is consistent with the CAA's applicable requirements, including the definition of lifecycle GHG emissions and threshold evaluation requirements.

1. Feedstock Production and Transport

We invited comment in the April 2015 carinata oil FRN on our analysis of the GHG emissions attributable to the production and transport of carinata oil feedstock (the "upstream" emissions) for use in making biofuels. In that notice, we stated our intention to use our estimate of the upstream emissions associated with soybean oil feedstock, as estimated for the March 2010 RFS2 rule, as a conservative estimate of the emissions associated with carinata oil feedstock. Based on comments received and additional information available after 2015, we reevaluated the upstream GHG emissions associated with carinata oil feedstock for the June 2022 REG Geismar determination. Instead of using the GHG estimates for soybean oil as a proxy for carinata oil, we used data published in peer-reviewed journal articles and the GREET model to estimate the GHG emissions associated specifically with carinata oil production. Since our June 2022 REG Geismar determination, additional data and estimates on carinata oil have been added to the GREET model. The GHG estimates for carinata oil in the GREET-2022 model are very similar to our estimates for the June 2022 REG Geismar determination, and we rely on the GREET-2022 estimates for our lifecycle GHG analysis of carinata oil used in the BP Cherry Point Carinata Pathway. Below we summarize these estimates and the reasons for our assumption that carinata oil production is not associated with significant indirect land use change emissions.

Carinata is grown during the winter in-between planting and harvesting of other crops. A typical farming schedule in the Southeast U.S. would include planting carinata in November and harvesting it in early May before planting starts for the subsequent crop. Carinata farming involves the use of fertilizer, pesticides and diesel fuel used to operate farm equipment. We rely on data in the GREET-2022 model to estimate the GHG emissions associated with carinata farming. Overall, we estimate 620 grams of carbon dioxide equivalent (CO_2e) emissions per kilogram (kg) of carinata seed harvested on a dry matter basis.

After carinata seeds are harvested, they are transported to a crushing facility for oil extraction. Based on the default assumptions for GREET-2022 and a study on the economics of a carinata to biofuel supply chain in the Southeast U.S.,[5] we assume seeds are transported 10 miles by medium-duty truck from the field to a collection point (the "stack") and then transported 62 miles by heavy-duty truck from the stack to the oil extraction mill. Based on these assumptions, and emissions factors from

[5] Alam, A., Masum, M. F. H., & Dwivedi, P. (2021). Break-even price and carbon emissions of carinata-based sustainable aviation fuel production in the Southeastern United States. GCB Bioenergy, 13, 1800–1813. https://doi.org/10.1111/gcbb.12888

the GREET-2022 model, we estimate carinata seed transport emissions of 21 gCO_2e per kg carinata seed.

Carinata oil is extracted from the rest of the seed through a process that uses natural gas, electricity and hexane as inputs. Based on data from the GREET-2022 model, we estimate GHG emissions from the oil extraction process of 119 gCO2e per kg of carinata seed consumed. Overall, we estimate unallocated GHG emissions of 759 gCO_2e per kg of carinata seed including GHG emissions from farming, seed transport and oil extraction. Based on data from the GREET-2022 model, each kg of carinata seed yields approximately 0.43 kg of carinata oil on a dry matter basis. Thus, we estimate the unallocated GHG emissions from farming, seed transport and oil extraction are 1,756 gCO2e per kg of carinata oil.

The co-products from the oil extraction process are carinata oil and carinata meal. The carinata meal co-product is a protein-rich livestock feed. Three common allocation methods for attributing the GHG emissions among co-products are mass, energy and market-based allocation. For example, Chen et al. (2018) use mass-based allocation for their lifecycle analyses of biodiesel pathways,[6] the United Nations International Civil Aviation Organization (ICAO) uses energy allocation,[7] and a report prepared for the European Commission recommends market-based allocation.[8] For our evaluation of the BP Cherry Point Pathway, we estimate lifecycle GHG emissions using all three allocation methods. We also consider available lifecycle GHG estimates for carinata oil that use a system expansion approach with economic modeling. Based on data from the GREET-2022 model, we use the mass, energy and market allocation assumptions summarized in Table 2.

