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

FEB 23 2018

OFFICE OF
AIR AND RADIATION

Mr. Chad Stone
Chief Financial Officer
Renewable Energy Group, Inc.
416 South Bell Avenue
Ames, Iowa 50010

Dear Mr. Stone:

You petitioned the Agency on behalf of Renewable Energy Group, Inc. (REG), to approve a pathway for the generation of advanced biofuel RINs for naphtha and liquefied petroleum gas (LPG) made from biogenic waste fats, oils, and greases ("biogenic waste FOGs") feedstock through a hydrotreating production process. REG's facility located in Geismar, Louisiana produces naptha and LPG fuel products from biogenic waste FOGs using a process involving hydrotreating with grid electricity, natural gas, and hydrogen produced from natural gas via steam methane reforming as energy sources (the "REG Geismar Process").

Through the petition process described under 40 CFR 80.1416, REG submitted data to EPA to perform a lifecycle greenhouse gas analysis of the naphtha and LPG fuel produced from biogenic waste FOGs through the REG Geismar Process. This analysis involved a straightforward application of the same methodology and much of the same modeling used for the March 2010 RFS rule (75 FR 14670) and the March 2013 RFS rule (78 FR 14190). The difference between this analysis and the modeling completed for these previous assessments is the evaluation of a modified fuel production process.

This analysis is also similar to the one completed for EPA's April 13, 2017, approval of an advanced biofuel pathway for naphtha and LPG produced from non-food grade corn oil feedstock at the REG Geismar facility (the "April 2017 REG Geismar determination").[1] The difference between this analysis and the modeling completed for the April 2017 REG Geismar determination is the evaluation of a different feedstock.

The attached document "Renewable Energy Group, Inc. Fuel Pathway Determination under the RFS Program" describes the data submitted by REG, the analysis conducted by the EPA, and our determination of the lifecycle greenhouse gas emissions associated with the fuel production pathway described in REG's petition.

Based on our assessment, naphtha and LPG produced from biogenic waste FOGs through the REG Geismar Process qualifies under the Clean Air Act (CAA) for advanced biofuel (D-code 5) RINs,

[1] For the April 2017 REG Geismar determination see: https://www.epa.gov/renewable-fuel-standard-program/reg-geismar-approval

assuming the fuel meets the other definitional 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 EPA implementing regulations.

This approval applies specifically to Renewable Energy Group, LLC, and to the process, materials used, fuels produced, and process energy types and amounts outlined and described in the petition request submitted by REG.

The OTAQ Reg: Fuels Programs Registration and OTAQEMTS: OTAQ EMTS Application will be modified to allow REG to register and generate advanced biofuel RINs for naphtha and LPG produced from biogenic waste FOGs using a production process of "REG Geismar Process."

Sincerely,

Christopher Grundler, Director
Office of Transportation and Air Quality

Enclosure

Renewable Energy Group, Inc. Fuel Pathway Determination under the RFS Program
Office of Transportation and Air Quality

**Summary:** Renewable Energy Group, Inc. (REG) petitioned the Agency under the Renewable Fuel Standard (RFS) program to approve a pathway that would allow them to generate advanced biofuel (D-code 5) renewable identification numbers (RINs) for the naphtha and liquefied petroleum gas (LPG) products produced at REG's facility located in Geismar, Louisiana. This facility uses, biogenic waste fats, oils, and greases ("biogenic waste FOGs") as feedstock, and a hydrotreating production process using grid electricity, natural gas, and hydrogen produced from natural gas via steam methane reforming as energy sources (the "REG Geismar Process").[2] The REG Geismar Process utilizes a known renewable fuel production process called hydrotreating which EPA has previously evaluated for the March 2010 RFS rule (75 FR 14670), the March 2013 RFS rule (78 FR 14190), and the April, 13 2017, petition approval for naphtha and LPG produced at the REG Geismar facility using non-food grade corn oil feedstock (the "April 2017 REG Geismar determination").[3] REG Geismar also plans to utilize, for the pathway under evaluation, a known renewable fuel feedstock, biogenic waste FOGs, which EPA evaluated in the March 2010 RFS rule, and produces fuel types (naptha and LPG) that have been previously analyzed. Based on the data submitted by REG, the evaluation of biogenic waste FOGs feedstock for the March 2010 RFS rule, and EPA's previous hydrotreating process modeling and evaluation of naptha and LPG fuels, EPA conducted a lifecycle assessment estimating that naphtha and LPG produced from biogenic waste FOGs using the REG Geismar Process reduces lifecycle greenhouse gas (GHG) emissions compared to the statutory petroleum baseline by approximately 76 percent. Based on the results of our lifecycle GHG assessment, naphtha and LPG produced from biogenic waste FOGs feedstock through the REG Geismar Process qualifies for advanced biofuel (D-code 5) RINs.

