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

May 11, 2020

OFFICE OF
AIR AND RADIATION

Mr. Thomas Paskach
President
San Joaquin Renewables
1421 South Bell Avenue, Suite 105
Ames, Iowa 50010

Dear Mr. Paskach:

You petitioned the Agency on November 16, 2018, on behalf of San Joaquin Renewables to approve a pathway for the generation of cellulosic biofuel (D-code 3) renewable identification numbers (RINs) for compressed natural gas (CNG) produced from orchard wood residue and almond and pistachio shells through a proprietary gasification and upgrading process. We call the steps from feedstock to fuel the "San Joaquin Renewables Pathway."

Through the petition process provided under 40 CFR 80.1416, San Joaquin Renewables submitted data to EPA to perform a lifecycle greenhouse gas analysis of the CNG produced from orchard wood residue and almond and pistachio shells through the San Joaquin Renewables Pathway. Because we determined that the proposed feedstocks qualify as crop residue, this analysis involved a straightforward application of the same methodology and much of the same modeling used for the March 2010 RFS2 rule (75 FR 14670) and the July 2014 Pathways II rule (79 FR 42128). The difference between this analysis and the modeling completed for these previous assessments was the evaluation of San Joaquin Renewables facility in McFarland, California.

Based on our assessment, CNG produced through the San Joaquin Renewables Pathway qualifies under the Clean Air Act (CAA) for D-code 3 RINs, provided the fuel meets all of the conditions specified in this document and all other applicable statutory and regulatory requirements, including the 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) and the requirement that to qualify as renewable fuel the CNG must be sold for use as transportation fuel and for no other purposes.

This approval applies specifically to San Joaquin Renewables' McFarland, California facility, and to the process, materials used, fuels produced, and process energy types and amounts outlined and described in the November 2018 petition request submitted by San Joaquin Renewables.

The Renewable Fuel Standard registration and RIN tracking systems will be modified to allow San Joaquin Renewables to register and generate cellulosic RINs for compressed natural gas produced through the San Joaquin Renewables Pathway.

Sincerely,

Sarah W Dunham

Sarah Dunham, Director
Office of Transportation and Air Quality

Enclosure

San Joaquin Renewables Fuel Pathway Determination under the RFS Program
Office of Transportation and Air Quality

Summary: San Joaquin Renewables petitioned the Agency under the Renewable Fuel Standard (RFS) program to approve a pathway that would allow them to generate cellulosic biofuel (D-code 3) renewable identification numbers (RINs) for compressed natural gas (CNG) produced from orchard wood residue, almond shells, and pistachio shells through a gasification and upgrading process at San Joaquin Renewables' facility in McFarland, California. San Joaquin Renewables proposes to use these feedstocks to produce CNG via gasification and upgrading using a proprietary process (the "BING process"). This process uses steam generated from process heat and oxygen produced by an air separation unit to convert biomass feedstock into syngas, biochar, and ash. The syngas is then upgraded to remove contaminants and converted to methane. Water and carbon dioxide are removed to produce commercial quality compressed natural gas (CNG) for use as a transportation fuel. Excess heat generated by the process is converted to electricity for use by the facility, thus reducing the total amount of power consumed by the plant. An air separation unit provides oxygen for the gasification and nitrogen for inert gas needs, and also produces excess nitrogen. Biochar, liquid nitrogen and argon may be produced as coproducts. We refer to this entire set of steps including all of the feedstocks, processes and conditions as the "San Joaquin Renewables Pathway."

The fuel pathway for which San Joaquin Renewables requested our evaluation is the type of new pathway that EPA described in the preamble to the March 2010 RFS rule as capable of being evaluated by comparing the applicant's fuel pathway to pathways that have already been analyzed. After determining that the proposed feedstocks qualify as crop residue, this analysis involved a straightforward application of the same methodology and modeling used for the March 2010 RFS2 rule (75 FR 14670) and the July 2014 Pathways II rule (79 FR 42128). The difference between this analysis and the analyses completed for these previous assessments was the evaluation of process data from San Joaquin Renewables' facility, evaluation of emissions from alternative uses of the feedstock, transport of the feedstock to the facility, and evaluation of tailpipe emissions from CNG. Based on our analysis, we have determined that CNG produced from the San Joaquin Renewables Pathway meets the 60% lifecycle greenhouse gas reduction requirement for cellulosic 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 petitions and the information that is required to be provided under the petition process as outlined in 40 CFR 80.1416. This section applies to all petitions submitted pursuant to 40 CFR 80.1416.