Table 2: Carinata Oil Extraction Co-Product Allocation Factors (Percent on Dry Matter Basis)

	Carinata Oil	Carinata Meal
Mass	44%	56%
Energy	62%	38%
Market	63%	37%

With each approach, the unallocated emissions are allocated to each of the co-products based on their shares of the total output from the oil extraction process. Table 4 reports the estimated GHG emissions, by stage, per kilogram of carinata oil using each allocation approach. Emissions per kilogram of carinata oil are higher for the energy and market-based allocation approaches that attribute a greater share of the emissions to the carinata oil.

[6] Chen, R., et al. (2018). "Life cycle energy and greenhouse gas emission effects of biodiesel in the United States with induced land use change impacts." Bioresource Technology 251: 249-258.
[7] ICAO (2021). CORSIA Eligible Fuels -- Lifecycle Assessment Methodology. CORSIA Supporting Document. March 2021. Version 3. Page 18.
[8] European Commission, Joint Research Centre and Institute for Environment and Sustainability. (2010). International Reference Life Cycle Data System (ILCD) handbook – General guide for life cycle assessment – Detailed guidance. 1st ed. Luxembourg: European Commission—Joint Research Centre.

Table 3: GHG Emissions Associated with Carinata Oil Production by Allocation Approach (gCO2e per kg carinata oil)

	Unallocated	Mass-Based Allocation	Energy-Based Allocation	Market-Based Allocation
Farming	1433	631	895	909
Seed Transport	48	21	30	30
Oil Extraction	274	121	171	174
Oil Transport	72	72	72	72
Total	1,756	773	1,096	1,113

Another approach that is commonly used in lifecycle analysis for co-product accounting is called the system expansion approach, also known as the displacement approach. Using the displacement approach in this case would involve determining a reference product that is "displaced" by the production of carinata meal. For example, we could assume that carinata meal replaces soybeans, soybean meal, or another type of livestock feed. In this case, it is not clear what reference product to assume for displacement. Nor have we previously estimated the GHG emissions associated with products, such as soybean meal, that would likely be displaced by carinata meal. Modeling with the FASOM and FAPRI models would be a potential way to estimate carinata meal displacement GHG emissions impacts in a manner consistent with the methodology developed for the March 2010 RFS2 rule. However, the FASOM and FAPRI models do not currently include carinata and we are unable to add it at this time. For these reasons, we have not used a displacement approach or conducted additional modeling for this analysis of the lifecycle GHG emissions associated with the REG Geismar Carinata Pathways. Should additional data and modeling resources become available, we may revisit the possibility of new agricultural sector modeling for purposes of evaluating future carinata oil biofuel pathways.

Although we are unable to estimate GHG emissions using a displacement approach for carinata meal at this time, based on available information it appears that the results using a displacement approach would be within the range estimated in Table 4 using the mass, energy or market allocation approaches. Based on the default assumptions in GREET-2022, if carinata meal displaces soybean production this results in -377 gCO2e per kg carinata oil.[9] However, this estimate does not include the land use change GHG benefits of displacing soybean production. These potential land use change GHG benefits were recently modeled using the GTAP-BIO and GLOBIOM models for the ICAO (2022) evaluation of renewable jet fuel lifecycle GHG emissions.[10] The models were used to simulate a scenario with roughly 200 million gallons of renewable diesel and jet fuel production from carinata oil

[9] GREET-2022 estimates emissions for producing soybeans of 297 gCO2e per kg.

[10] International Civil Aviation Organization (ICAO). (2022). "Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) Eligible Fuels -- Lifecycle Assessment Methodology." CORSIA Supporting Document. June 2022. Version 5. Page 173-175.