Through the petition process described under 40 CFR 80.1416, REG submitted data to EPA to perform a lifecycle GHG analysis of the naphtha and LPG fuel produced through the REG Geismar Process from biogenic waste FOGs feedstock. This analysis involved a straightforward application of the same methodology and much of the same modeling used for the March 2010 RFS rule (75 FR 14670) and the March 2013 RFS rule (78 FR 14190). The difference between this analysis and the analyses completed for these previous assessments is the evaluation of a different hydrotreating fuel production process for naptha and LPG fuel.

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[2] Under the RFS program, a fuel pathway consists of a unique combination of a feedstock, a fuel production process and a type of transportation fuel. In this determination document the term "REG Geismar Process" refers only to the hydrotreating fuel production process and energy sources used by REG at their facility in Geismar, LA, to convert feedstocks to fuel products, including naphtha and LPG.

[3] The April 2017 REG Geismar Determination (assessing a pathway involving use of non-food grade corn oil feedstock) is available at: https://www.epa.gov/renewable-fuel-standard-program/reg-geismar-approval. This determination has no impact on the April 2017 REG Geismar Determination; i.e., both the pathway addressed in this decision document and the one analyzed in the April, 2017 Determination are approved for use at the REG Geismar facility.

This analysis is also similar to the one completed for the April 2017 REG Geismar determination, with the only difference being the evaluation of a different feedstock. The fuel pathways for which REG has requested EPA analysis are the type of new pathways that EPA described in the preamble to the March 2010 RFS rule as capable of being evaluated by comparing the applicant's fuel pathways to the pathways that have already been analyzed. In the March 2010 RFS rule, EPA analyzed and approved pathways for renewable diesel produced from biogenic waste FOGs through a hydrotreating process. In the March 2013 RFS rule, EPA conducted more detailed process modeling using data representing an industry average hydrotreating production process maximized for diesel fuel output and the same process maximized for jet fuel output.[4] Based on this analysis, EPA approved a pathway for the use of camelina oil feedstock to produce renewable diesel, jet fuel, naphtha and LPG with a hydrotreating process. (In the March 2013 RFS rule EPA also approved pathways for jet fuel and heating oil produced with a hydrotreating process using biogenic waste FOGs feedstock.) In the April 2017 REG Geismar determination, EPA evaluated naptha and LPG fuel produced by REG's hydrotreating facility using non-food grade corn oil as feedstock. Based on EPA's assessment using conservative assumptions,[5] naphtha and LPG produced through the REG Geismar Process from biogenic waste FOGs feedstock achieve lifecycle GHG emissions reductions that are sufficient to qualify them as advanced biofuel.

This document is organized as follows:

- *Section I. Required Information and Criteria for Petition Requests*: Information on the background and purpose of the petition process, the criteria EPA uses to evaluate the petitions and the information that is required to be provided under the petition process as outlined in 40 CFR 80.1416. This section is not specific to REG's request and applies to all petitions submitted pursuant to 40 CFR 80.1416.
- *Section II. Available Information*: Background information on REG, the information that REG provided and how it complies with the petition requirements outlined in Section I.
- *Section III. Analysis and Discussion*: Description of the lifecycle analysis done for this determination and how it differs from the analyses done for previous assessments. This section also describes how we have applied the lifecycle results to determine the appropriate D-code for naptha and LPG fuel produced through the REG Geismar Process from biogenic waste FOGs feedstock.