- *Section II. Available Information*: Background information on San Joaquin Renewables, the information that they 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 CNG produced through the San Joaquin Renewables Pathway.
- *Section IV. Conditions and Associated Regulatory Provisions:* Registration, reporting, and recordkeeping requirements for CNG produced through the San Joaquin Renewables Pathway.
- *Section V. Public Participation*: Description of how this petition is an extension of the analyses done as part of prior notice and public comment processes.
- *Section VI. Conclusion*: Summary of our conclusions regarding the San Joaquin Renewables petition.

I. Required Information and Criteria for Petition Requests

A. Background and Purpose of Petition Process

In 2010, EPA revised the RFS regulations at 40 CFR part 80, subpart M as a result of the 2007 Energy Independence and Security Act's (EISA) amendments to Clean Air Act section 211(o). The RFS regulations at subpart M 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.[1]

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 comprises a fuel pathway and is assigned a D-code. EPA may also independently approve additional generally applicable fuel pathways into Table 1 for participation in the RFS program, or a third party may petition for EPA to evaluate a new, facility-specific 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 exemption from the 20 percent GHG emissions reduction requirement of the Act for a baseline volume of fuel ("grandfathered fuel")

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

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.[2]

The petition process under 40 CFR 80.1416 allows parties to request that EPA evaluate a potential 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 for new renewable fuel pathways 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 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 pursuant to 40 CFR 80.1416(b)(2). San Joaquin Renewables proposed to use orchard wood residue and almond and pistachio shells

[2] "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 80.1401.

as feedstocks. As explained below, EPA is determining that these feedstocks qualify as crop residue. Because EPA has previously evaluated this category of feedstock, the additional information described under 80.1416(b)(2) was not required for the San Joaquin Renewables petition. However, in response to questions from EPA, San Joaquin Renewables provided additional information about the sources and likely alternative uses of the feedstocks to assist EPA in evaluating whether these feedstocks are consistent with the definitional requirements and previous evaluations of crop residue feedstocks.

II. Available Information

A. Background on San Joaquin Renewables

San Joaquin Renewables petitioned the Agency to approve a pathway that would allow them to generate cellulosic biofuel (D-code 3) RINs for CNG produced from orchard wood residue and almond and pistachio nut shells through a gasification and upgrading process at San Joaquin Renewables' facility in McFarland, California. A petition is required because this is not an approved pathway in Table 1 to 40 CFR 80.1426.

B. Information Available Through Existing Modeling

The pathway described in the San Joaquin Renewables petition would produce CNG using orchard wood residue and almond and pistachio shells as feedstocks. Here we conduct an assessment of these feedstocks and conclude that they qualify as crop residue.

40 CFR 80.1401 defines crop residue as:

> [B]iomass left over from the harvesting or processing of planted crops from existing agricultural land and any biomass removed from existing agricultural land that facilitates crop management (including biomass removed from such lands in relation to invasive species control or fire management), whether or not the biomass includes any portion of a crop or crop plant. Biomass is considered crop residue only if the use of that biomass for the production of renewable fuel has no significant impact on demand for the feedstock crop, products produced from that feedstock crop, and all substitutes for the crop and its products, nor any other impact that would result in a significant increase in direct or indirect GHG emissions.