via a hydrotreating process. The analysis included an estimate of the "indirect land use change" (ILUC) emissions associated with producing carinata oil as a winter cover crop, including the co-product meal displacing soybeans and other types of animal feed. The GTAP-BIO modeling estimated ILUC emissions of -311 gCO2e per kg carinata oil and the GLOBIOM model estimated -492 gCO2e per kg carinata meal.[11] If we combine these ILUC estimates with the soybean production benefit of -377 gCO2e per kg carinata oil, we get an overall displacement benefit of -688 to -869 gCO2e per kg carinata oil. As shown in Table 3, the unallocated upstream emissions are 1,756 gCO2e per kg carinata oil. Subtracting the displacement benefits from the unallocated emissions suggests that using an allocation approach might result in upstream GHG emissions of 887 to 1,068 gCO2e per kg carinata oil, which is within the range of estimates in Table 3 for the allocation approaches of 773 to 1,113 gCO2e per kg carinata oil. Thus, available information suggests that using a displacement approach would result in GHG estimates that are within the range or lower than our estimates using the mass, energy or market allocation approaches. Thus, using these displacement estimates would not change our determination that renewable diesel produced through the BP Cherry Point Pathway satisfies the 50 percent GHG reduction threshold. Given that these displacement estimates are provisional, the rest of this determination focuses on the results using the three allocation approaches.

After the oil is extracted, we assume it is transported 2,500 miles by rail and 80 miles by heavy-duty truck from the oil extraction mill to the BP Cherry Point refinery.[12] Based on these assumptions, we estimate emissions from carinata oil transport of 72 gCO_2e per kg oil of carinata oil. The oil transport emissions are included in Table 3, above.

2. Land Use Change

Another component of upstream emissions is emissions associated with any land use change resulting from production of the carinata seed feedstock. In the April 2015 carinata oil FRN, the EPA said that carinata is not expected to have significant LUC impacts for two reasons. First, the EPA said that carinata will be grown primarily on fallow cropland, so it will not impact other commodities through land competition. Second, the EPA said that carinata is not expected to have a significant impact on other agricultural commodity markets because of the lack of large-scale production of carinata or use in non-biofuel applications. However, in that FRN, to provide a conservative estimate of emissions, we said it would be reasonable to assume that carinata oil production and use associated with the same GHG emissions as soybean oil, including land use change emissions. However, after considering the public comments on the April 2015 carinata oil FRN, we determined, in the June 2022 REG Geismar determination that it was reasonable to assume there are no significant indirect land use

[11] ICAO (2022) reports GTAP-BIO and GLOBIOM results of -9.8 and -15.5 gCO2e per MJ carinata-based jet fuel, respectively. We converted these estimates to per kg carinata oil based on the following assumptions in GREET-2022: conversion yield of 1.39 kg carinata oil per kg jet fuel, jet fuel lower heating value of 119,777 Btu/gal and jet fuel density of 2,866 g/gal.

[12] By default, GREET-2022 assumes carinata oil is transported on average 700 miles by rail. For this facility-specific analysis, we adjust this to 2,500 miles to account for transporting oil from the U.S. southeast to the BP Cherry Point refinery in Blaine, Washington. This change increases the emissions estimate from 14 to 72 gCO2e per kg carinata oil. This adjustment increases the lifecycle emissions estimate by approximately 1 percent relative to the petroleum bassline.

change emissions associated with carinata oil production and use in the context of evaluating the facility-specific REG Geismar pathways. For purposes of evaluating the BP Cherry Point Carinata Pathway, we are making the same determination that it is reasonable to assume no significant indirect land use change emissions associated with carinata oil production and use. Our reasons for taking this approach are summarized below.

At this time we believe carinata will most likely be grown as a rotational winter crop in the U.S. Southeast or South America.[13,14] Based on the data currently available, we believe it is reasonable to assume that carinata is unlikely to be associated with significant indirect land use change emissions when grown as a winter crop rotation in both the U.S. Southeast and South America, and we detail the rational for this assumption based on four considerations described below.

First, as stated in the April 2015 carinata oil FRN, carinata oil does not currently have established markets outside of its potential as a biofuel feedstock. For established food-based biofuel feedstocks such as soybean oil, there is a risk that diverting the feedstock for biofuel production will result in additional production elsewhere to backfill the initial use. For carinata oil, there is currently no such risk.

Second, it is unlikely that carinata will be grown as a primary crop and displace established cash crops such as corn or soybeans. Carinata oil is not a viable oilseed for food use due to high concentrations of erucic acid, which poses risks to human health.[15] As there are currently no established markets there are no market prices for carinata in the U.S., which introduces considerable uncertainty around the economic return from carinata plantings. Furthermore, carinata has been unviable when grown through the summer in the U.S. Southeast since carinata experiences heat stress-induced flower abortion,[16] limiting its potential to become an economically viable primary spring crop in the Southeast.