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[4] Pearlson, M., Wollersheim, C., Hileman, J. (2013). "A techno-economic review of hydroprocessed renewable esters and fatty acids for jet fuel production." *Biofuels, Bioproducts & Biorefining*, 7:89-96

[5] The purpose of lifecycle assessment under the RFS program is not to precisely estimate lifecycle GHG emissions associated with particular biofuels, but instead to determine whether or not the fuels satisfy specified lifecycle GHG emissions thresholds to qualify as one or more of the four types of renewable fuel specified in the statute. Where there are a range of possible outcomes and the fuel satisfies the GHG reduction requirements when "conservative" assumptions are used, then a more precise quantification of the matter is not required for purposes of a pathway determination.

- *Section IV. Conditions and Associated Regulatory Provisions:* Registration, reporting, and recordkeeping requirements for naptha and LPG fuel produced through the REG Geismar Process from biogenic waste FOGs feedstock.
- *Section V. Public Participation*: Description of how this petition is an extension of the analyses done as part of the March 2010 RFS rule and the March 2013 RFS rule.
- *Section VI. Conclusion*: Summary of our conclusions regarding REG's petition, including the D-code REG may use in generating RINs for naptha and LPG fuel produced through the REG Geismar Process from biogenic waste FOGs feedstock.

## I. Required Information and Criteria for Petition Requests

### A. Background and Purpose of Petition Process

As a result of changes to the RFS program in Clean Air Act section 211(o), as amended by the Energy Independence and Security Act of 2007 (EISA), EPA adopted new regulations, published at 40 CFR Part 80, Subpart M. The RFS regulations specify the types of renewable fuels eligible to participate in the RFS program and the procedures by which renewable fuel producers and importers may generate RINs for the qualifying renewable fuels they produce through approved fuel pathways.[6]

Pursuant to 40 CFR 80.1426(f)(1):

> *Applicable pathways.* D-codes shall be used in RINs generated by producers or importers of renewable fuel according to the pathways listed in Table 1 to this section, subparagraph 6 of this section, or as approved by the Administrator.

Table 1 to 40 CFR 80.1426 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. 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 EPA to evaluate a new fuel pathway in accordance with 40 CFR 80.1416. In addition, renewable fuel producers qualified in accordance with 40 CFR 80.1403(c) and (d) for an e 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 of 6 pursuant to 40 CFR 80.1426(f)(6) for that baseline volume, assuming all other regulatory requirements are satisfied.[7]

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[6] See EPA's website for information about the RFS regulations and associated rulemakings: https://www.epa.gov/renewable-fuel-standard-program

[7] "Grandfathered fuel" refers to a baseline volume of renewable fuel produced from facilities 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 facilities 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 80.1401.

The petition process under 40 CFR 80.1416 allows parties to request that EPA evaluate a new fuel pathway's lifecycle GHG emissions 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, and should also include 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 80.76 (Registration of refiners, importers or oxygenate blenders).
- A technical justification that includes a description of the renewable fuel, feedstock(s), and production process. The justification must include process modeling flow charts.
- A mass balance for the pathway, including feedstocks, 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.
- 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.
- Other additional information as requested by the Administrator to complete the lifecycle greenhouse gas assessment of the new fuel pathway.

In addition to the requirements stated above, parties who use a feedstock not previously evaluated by EPA must also include additional information. This information was not required for the REG Geismar petition because their proposed pathways use a feedstock, biogenic waste FOGs, that EPA has previously evaluated.

## II. Available Information

### A. Background on REG

REG petitioned the Agency to approve advanced biofuel pathways involving the production of naphtha and LPG from biogenic waste FOGs feedstock through a hydrotreating production process. A petition is required because these are not approved pathways in Table 1 to 40 CFR 80.1426.

### B. Information Available Through Existing Modeling

The process described in REG's petition would produce naphtha and LPG using a feedstock, biogenic waste FOGs, that has already been evaluated as part of the March 2010 RFS rule and the March 2013 RFS rule (see Table 1). Therefore, no new feedstock modeling was required. Similarly, no new modeling of the emissions associated with the combustion of naphtha or LPG was required because that was previously evaluated as part of the March 2010 and 2013 RFS rules. Compared to previous rulemakings, this petition only required EPA to evaluate a different hydrotreating fuel production process, as described below.