San Joaquin Renewables' petition states that the orchard wood residue proposed to be used as a feedstock is generated from almond and other types of orchard trees removed from orchards at the end of their economic lives in order to make way for younger, more productive trees. The petition also provides that the feedstock includes prunings, trimmings, and unscheduled tree losses. Because orchards are not forestland under the regulatory definition, *see* 40 CFR 80.1401 (definition of forestland excludes "tree-covered areas in intensive agricultural crop production settings, such as fruit orchards"), and because orchard trees are planted for the purpose of growing and harvesting a crop (e.g., nuts) as opposed to growing trees, EPA believes

that orchard wood residue could qualify as "biomass left over from the harvesting or processing of planted crops" or "biomass removed from existing agricultural land that facilitates crop management." San Joaquin Renewables has also provided information on the alternative fates of orchard wood residues as evidence that the orchard wood intended to be used as a feedstock is a "residue" pursuant to the regulatory definition of "crop residue." As described further in Section III.A. of this document, the primary alternative fate of orchard wood residue is either fuel for biomass power plants or cogeneration plants, or open burning. In recent years, open burning of agricultural wastes has increased significantly in the San Joaquin Valley due to a lack of other outlets for agricultural residues in the region. EPA believes open burning is the most likely alternative fate for the orchard wood residues used as feedstock by San Joaquin Renewables. Therefore, EPA believes that orchard wood residue in San Joaquin Valley "has no significant impact on demand for the feedstock crop, products produced from that feedstock crop, and all substitutes for the crop and its products, nor any other impact that would result in a significant increase in direct or indirect GHG emissions." Based on this information, EPA is determining that orchard wood residue qualifies under the definition of crop residue.

For petitions seeking RINs for cellulosic biofuel, EPA must evaluate whether the feedstock meets the 75% adjusted cellulosic content threshold, 40 CFR 80.1416(d), where "adjusted cellulosic content" is defined as the percent of organic material that is cellulose, hemicellulose, and lignin. 40 CFR 80.1401. As part of the July 2014 Pathways II rule, EPA evaluated the adjusted cellulosic contents of several types of feedstocks, including wood, which the Agency determined was predominantly cellulosic.[3] San Joaquin Renewables has stated that when orchard trees are removed at the end of their economic lives, any remaining fruit is harvested before the remaining biomass is removed and disposed of through one of the alternative fates. So long as San Joaquin Renewables' feedstock is subject to this same practice—removal of any remaining fruit before the orchard wood residues are removed from the orchard and used as a biofuel feedstock—EPA is determining that the orchard wood residues are a predominantly cellulosic crop residue.

The almond and pistachio nut shells San Joaquin Renewables proposes to use as feedstocks will be provided by independent farmers and crop processors that generate these excess materials in the course of their normal operations. Because almond and pistachio trees are planted for the purpose of growing and harvesting the nuts as opposed to the nut shells, EPA believes that almond and pistachio shells could qualify as "biomass left over from the harvesting or processing of planted crops." San Joaquin Renewables has provided information on the alternative fates of almond and pistachio shells as evidence that the shells intended to be used as

[3] The Memorandum to the Docket "Cellulosic Content of Various Feedstocks – 2014 Update," available in docket EPA-HQ-2012-0401, presents data on the cellulosic content of wood and leaves. According to the data included in this memorandum, wood has an average adjusted cellulosic content of 92%, and leaves have an average adjusted cellulosic content of 75%.

a feedstock is a "residue." As described further in Section III.A of this document, the alternative fate for these nut shells appears to be mulching or temporary storage. Based on this information, EPA is determining that almond and pistachio shells qualify under the definition of crop residue.

San Joaquin Renewables provided with its petition data on the cellulosic contents of almond and pistachio shells demonstrating that each of these types of nut shells satisfy the 75% adjusted cellulosic content threshold and therefore are predominantly cellulosic. If San Joaquin Renewables seeks to use other nut shells as feedstocks in the San Joaquin Renewables Pathway, they will first need to submit and have EPA review and accept data on the cellulosic content and alternative uses for each kind of nut shell, in order to demonstrate that the nut shell is predominantly cellulosic and qualifies as crop residue under the RFS2 program.