Third, carinata grown as a winter rotation crop is unlikely to compete for land with other marketable winter rotation crops and therefore there is little risk for indirect impacts from land displacement. In the U.S. Southeast and South America, carinata is being developed as a winter cropping option in rotation with summer crops such as soybeans, sorghum, peanuts, and cotton. There is an increasing trend of winter plantings in the Southeast due to the relatively mild winters, though risk of frost is a concern. Current winter crops are mostly cover crops for the purpose of providing landscape benefits such as weed control, reducing soil erosion, nutrient retention, nematode mitigation, providing habitat for native insect and animal species, and forage. While adoption of winter and cover crops is growing in response to state programs and outreach, many fields still go without

[13] https://rsb.org/2021/04/22/nuseed-carinata-restoring-the-earth-through-regenerative-agriculture/

[14] https://www.icao.int/environmental-protection/CORSIA/Documents/ICAO%20document%2006%20-%20Default%20Life%20Cycle%20Emissions%20-%20March%202021.pdf

[15] *Erucic acid in feed and food*, 2016, EFSA Journal Vol 14, Issue 11 **https://doi.org/10.2903/j.efsa.2016.4593**

[16] Communication with Dr. Sheeja George, University of Florida

winter or cover crops. The 2022 Agricultural Census reported that 18.0 million acres were planted with cover crops throughout the US, a 17% increase from the reported amount in 2017, but only 5% of the total amount of reported cropland acres in 2022 (382 million).[17] A 2021 USDA report found that of fields that had planted a cover crop at least once in the last four years, only 32% of soybean acres planted cover crops in at least three of four years, while that number was 69% for cotton, indicating that that there is opportunity for additional winter plantings.[18] Additionally, carinata is only rotated every three years further moderating any potential market impacts.[19] If winter wheat, which is sometimes harvested for markets in the Southeast, is also planted on a given farm, it could still be rotated with the introduction of carinata. An average of 1.63 million acres of winter wheat were planted between 2015 to 2023 in the Southeast,[20] of which an average of 436 thousand acres went unharvested (27%).[21] This indicates that there are opportunities for expanding winter crops in the Southeast without risk of displacing current plantings.

Fourth, carinata is unlikely to significantly reduce the yields of the primary crops it will be grown in rotation with. These crops are mainly cotton, peanuts, soybeans, and sorghum in the U.S. Southeast. If carinata were to reduce yields of the primary crop, this could trigger a market-mediated response, which could have indirect emissions impacts. Early evidence in the Southeast suggests that winter carinata plantings have positive yield effects on the summer crops by reducing soil erosion, reducing nutrient losses through leaching, and increasing soil organic matter accumulation.[22] However, research is still ongoing on how to fit carinata into agricultural systems efficiently and without adversely affecting the primary crop. Timing of planting and harvesting of carinata is critical to this end. Carinata needs to be planted early enough (e.g., mid-November in the U.S. Southeast) to allow for robust growth for harvest by mid-May. If carinata is not planted early enough or encounters suboptimal winter weather conditions, farmers will be in a position of facing a carinata crop that is not ready to be harvested by the time of the spring planting. In this event the farmer could 1) terminate the carinata; 2) harvest the carinata early to ensure the full summer crop rotation; or 3) delay the carinata harvest and planting of the summer crop. In this last scenario, the yield of the summer crop could be negatively affected as the planting date is a key determinant in cotton and soybean yields.[23,24] Delayed summer crop planting is a greater risk for cotton (planted late-April to early- May) and

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[17] 2022 Census of Agriculture. (2024). Table 47. Land Use Practices: 2022 and 2017. https://www.nass.usda.gov/Publications/AgCensus/2022/Full_Report/Volume_1,_Chapter_1_US/st99_1_047_047.pdf

[18] *Cover Crop Trends, Programs, and Practices in the United States* USDA Economic Research Service, Economic Information Bulletin Number 222, February 2021

[19] Communication with Dr. Sheeja George, University of Florida

[20] Alabama, Arkansas, Florida, Georgia, Louisiana, Mississippi, North Carolina, South Carolina, and Tennessee