In the March 2010 RFS rule, EPA analyzed and approved biomass-based diesel (D-code 4) and advanced biofuel (D-code 5) pathways for the production of renewable diesel through a hydrotreating process using biogenic waste FOGs feedstock. In the March 2013 RFS rule, EPA conducted more detailed process modeling using data representing an industry average hydrotreating production process maximized for diesel fuel output and the same process maximized for jet fuel output. In the April 2017 REG Geismar determination, EPA evaluated mass and energy balance data associated with naphtha and LPG production from non-food grade corn oil feedstock at REG Geismar's hydrotreating facility, located in Geismar, LA. In addition to producing renewable diesel from biogenic waste FOGs, which is an existing pathway in rows F and H of Table 1 to 40 CFR 80.1426, REG also plans to produce naphtha and LPG from this feedstock. The REG Geismar facility uses the same general type of hydrotreating process previously studied by EPA in the March 2013 RFS rule, with the difference being that REG Geismar uses different amounts of process energy and does not produce jet fuel co-product.

EPA performed a comparison with the hydrotreating process modeling done for the March 2013 RFS rule. To do this comparison the amount of feedstock input, the amount of fuel outputs, and the amount of energy use and associated emissions were changed based on the data submitted by REG.

This was a straightforward analysis based on existing modeling done for previous rulemakings for the RFS program, and substituting REG's process data, which only altered the amounts of inputs and outputs. The analysis completed for this petition utilized the same fundamental modeling approach as was used in previous rulemakings for the RFS program.

**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 |
|---|---|---|---|---|
| F | Biodiesel, renewable diesel, jet fuel and heating oil | Biogenic waste oils/fats/greases | One of the following: Trans-Esterification Hydrotreating (Excluding processes that co-process renewable biomass and petroleum) | 4 (Biomass-based diesel) |

| | | | | |
|---|---|---|---|---|
| H | Biodiesel, renewable diesel, jet fuel and heating oil | Biogenic waste oils/fats/greases | One of the following: Trans-Esterification Hydrotreating (Includes only processes that co-process renewable biomass and petroleum) | 5 (Advanced) |
| I | Naphtha, LPG | *Camelina sativa* oil | Hydrotreating | 5 (Advanced) |

### C. Information Submitted by REG

REG supplied all the information as required in 40 CFR 80.1416 that EPA needed to analyze the lifecycle GHG emissions associated with the naphtha and LPG produced through the REG Geismar Process from biogenic waste FOGs. The information submitted included a technical justification describing the fuel, feedstocks used, and REG's hydrotreating production process with modeling flow charts, a detailed mass and energy balance of the process 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 the 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. As mandated by CAA 211(o), the lifecycle 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, EPA considers the following:

- Feedstock production – based on agricultural sector models that include direct and indirect impacts of feedstock production.
- 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.

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

EPA's evaluation of the lifecycle GHG emissions related to the naphtha and LPG produced through the REG Geismar Process from biogenic waste FOGs under this petition request is consistent with the CAA's applicable requirements, including the definition of lifecycle GHG emissions and threshold evaluation requirements. It was based on previous lifecycle analysis modeling that EPA completed for the March 2010 and 2013 RFS rules, the April 2017 REG Geismar determination, and the information submitted in REG's petition.

**Feedstock Production** – REG's petition seeks EPA review of a pathway involving the use of biogenic waste FOGs as feedstock, which was evaluated as part of previous assessments; therefore, no new feedstock production modeling was required. According to their petition, the FOG feedstocks that REG intends to use include yellow grease (also known as used cooking oil) and animal tallow. For the March 2010 RFS rule, EPA estimated the lifecycle GHG emissions associated with biodiesel produced from yellow grease feedstock, which formed the basis for the Agency's determination that biodiesel and renewable diesel produced from a variety of biogenic waste FOGs, including animal tallow, satisfies the RFS program's 50 percent GHG reduction requirement for fuel to qualify as advanced biofuel. For our analysis of REG Geismar's petition, we evaluated the lifecycle GHG emissions associated with using yellow grease feedstock. Following the approach used for the March 2010 RFS rule, we consider the GHG emissions associated with the use of yellow grease as feedstock to be representative of such emissions associated with the use of other qualifying biogenic waste FOG feedstocks, including animal tallow.