EPA previously evaluated crop residue as a biofuel feedstock in the March 2010 RFS2 rule (75 FR 14670) and July 2014 Pathways II rule (79 FR 42128) (see Table 1). We therefore were able to rely on this existing feedstock analysis, which we supplemented with information regarding GHG emissions associated with the specific feedstocks described in the petition. Compared to previous rulemakings, this petition required EPA to evaluate a specific fuel production facility and the tailpipe GHG emissions associated with CNG combustion in motor vehicles. This was a straightforward analysis based on existing modeling done for previous rulemakings for the RFS program. The difference between this analysis and the analyses completed for these previous assessments was the evaluation of process data from San Joaquin Renewables' facility, evaluation of emissions from alternative uses of the feedstocks, transport of the feedstocks to the facility, and evaluation of tailpipe emissions from CNG. 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
M	Renewable Gasoline and Renewable Gasoline Blendstock; Co-Processed Cellulosic Diesel, Jet Fuel, and Heating Oil	**Crop residue**, slash, pre-commercial thinnings, tree residue, and separated yard waste; biogenic components of separated MSW; cellulosic components of separated food	Catalytic Pyrolysis and Upgrading, **Gasification and Upgrading**, Thermo-Catalytic Hydrodeoxygenation and Upgrading, Direct Biological Conversion, Biological Conversion and Upgrading utilizing	**3 (Cellulosic biofuel)**

		waste; and cellulosic components of annual cover crops.	natural gas, biogas, and/or biomass as the only process energy sources providing that process used converts cellulosic biomass to fuel; any process utilizing biogas and/or biomass as the only process energy sources which converts cellulosic biomass to fuel	
Q	**Renewable Compressed Natural Gas**, Renewable Liquefied Natural Gas, Renewable Electricity	Biogas from landfills, municipal wastewater treatment facility digesters, agricultural digesters, and separated MSW digesters; and biogas from the cellulosic components of biomass processed in other waste digesters	Any	**3 (Cellulosic biofuel)**

C. Information Submitted by San Joaquin Renewables

San Joaquin Renewables supplied all the information as required in 40 CFR 80.1416 that EPA needed to analyze the lifecycle GHG emissions associated with the CNG produced through the San Joaquin Renewables Pathway. The information submitted included a technical justification describing the requested pathway, 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. 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 and other 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 CNG produced through the San Joaquin Renewables Pathway under this petition request is consistent with the CAA's applicable requirements, including the definition of lifecycle GHG emissions and threshold evaluation requirements. In general, the analysis described below is based on "conservative" assumptions (i.e., assumptions that results in higher estimated lifecycle GHG emissions). 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 GHG reduction requirements for the optimum RFS renewable fuel qualification when conservative assumptions are used, then a more precise quantification of the matter is not required for purposes of a pathway determination.

Feedstock Production/Collection and Transport – San Joaquin Renewables proposes to use orchard wood residues and almond and pistachio nut shells as feedstocks. The orchard wood residues they propose to use include orchard prunings and trimmings and qualify as crop residues. According to the petition, the largest single source of orchard residue they intend to use is wood from almond trees that have reached the end of their economic life, primarily from Kern,

Tulare and Kings counties in California. The almond shells and pistachio shells come from nearby nut shelling operations and also qualify as crop residue. An important consideration in our lifecycle analysis was to determine the most likely fate of these materials if they are not used by San Joaquin to produce CNG (the "alternative fate") in order to assess any changes in emissions associated with instead using the materials as biofuel feedstock. This section starts with a discussion of potential alternative fates for the orchard wood residue feedstock, and then the almond and pistachio nut shell feedstocks. Next, we discuss the emissions associated with San Joaquin Renewables' use of these feedstocks, including collection and transport, compared to the most likely alternative fates for these materials.

We start with an analysis of the most likely alternative fate for orchard wood residue. According to their petition, the San Joaquin Renewables plant will consume a variety of orchard residue from the surrounding regions, including wood from almond, apple, apricot, cherry, citrus, fig, nectarine, olive, peach, pear, pecan, persimmon, plum, pomegranate, pistachio, walnut, and other tree crops. The biomass used includes wood from prunings, trimmings and unscheduled tree losses, but is mostly comprised of wood from the trees themselves. According to the San Joaquin Renewables petition, the California biomass industry and the literature tracking orchard removals for replanting do not differentiate between orchard types and wood species, and thus it is assumed that orchard wood from different tree species will have similar alternative fates. Based on records from the San Joaquin Valley Air Pollution Control District, the petition estimates that approximately three quarters of orchard waste in the California Central Valley is generated from almond orchards. The San Joaquin Renewables petition then focuses on almond wood, as there is more information on almond wood than other types of tree crops in the region due to the relatively large area of almond orchards and the greater frequency of almond replanting and tree removals.