[21] USDA's National Agricultural Statistical Survey (NASS). https://quickstats.nass.usda.gov/#F052B91F-B834-3EDF-B405-BED7458DD024

[22] *Carinata fit into SE Cropping Systems,* David Wright. Conference Presentation: *Brassica carinata* Summit. March 30, 2017. Quincy, FL https://sparc-cap.org/wp-content/uploads/2018/03/Carinata-fit-in-SE-crop-rotations.pdf

[23] Liu, Jingran et. al. 2015. *Effect of late planting and shading on cotton yield and fiber quality formation,* Field Crops Research, Volume 183, https://doi.org/10.1016/j.fcr.2015.07.008.

[24] Lee, Chad D. et. al. 2008. *Soybean Response to Plant Population at Early and Late Planting Dates in the Mid-South*, Agronomy Journal, Volume 100, Issue 4, doi:10.2134/agronj2007.0210

peanuts (planted early- to late-May) in the Southeast. In contrast, soybeans and sorghum can be planted later in June and even into July, and achieve a full growth cycle due to the high number of growing degree days in that part of the country.[25] However, as mentioned earlier, given the 3-year rotational schedule that is recommended for crops in these systems, we expect that interannual planting will be sequenced so that the timing of a carinata harvest would not pose a challenge for those rotated summer crops that need to be planted earlier in the Spring.[26]

For the reasons outlined above, the EPA believes that it is more appropriate to assign zero land use change emissions to the oil from carinata grown in the winter-rotation patterns discussed above than to apply soybean-oil based land use change emissions, which we acknowledged in the April 2015 carinata oil FRN were conservative. It is worth noting that carinata could technically be planted in other agricultural systems outside of what is outlined above, including as a primary, summer crop in Northern States for example. In such cases, if carinata were to be dedicated to new cropland or cropland converted from a different crop, the reasons the EPA has outlined for why carinata would have zero LUC emissions would not hold. However, the EPA believes it is unlikely that carinata would be grown in this manner due to its nascent status that makes it uncompetitive with established crops. These conditions could change as interest and experience with carinata expands in the future and alternative end uses are established, but this evolution would take time.[27] The EPA will revisit the feedstock production emissions of carinata in the future if evidence emerges that it is being grown as a primary crop on dedicated cropland.

3. Renewable Diesel Production

The diesel hydrodesulfurization (DHDS) unit at the Cherry Point Refinery produces diesel from a crude unit and coker unit. In 2018, the Cherry Point Refinery began to co-process biogenic oils, fats and greases with petroleum feed at the DHDS unit. The BP petition seeks the EPA's evaluation of the use of carinata oil in this process.

There are many studies and models that estimate the lifecycle GHG emissions associated with producing renewable diesel through a standalone hydrotreating process that does not co-process petroleum. In contrast, there are no widely accepted methods for estimating the lifecycle GHG emissions associated with renewable diesel through a hydrotreating that co-processes petroleum. The EPA has approved pathways for renewable diesel produced through hydrotreating processes that co-process vegetable oil with petroleum (see row H of Table 1 to 40 CFR 80.1426) based on estimates for standalone renewable diesel hydrotreating processes and extension of those estimates to hydrotreating processes that co-process petroleum. For our evaluation of the BP Cherry Point Carinata Pathway, we are using existing lifecycle analysis modeling of a standalone hydrotreating process that

[25] Communication with Dr. Sheeja George, University of Florida
[26] Ibid.
[27] Communication with Dr. Brett Allen, USDA – Agricultural Research Service

does not include petroleum co-processing. For the reasons discussed below, we believe this is an accurate and reasonable approach for this evaluation.

When hydrotreating a regular petroleum distillate feed, the primary reactions are Hydrodesulfurization (HDS), Hydrodenitrogenation (HDN), olefin saturation, aromatics saturation (HDA) and hydrodemetallization (HDM). The primary purpose of these petroleum hydrotreating units is to perform HDS such that the sulfur content of the resulting diesel fuel is below the 10 parts per million (ppm) standard. Reaching a sulfur content below 10 ppm requires multiple reactions and high severity refining.