Following the methodology developed for the March 2010 RFS rule, our analysis does not include any significant indirect GHG emissions associated with the use of yellow grease feedstock. REG's petition included their process yields in terms of pounds of feedstock used per pound of finished fuel product (renewable diesel, naphtha and LPG). In this case, there are no upstream emissions associated with the production of naptha and LPG from yellow grease through the REG Geismar Process, other than the feedstock transport emissions discussed below. For some biofuel pathways using biogenic waste FOGs as feedstock, there are upstream emissions associated with rendering. In this case, rendering of yellow grease is considered to be part of feedstock pretreatment as part of the REG Geismar Process, as discussed below.

**Feedstock Transport** – In our analysis, as a conservative assumption, biogenic waste FOGs are transported 300 miles by heavy duty truck from collection points such as restaurants and meat processors to REG Geismar's facility.[8] The GHG emissions associated with feedstock transport are relatively small, and reasonable changes in transport distance or mode would have a small impact on

[8] For comparison, the default assumption in the CA-GREET2.0 model (used by the California Air Resources Board for implementation of the California Low Carbon Fuel Standard) is that yellow grease collected at rendering facilities is trucked 50 miles (one way) from the collection point to the renewable diesel facility. We use a longer distance here as a conservative assumption, and because REG may source yellow grease directly from more disparate sources.

the overall lifecycle GHG emissions, and therefore would not affect our assessment that these fuels satisfy a 50 percent GHG reduction relative to the petroleum baseline.

**Feedstock Pretreatment** – After the biogenic waste FOGs feedstock is trucked to the REG production facility and loaded into storage tanks it is pretreated to remove naturally occurring minerals which are known to deactivate the downstream hydrotreating catalyst. REG uses electricity and natural gas for process energy to pretreat the biogenic waste FOGs. Feedstock pretreatment occurs onsite at the REG Geismar facility, and the energy used for pretreatment was included as part of the fuel production mass and energy balance data provided in the REG petition. For this analysis, the energy used and emissions associated with feedstock pre-treatment were evaluated as part of the fuel production stage of the lifecycle, discussed below.

**Fuel Distribution** – We assumed that the GHG emissions per mmBtu of fuel associated with transporting and distributing the naphtha and LPG produced through the REG Geismar Process are the same, on average, as biodiesel, and used the same assumptions adopted through notice and comment rulemaking in the March 2010 rule for biodiesel. The analysis for the March 2010 RFS rule assumed biodiesel transported from the fuel production facility to the distribution terminal would travel, on average, 26 miles by barge, 360 miles by pipeline and 25 miles by truck. The same analysis assumed that biodiesel was transported 50 miles by truck from the terminal to retail fuel stations. Emissions factors were applied for each of these modes and distances, and GHG emissions from biodiesel transport and distribution were estimated to be approximately 0.8 kg $CO_2$-equivalent per mmBtu of biodiesel. Given the relatively small contribution of distribution emissions to overall lifecycle greenhouse gas emissions, even a significantly large change in this assumption would not impact our assessment that these fuels meet a 50 percent GHG emission reduction.

**Fuel Use** – For this analysis we applied fuel use emissions factors developed for the March 2010 RFS final rule. For naphtha we used the emissions factors for non-carbon dioxide GHGs for baseline gasoline fuel developed for the March 2010 RFS rule. For LPG, we used the LPG non-carbon dioxide emissions factor developed for the March 2010 RFS rule.[9] The tailpipe emissions are relatively small, and the threshold GHG reduction results are not sensitive to the emission factor assumptions.