San Joaquin Renewables identified the following as the most likely alternative fates for almond wood, and by extension all of the orchard wood used at their facility: biomass power plant or cogeneration plant fuel, open burning, incorporating chips into the soil (also known as whole orchard recycling), and surface mulch and temporary storage. Table 2 summarizes the amount of almond orchard wood that went to each of these alternative fates from 2015 to 2018 in the San Joaquin Valley Air Pollution Control District.

Table 2: Summary of the Alternative Fates of Almond Orchard Wood Removals in the San Joaquin Valley Air Pollution Control District from 2015-2018[4]

Alternative Fate	2015	2016	2017	2018	Total

[4] Data provided by San Joaquin Renewables based on communications with the San Joaquin Valley Air Pollution Control District and related public records requests. These data are largely similar to, and therefore supported by, research findings published online by the UC-Davis Whole Orchard Recycling program, see Figure B here: https://orchardrecycling.ucdavis.edu/environment.

Biomass Power / Cogeneration Plant	77%	43%	47%	54%	53%
Open Burning	10%	49%	43%	33%	37%
Incorporation of Chips into Soil	1%	1%	3%	5%	2%
Surface Mulch / Temporary Storage	12%	7%	7%	8%	8%
Total (Thousand Field-Dry Tons)	354	634	583	506	2077

As shown in the table above, approximately 90% of almond wood removed from orchards in this region in recent years was burned to generate electricity or burned openly in fields. In recent years biomass power and cogeneration plants in this region have been closed or idled due to expiring power purchase agreements, competition from wind, solar and other electricity sources, and other reasons. As of September 2019, there were five cogeneration plants operating in the San Joaquin Valley Air Pollution Control District with a combined nameplate capacity of 140 MW.[5] These plants are operating close to capacity and consuming approximately one million field-dry tons of biomass per year, only a fraction of which came from orchard wood removals (other sources include annual crop residues and urban wood removals). Open burning of agricultural wastes has increased significantly in recent years in the San Joaquin Valley as biomass power has declined, as well as for other reasons.[6] Although local authorities have sought alternatives to open burning to reduce air pollution, burn permits have been granted due to a lack of other outlets for agricultural residues in the region. On top of this, almond orchard wood removals are projected to increase in future years based on recent growth in almond plantings and assuming an average 25-year lifespan of almond trees.[7]

Based on the facts reviewed above on the fate of almond orchard wood removals in the region surrounding the San Joaquin Renewables plant, we believe open burning is the most likely alternative fate, for the foreseeable future, for the orchard wood residues used as feedstock by San Joaquin Renewables. The data shows that this region is generating more wood and other biomass than it can reasonably be expected to use for biomass power, soil amendments, or other purposes. Based on market forces and other factors biomass power appears to be trending downward and diminishing its capacity to absorb the orchard wood. This leaves open burning as the most likely fate for the orchard wood if it is not used as biofuel feedstock.[8]

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[5] California Biomass Energy Alliance. Facilities Map. January 2020. http://www.calbiomass.org/facilities-map/

[6] K. Klein, "NPR For Central California," Valley Public Radio, 1 May 2018. Online. Available: https://www.kvpr.org/post/despite-tight-restrictions-open-ag-burning-increases-valley

[7] 2019 California Almond Forecast (May 10, 2019) USDA, National Agricultural Statistics Service. http://www.almonds.com/sites/default/files/content/attachments/2019_NASS_Subjective_Forecast.pdf

[8] Other uses for orchard wood, such as whole orchard recycling, are being researched and promoted but their application is currently relatively small. If there are additional facility-specific petitions for orchard wood to biofuels we intend to review available data at that time to determine if open burning remains the primary alternative fate for this wood.