When a refinery introduces a bio-feed to the reactor (i.e., co-processing) they add an additional reaction, hydrodeoxygenation (HDO). The reactions required to convert a triglyceride, such as carinata oil, into a pure hydrocarbon are very facile compared with the HDS/HDN reactions required to remove sulfur from petroleum. This is partly because the oxygen atoms in the triglycerides are easily accessible and not as tightly bound as sulfur is in the petroleum-based molecules. For this reason, the HDO reaction will occur first in a hydrotreating unit that co-processes petroleum. Thus, the HDO reaction in a co-processing hydrotreater will be similar to the HDO reaction in a standalone hydrotreating unit.

All hydrotreating reactors producing renewable diesel, regardless of whether they are standalone renewable diesel plants or units that co-process with petroleum, will need to remove the oxygen from the vegetable oil triglycerides to convert them to renewable diesel hydrocarbons. As the hydrodeoxygenation reactions occur, the unsaturated hydrocarbon chains will also be saturated as those reactions occur more readily. For this reason, we expect the hydrogen demand for producing renewable diesel, whether standalone or coprocessing, to virtually be the same, and hydrogen demand is the largest energy input for producing renewable diesel.

For these reasons, we believe that modeling the lifecycle GHG emissions of hydrotreating carinata oil in a standalone hydrotreating process is a reasonable method to estimate the lifecycle GHG emissions associated with the fuel production stage of the BP Cherry Point Carinata Pathway.

The hydrotreating process data from the Cherry Point refinery is not helpful for our analysis as we are only interested in the unmeasurable subset of this process that hydrotreats the carinata oil, not the rest of the process with hydrotreats the petroleum feed. As we expect the subset of this process that hydrotreats the carinata oil to reflect a typical standalone renewable diesel hydrotreating process, to estimate the lifecycle GHG emissions associated with hydrotreating carinata oil to produce renewable diesel, we rely on the default assumptions in the GREET-2022 model. For the final rule published on December 2, 2022 (87 FR 73956) (the “December 2022 canola oil pathways rule”), we evaluated hydrotreating production emissions based on a range of available data sets and determined that the default assumptions from the GREET-2021 model were reasonable and conservative for the purposes of estimating lifecycle GHG emissions for the RFS program. We are extending this approach to our evaluation of the BP Cherry Hill Carinata Pathway but updating it by replacing data from the GREET-2021 model with data from the GREET-2022 model.

4. Fuel Distribution and Use

We used data from GREET-2022 to estimate emissions associated with renewable diesel transportation and distribution. Our analysis does not assume a particular location for the renewable diesel use, i.e., it reflects a national average approach for the fuel distribution and use stage. Based on the data from GREET-2022, we assume the renewable diesel is transported from the BP plant to a bulk terminal 8 percent by barge 520 miles, 29 percent by rail 800 miles and 63 percent by truck 50 miles. We then assume the renewable diesel is transported 50 miles by truck from the bulk terminal to refueling stations. For fuel use emissions, we consider the non-CO2 emissions (methane and nitrous oxide) estimates from GREET-2022 for renewable diesel used in a compression-ignition direct-injection vehicle fueled with 100-percent renewable diesel.[28]

5. Lifecycle GHG Results

Based on our analysis, we estimate the lifecycle GHG emissions associated with renewable diesel produced through the BP Cherry Point Carinata Pathway. In Table 4, we report estimates using the three different allocation methods for the oil extraction co-products discussed in Section III.A.1: mass-, energy- and market-based allocation. To estimate the lifecycle GHG reductions relative to the statutory petroleum baseline, we compare renewable diesel with average diesel fuel sold or distributed in the U.S. in 2005.

Table 4: Lifecycle GHG Emissions for Renewable Diesel Produced from Carinata Oil through the BP Cherry Point Process (kgCO_2e/mmBtu)[29]

	Co-Product Allocation Method		
Emissions Category	Mass	Energy	Market
Farming	17.5	24.7	25.1
Seed Transport	0.6	0.8	0.8
Oil Extraction	3.3	4.7	4.8
Oil Transport	2.0	2.0	2.0
Fuel Production	14.0	14.0	14.0
Fuel Distribution & Use	1.2	1.2	1.2
Total	38.6	47.5	48.0
Percent Reduction	60.5%	51.4%	50.9%

[28] Following the methodology developed for the March 2010 RFS2 rule after notice, public comment, and peer review, the carbon in the finished fuel derived from renewable biomass is treated as biologically derived carbon originating from the atmosphere. In the context of a full lifecycle analysis, the uptake of this carbon from the atmosphere by the renewable biomass and the CO_2 emissions from combusting it cancel each other out. Therefore, instead of presenting both the carbon uptake and tailpipe CO_2 emissions, we leave both out of the results. Note that our analysis also accounts for all significant indirect emissions, such as from land use changes, meaning we do not simply assume that biofuels are "carbon neutral."