**Fuel Production** – REG's fuel production method fits in the category of a hydrotreating process already analyzed for the March 2010 and 2013 RFS rules and the April 2017 REG Geismar determination. As discussed above, there are existing approved pathways under the RFS program for

[9] Using the same approach as the March 2010 RFS rule, we excluded carbon dioxide emissions associated with combusting the finished naphtha and LPG fuels from our lifecycle greenhouse gas analysis. Following the methodology developed for the March 2010 RFS rule, the carbon in the finished fuel derived from renewable biomass is treated as biologically derived carbon originating from the atmosphere. The uptake of this carbon from the atmosphere by the renewable biomass and the carbon dioxide emissions from combusting it cancel each other out. Instead of presenting both the carbon uptake and tailpipe carbon dioxide emissions, we left 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."

renewable diesel, jet fuel and heating oil produced from biogenic waste FOGs using a hydrotreating production process, and there are also approved pathways for renewable diesel, jet fuel, heating oil, naphtha and LPG produced from camelina oil feedstock using a hydrotreating process. EPA's most detailed hydrotreating process analysis was conducted for the March 2013 RFS rule using data representing an industry average hydrotreating process maximized for diesel fuel output and a hydrotreating process maximized for jet fuel output.[10] The REG Geismar Process is similar to the hydrotreating processes previously studied by EPA, with the difference being that the REG Geismar Process uses different amounts of process energy, does not produce jet fuel co-product, and has different process yields in terms of the amount of fuel produced per pound of feedstock input.

As discussed in the March 2010 and 2013 RFS rules, EPA's lifecycle analyses account for the various uses of the co-products. In previous analyses, we have used two general approaches to account for co-products: the allocation approach and the displacement approach. As discussed in the March 2013 RFS rule,[11] for analysis of hydrotreating processes we have applied the allocation approach for RIN-generating co-products that qualify as renewable fuel. For this evaluation of the fuels produced through the REG Geismar Process we used the allocation approach, as REG Geismar is proposing to generate RINs for all of its fuel products (renewable diesel, naphtha and LPG). For the REG Geismar Process, and other hydrotreating processes that EPA has evaluated, the allocation approach results in the highest lifecycle GHG emissions for each of the fuel products, hence in this case it can be viewed as a conservative approach.

In the allocation approach, all the emissions from the hydrotreating process are allocated across all co-products. There are a number of ways to do the allocation, for example on the basis of energy, mass or economic value. Consistent with the approach taken in the hydrotreating analysis for the March 2013 RFS rule, for this analysis of the REG Geismar Process we allocated emissions to the renewable diesel, naphtha and LPG based on the energy content (using lower-heating values) of the products produced. Emissions from the process were allocated equally to all of the British thermal units (Btus) of fuel produced. Therefore, on a per Btu basis all of the primary products coming from the process have the same emissions from the fuel production stage of the lifecycle. For this analysis the energy content was the most appropriate basis for allocating emissions because all of the fuel products are used as sources of energy. Energy content also has the advantage of being a fixed factor as opposed to market prices which fluctuate over time.

Table 2 compares our lifecycle GHG analysis of the REG Geismar Process with the hydrotreating modeling completed for the March 2013 RFS rule, using the allocation approach for co-products described above.[12] Consistent with analyses for previous RFS rulemakings, results are

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[10] Pearlson et al. 2013

[11] See 78 FR 14198-9

[12] In the table, the hydrotreating process maximized for diesel fuel and jet fuel are labeled as "industry average" hydrotreating processes, because the data used to model them from Pearlson et al. 2013 were intended to represent a generic process based on data available in the literature and standard petrochemical support processes such as storage tanks, hydrogen gas production, cooling water towers, etc.

presented in terms of kilograms of carbon-dioxide equivalent emissions per million British thermal unit of fuel product outputs ($kgCO_2e$/mmBtu). The REG petition provided aggregated energy use data for feedstock pretreatment and fuel production, thus the GHG emissions in Table 2 represent the emissions for both of these activities. Based on these results, the REG Geismar Process results in higher GHG emissions than other hydrotreating processes EPA has evaluated.