We then turn to the alternative fate of almond and pistachio shells. According to the San Joaquin petition, the only large scale use of almond shells is for livestock bedding, primarily for dairy cows. In California, the supply of almond shells is larger than the demand for their use as livestock bedding, in part because the dairy industry has been shrinking while the almond industry has been expanding. A large amount of these shells are mulched or stockpiled where they decompose aerobically and release carbon dioxide into the atmosphere over the relevant time period for our lifecycle analysis.[9] Pistachio shells are spread on gravel or unpaved roads for dust control, but these uses are saturated, and a large portion of the shells are also mulched or stockpiled. Thus, the alternative fate for these nut shells appears to be mulching or temporary storage – in both cases the nut shells would aerobically decompose.

For our analysis we considered two scenarios: (1) a baseline scenario where orchard wood residue is open burned and nut shells are mulched, and (2) the San Joaquin Renewables Pathway where orchard wood residue and nut shells are used as feedstocks to produce CNG. In both scenarios the trees are felled and piled in the field. When the wood is used for biofuel it is also chipped, using approximately 0.8 gallons of diesel fuel per dry ton of wood,[10] and transported to the San Joaquin Renewables facility. In both cases the shells are ground, and although they may be transported for stockpiling or spreading, as a conservative approach we assume that shells are not transported in the baseline scenario.

For open burning emissions, we used the combustion emissions factors for wood and woody residuals from the EPA Emissions Factors for Greenhouse Gas Inventories.[11] In addition to carbon dioxide, open burning of wood releases methane and nitrous oxide to the atmosphere. The methane and nitrous oxide emissions account for only 1.3% of the carbon dioxide-equivalent emissions from open burning wood. The mulching and aerobic decomposition scenario also includes diesel emissions from chipping the wood in the baseline, which would increase the baseline emissions by only 1 $kgCO_2e$/mmBtu. Therefore, the results of our analysis would not change significantly if we used mulching and aerobic decomposition as the alternative fate for the orchard wood. It should also be noted that reducing open burning of biomass has multiple air quality benefits including reductions in black carbon emissions, a potent contributor to climate warming.[12]

Based on information in the San Joaquin Renewables petition, we assumed the chipped wood and shells are transported 80 miles round trip by truck from the surrounding fields to the

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[9] Based on the lifecycle analysis methodology developed for the March 2010 RFS2 rule, EPA considers lifecycle GHG emissions over 30 years.

[10] Nati, Carla, Lars Eliasson, and Raffaele Spinelli. "Fuel Consumption and Productivity for Two Tractor-mounted Chippers in Relation to Knife Wear and Raw Material." Formec Austria 2011 Proceedings, October 13, 2011. https://www.formec.org/images/proceedings/2011/formec2011_paper_nati_etal.pdf.

[11] EPA Center for Corporate Climate Leadership. Emissions Factors for Greenhouse Gas Inventories. March 2018. https://www.epa.gov/sites/production/files/2018-03/documents/emission-factors_mar_2018_0.pdf

[12] EPA. 2012. Report to Congress on Black Carbon. March 2012. EPA-450/R-21-001

San Joaquin Renewables. For this feedstock transport we assumed truck capacity of 20.5 dry tons, and 0.2 gallons of diesel consumption per mile based on data from GREET-2019.[13]

Compressed Natural Gas Production – The San Joaquin Renewables facility will use a gasification and upgrading process called the BING Process, whereby a fluid bed gasifier is utilized to convert biomass, oxygen, and steam feedstock to synthesis gas (syngas), biochar, and ash. Several upgrading steps are undertaken to make the produced syngas suitable to add to the natural gas pipeline. San Joaquin Renewables provided mass and energy balance data for CNG production at their facility. These data are claimed as confidential business information. For chemical inputs, we used emission factors from the GREET model to determine the upstream emissions associated with producing those inputs.[14] For energy inputs, we used the same emission factors for electricity and diesel used in previous lifecycle GHG analyses for the RFS program.

The San Joaquin Renewables petition reports waste carbon dioxide as an output. This carbon dioxide is produced as a byproduct of the gasification and upgrading process. Because we included biogenic carbon dioxide emissions from burning or mulching the feedstock in the baseline scenario, we also account for the biogenic carbon dioxide emissions created during the production of CNG.