[29] In Table 4, totals may not be the sum of the rows due to rounding.

B. Application of the Criteria for Petition Approval

The BP Cherry Point carinata oil petition included a feedstock, production process and fuel type that, separately, were already considered as part of the March 2010 RFS2 rule and the April 2015 carinata oil FRN. BP provided all the necessary information that was required for its pathway petition under 40 CFR 80.1416. Based on the data submitted and information already available through analyses conducted for previous RFS rulemakings, the EPA conducted a lifecycle assessment and determined that renewable fuels produced through the RFS Carinata Oil Renewable Fuel pathways meet the 50 percent lifecycle GHG threshold requirement specified in the CAA for advanced biofuel (see Table 4). The lifecycle GHG results presented above justify authorizing the generation of D code 5 RINs for renewable diesel through the BP Cherry Point Carinata Pathway, assuming that the fuel satisfies the definitional and other criteria for renewable fuel (e.g., produced from renewable biomass, and used to reduce or replace the quantity of fossil fuel present in transportation fuel, heating oil or jet fuel) specified in the CAA and the EPA implementing regulations.

IV. Conditions and Associated Regulatory Provisions

The EPA's approval of a pathway for renewable diesel produced from carinata oil through the BP Cherry Point Process is predicated on the circumstances and analysis described in this document. To ensure that renewable fuel produced through this fuel pathway is produced in a manner consistent with those circumstances and analysis, we are prescribing certain conditions as described below. The authority for BP to generate RINs for renewable diesel produced through the BP Cherry Point Carinata Pathway is expressly conditioned on BP satisfying all of the following conditions as detailed in this section, in addition to other applicable requirements for renewable fuel and renewable fuel producers set forth in the RFS regulations.

The conditions in this section are enforceable under the CAA. They are established pursuant to the informal adjudication reflected in this decision document, and also pursuant to any regulations cited below and 40 CFR 80.1426(a)(1)(iii), 40 CFR 80.1416(b)(1)(vii), 80.1450(i), and 80.1451(b)(1)(ii)(W). In addition or in the alternative to bringing an enforcement action under the CAA, the EPA may revoke this pathway approval if it determines that BP has failed to comply with any of the conditions specified herein. The EPA has authority to bring an action to enforce these conditions under 40 CFR 80.1460(a), which prohibits producing or importing a renewable fuel without complying with the RIN generation and assignment requirements. These conditions are also enforceable under 40 CFR 80.1460(b)(2), which prohibits creating a RIN that is invalid; a RIN is invalid if it was improperly generated. Additionally, pursuant to 40 CFR 80.1460(b)(7), generating a RIN for fuel that fails to meet all of the conditions set forth in this petition determination is a prohibited act. In other words, unless all of the conditions specified in this section are satisfied, fuel cannot be validly produced through the pathways approved in this document.

A. Invasiveness Concerns and Provisions

The EPA sought comment on appropriate provisions to address potential concerns with invasiveness of carinata in the April 2015 carinata oil FRN. In response to the comments, the EPA engaged with the Animal and Plant Health Inspection Service (APHIS) of USDA and Nuseed, the research and development company that provides guidance to farmers on growing carinata and supplies the carinata oil to the BP Cherry Point facility, to evaluate best management practices and to produce a risk mitigation plan (RMP). The attached letter from APHIS to Nuseed expresses APHIS's support for the use of carinata to produce renewable fuel under the RFS program based on the RMP outlined by Nuseed for a period of six years.[30] In recognition of the nascent nature of carinata cultivation, APHIS believes it is appropriate to reevaluate carinata and Nuseed's RMP after a period of six years.