**Table 2: Feedstock Pretreatment and Hydrotreating Process Lifecycle GHG Emissions ($kgCO_2e$/mmBtu)**

| Hydrotreating Process Modeled | Feedstock Pretreatment and Fuel Production Lifecycle GHG Emissions | Fuel Products |
|---|---|---|
| REG Geismar Process | 19.7 | Renewable diesel, naphtha, LPG |
| Industry Average Hydrotreating Process Maximized for Diesel Fuel | 14.7 | Renewable diesel, naphtha, jet fuel, LPG |
| Industry Average Hydrotreating Process Maximized for Jet Fuel | 19.5 | Renewable diesel, naphtha, jet fuel, LPG |

**Lifecycle GHG Results** – Based on our analysis of the full fuel lifecycle described above, we estimated the lifecycle GHG emissions associated with naphtha and LPG produced from yellow grease through the REG Geismar Process. Table 3 shows the lifecycle GHG emissions associated with the naphtha and LPG produced from yellow grease through the REG Geismar Process. To evaluate these fuels we compared the lifecycle GHG emissions from REG's naphtha product to the 2005 gasoline baseline because renewable naphtha is a gasoline blendstock replacement. Since LPG can be used in a range of applications, including heating oil and transportation fuel, it was less clear which baseline to compare it to. Section 211(o)(1)(C) of the CAA defines baseline lifecycle GHG emissions as "the average lifecycle greenhouse gas emissions . . . for gasoline or diesel (whichever is being replaced by the renewable fuel sold or distributed as transportation fuel in 2005)." Since LPG may replace either gasoline or diesel, as a conservative approach, in this case we compared REG Geismar's renewable LPG product to baseline diesel. This is viewed as a conservative approach because for the March 2010 RFS rule EPA determined that the lifecycle GHG emissions for baseline diesel are slightly lower than for baseline gasoline (see Table 3 below). As shown in the table, naphtha and LPG produced through the REG Geismar Process from yellow grease feedstock exceed the CAA 50 percent GHG reduction threshold for advanced biofuel.

**Table 3: Lifecycle GHG Emissions from the REG Geismar Pathways (kgCO2e/mmBtu)[13]**

| | Naphtha produced from yellow grease through the REG Geismar Process | LPG produced from yellow grease through the REG Geismar Process | 2005 Gasoline Baseline | 2005 Diesel Baseline |
|---|---|---|---|---|
| Feedstock transport | 0.9 | 0.9 | * | * |
| Feedstock Pretreatment and Fuel production | 19.7 | 19.7 | 19.2 | 18.0 |
| Fuel distribution | 0.8 | 0.8 | * | * |
| Tailpipe | 1.7 | 1.5 | 79.0 | 79.0 |
| Net emissions | 23.2 | 23.0 | 98.2 | 97.0 |
| Percent GHG reduction relative to baseline | 76.4% | 76.3% | -- | -- |

* Emissions included in the Fuel Production stage.

### B. Application of the Criteria for Petition Approval

REG's petition request involved a production process, feedstock and fuel products already considered as part of the March 2010 and 2013 RFS rules and the April 2017 REG Geismar determination. REG provided all necessary information that was required for this type of petition request.

Based on the data submitted and information already available through analyses conducted for previous RFS rulemakings, EPA conducted a lifecycle assessment and determined that the renewable naphtha and LPG produced from yellow grease through the REG Geismar Process meets the 50 percent lifecycle GHG threshold requirement specified in the CAA for advanced biofuel. These results, based on yellow grease as the feedstock, apply for the similar biogenic waste FOG feedstocks included in REG's petition, including inedible animal tallow.

The lifecycle GHG results presented above justify authorizing the generation of advanced biofuel RINs for naphtha and LPG produced through the REG Geismar Process from biogenic waste

[13] Totals may not be the sum of the rows due to rounding.

FOGs feedstock, assuming that the fuel meets the other definitional 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 EPA implementing regulations.

## IV. Conditions and Associated Regulatory Provisions

The authority for REG Geismar to generate RINs for naphtha and LPG produced through the REG Geismar Process from biogenic waste FOGs is expressly conditioned on REG Geismar satisfying all of the applicable requirements for renewable fuel producers set forth in the RFS regulations. In addition, or in the alternative to bringing an enforcement action under the CAA for any violations, EPA may revoke this pathway approval if it determines that REG Geismar has failed to comply with any applicable requirements.

The description of REG Geismar's renewable fuel that is required for registration pursuant to 40 CFR 80.1450(b)(1)(ii) shall contain a Compliance Monitoring Plan detailing how REG Geismar will ensure that RINs are only generated for volumes of LPG and naphtha sold for use as transportation fuel and for no other purpose.[14] For example, the Compliance Monitoring Plan shall detail how the LPG will be distributed to end users, and the records that REG Geismar will keep to demonstrate the volume of LPG that was sold for use as transportation fuel.

We also note that in accordance with 40 CFR 80.1426(f)(5), in order to be accepted by EPA, REG's registration application will need to provide adequate information to demonstrate that the feedstock material used is biogenic waste FOGs, including information on the source and composition of the materials and how they are collected.

## 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 2010 and 2013 RFS rules, we took public comment on our lifecycle assessment of pathways involving the production of renewable diesel from biogenic waste FOGs feedstock using a hydrotreating process, including all models used and all modeling inputs and evaluative approaches. We also took comment on pathways that involved the production of naphtha and LPG including an assessment of GHG emissions associated with the distribution and tailpipe emissions from this fuel. In the March 2010 RFS rule we acknowledged that it was unlikely that our final regulations would address all possible qualifying fuel production pathways, and we took comment on allowing the generation of RINs using a temporary D code in certain circumstances while EPA was evaluating such new pathways and updating its regulations. After considering comments, we finalized the current petition process, where we allow for EPA approval of certain petitions without

[14] All of the registration materials required by 80.1450(b)(1), including those specifically described in this document, must be reviewed and verified pursuant to the independent third party engineering review required in 80.1450(b)(2).

going through additional rulemaking if we can do so as a reasonably straightforward extension of previous assessments, whereas rulemaking would typically be conducted to respond to petitions requiring new modeling. See 75 FR 14797 (March 26, 2010).

In responding to this petition, we have largely relied on the same modeling that we conducted for the March 2010 and 2013 RFS rules, and have simply adjusted the analysis to account for REG's process data. This includes use of the same emission factors and types of emission sources that were used in the March 2010 and 2013 RFS rules. Thus, the fundamental analyses relied on for this decision have been made available for public comment as part of previous rulemakings, consistent with the reference to notice and comment in the statutory definitions of "advanced biofuel." Our approach today is also consistent with our description of the petition process in the preamble to the March 2010 RFS Rule, as our work in responding to the petition was a logical extension of analyses already conducted.

## VI. Conclusion

Based on our assessment, naphtha and LPG produced from biogenic waste FOGs through the REG Geismar Process qualifies under the CAA for advanced biofuel (D-code 5) RINs, assuming the fuel meets the other definitional 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 EPA implementing regulations.

This approval applies specifically to Renewable Energy Group, LLC, and to the process, materials used, fuels produced, and process energy types and amounts outlined and described in the petition request submitted by REG.[15] This approval is effective as of signature date. RINs may only be generated for non-grandfathered naphtha and LPG produced from biogenic waste FOGs feedstock through the REG Geismar Process that is produced after the date of activation of REG's registration for the new pathway(s).[16]

The OTAQ Reg: Fuels Programs Registration and OTAQEMTS: OTAQ EMTS Application will be modified to allow REG to register and generate RINs for naphtha and LPG produced from biogenic waste FOGs through the "REG Geismar Process."

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[15] As with all pathway determinations, this approval does not convey any property right of any sort, or any exclusive privilege.

[16] A fuel pathway is activated under the RFS program when EPA accepts the registration application for the pathway, allowing it to be used in EMTS for RIN generation. When EPA accepts a registration application, an email is automatically sent from otaqfuels@epa.gov to the responsible corporate officer (RCO) of the company that submitted the registration application. The subject line of such an email includes the name of the company and the company request (CR) number corresponding with the registration application submission, and the body of the email says the company request "has been activated."