As a condition of this pathway approval, we are stipulating that the carinata oil used as feedstock through the BP Cherry Point Carinata Pathway must be sourced from carinata seeds that are grown in accordance with the Nuseed RMP reviewed by APHIS. Furthermore, every other registration renewal for the BP Cherry Point Carinata Pathway (i.e., approximately every six years),[31] will require a new letter of support from APHIS regarding proper risk management practices to mitigate potential risks of carinata becoming weedy or invasive in the United States.

V. Public Participation

The definition of advanced biofuel in CAA 211(o)(1) specifies that the term means renewable fuel that has "lifecycle greenhouse gas emissions, as determined by the Administrator, after notice and opportunity for comment, that are at least 50 percent less than the baseline lifecycle greenhouse gas emissions..." As part of the March 2013 RFS2 rule (78 FR 14190) we took public comment on our lifecycle assessment of renewable diesel, jet fuel, naphtha and LPG produced from camelina oil feedstock through a hydrotreating process, including all models used and all modeling inputs and evaluative approaches. In the 2015 FRN (80 FR 22996) we invited comment on our assessment of the GHG emissions associated with producing and transporting carinata oil for use as a renewable fuel feedstock.

In the March 2010 RFS2 rule we acknowledged that it was unlikely that our final regulations would address all possible qualifying fuel production pathways. We therefore promulgated the petition process at 40 CFR 80.1416, under which we allow for the EPA's approval of certain petitions without going through additional rulemaking if we can do so as a reasonably straightforward extension of

[30] We are not attaching the Nuseed Risk Management Plan to this determination as Nuseed is claiming this information as confidential business information.

[31] For example, the initial registration application will include the existing APHIS letter. The first registration renewable does not require a new APHIS letter. The second registration renewable requires a new APHIS letter, and so on.

previous assessments, whereas rulemaking would typically be conducted to respond to petitions requiring new modeling. See 75 FR 14797 (March 26, 2010).

In the April 2015 carinata oil FRN we invited comment on our analysis of the GHG emissions attributable to the production and transport of carinata oil feedstock for use in making biofuels such as renewable diesel, jet fuel, naphtha, and LPG. We proposed to apply our estimate, from the March 2010 RFS2 rule, of the upstream GHG emissions associated with soybean oil feedstock production and transport, including indirect agricultural and forestry sector impacts, to future evaluations of petitions proposing to use carinata oil as a feedstock for biofuel production. We attached our responses to the relevant public comments to the June 2022 REG Geismar determination.

In responding to this petition from BP, we have relied to a large extent on the modeling and analysis approach developed for the March 2010 RFS2 rule and the April 2015 carinata oil FRN, as adjusted based on public comments.[32] Thus, the fundamental approaches and analyses relied on for this decision have been made available for public comment as part of previous actions. Our approach to evaluating the lifecycle emissions associated with REG's proposed pathways is also consistent with the petition process for new RFS fuel pathways at 40 CFR 80.1416, which was established in the March 2010 RFS2 rule after notice and public comment.

VI. Conclusion

Based on our assessment, renewable diesel produced from carinata oil via the hydrotreating process with petroleum co-processing at the BP Cherry Point Refinery (the "BP Cherry Point Carinata Pathway") qualifies for advanced biofuel (D code 5) RINs, provided all the conditions and associated regulatory provisions specified in Section IV of this document are satisfied, and the fuel meets the definitional and other criteria for renewable fuel (e.g., produced from renewable biomass, and used to reduce or replace the quantity of fossil fuel present in transportation fuel, heating oil or jet fuel) specified in the CAA and the EPA implementing regulations.

This approval applies specifically to BP Cherry Point and to the process, materials used, fuels produced, and process energy types and amounts outlined and described in the petition request submitted by BP. This approval is effective as of signature date. RINs may only be generated for renewable fuel produced through the BP Cherry Point Carinata Pathway that is produced after the date of activation of the registration for this new pathway.

The OTAQ Reg: Fuels Programs Registration and OTAQ EMTS Application will be modified to allow BP to register and generate D code 5 RINs for renewable diesel produced from carinata oil using a production process of "BP Cherry Point Carinata Process."

[32] For more information on these adjustments see the Response to Comments document attached to the April 2015 carinata oil FRN).