Fuel Transport and Use – For this analysis we used factors from GREET to calculate the emissions associated with transporting methane gas by pipeline and compressing the gas to CNG, as well as the tailpipe emissions from using CNG as transportation fuel. Our analysis accounts for tailpipe emissions of biogenic carbon dioxide to be consistent with the inclusion of biogenic carbon dioxide emissions in the baseline scenario.

We assumed the methane gas is transported 150 miles via pipeline.[15] Based on GREET-2018, we assumed that 46 Btu of natural gas energy is used for pipeline operation per million British thermal unit (mmBtu) mile of gas transport, and 0.12 grams of methane leakage from the pipeline network per mmBtu-mile of gas transport. Once the gas reaches the refueling location it is compressed. Based on GREET-2018, we assumed 21,820 Btu of grid electricity is used for compression per mmBtu of CNG produced. Emissions from vehicle combustion of landfill biogas CNG were based on the GREET-2018 emissions factors for a dedicated CNG vehicle.

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[13] Argonne National Laboratory. (2019). The GREET1-2019 is available for download at https://greet.es.anl.gov/. See Table 1.1 in the "Woody" tab, cells C49:F49.

[14] Material input emissions factors were based on values from GREET2-2018. For one chemical not found in GREET we relied on data published in the Journal of Chemical Engineering Processing Technologies.

[15] GREET-2018 assumes natural gas CNG is pipelined 750 miles, but that landfill biogas is pipelined only 50 miles. We used 150 miles for this analysis based roughly on the distance from McFarland, CA to Los Angeles, a potential market for CNG fueling.

Coproducts – Based on their petition, San Joaquin Renewables is planning to produce biochar, process water and liquid nitrogen as coproducts. Depending on the ultimate use of these coproducts, their production and use could result in significant carbon sequestration or reductions in GHG emissions. However, there is uncertainty regarding the ultimate use of these products. We took a conservative approach to evaluating the effect of these co-products on the lifecycle GHG emissions associated with the pathway evaluated. What follows is a brief description of how we accounted for each co-product.

According to the San Joaquin Renewables petition, the BING Process produces approximately 12 dry-tons of biochar per 100 dry tons of biomass feedstock processed. Biochar is a combination of unconverted carbon from the gasifier, ash that was in the biomass, and limestone that is added to the gasifier during operation. The biochar produced from the San Joaquin Renewables facility has a number of possible applications: (1) it can be used as a soil amendment to enhance soil carbon and moisture retention, (2) it may be briquetted and sold for use in household barbeque or kiln fuel for cement factories displacing other fossil fuels, or (3) it may be burned in powder form for heat and energy at the San Joaquin Renewables facility. In our analysis we assumed the biochar will be used as a soil amendment, although the determination that the pathway meets the GHG reduction threshold based on our analysis is not sensitive to this assumption.[16] Given the high production temperature of the BING Process, the biochar produced is expected to have an oxygen to carbon ratio below 0.1, indicating residence time for the carbon in the soil longer than 1,000 years.[17] For a conservative estimate, we assumed that 90% of the carbon contained in the biochar is stable, and assumed that the other 10% would be mineralized and emitted to the atmosphere as carbon dioxide within the 30-year period of our analysis. This resulted in biogenic carbon dioxide emissions of 2 kg per mmBtu of CNG produced.

The San Joaquin Renewables facility has the potential to produce excess water that could be treated onsite and sold for irrigation purposes to nearby farmers. We did not include any emissions credits for excess water in our analysis.

The San Joaquin Renewables facility will include a cryogenic air separation plant that will produce excess nitrogen. The nitrogen can be vented or liquefied and sold for industrial applications displacing other sources of liquid nitrogen. Due to the uncertainty of this market we did not include any credits for liquid nitrogen in our analysis, nor did we include the additional energy needed to liquify excess nitrogen.

Lifecycle GHG Results – Based on our analysis described above, we estimated the lifecycle GHG emissions associated with CNG produced through the San Joaquin Renewables

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[16] If we assume the biochar is burned, the lifecycle GHG emissions would increase by approximately 23 kgCO2e/mmBtu and result in a 73% reduction relative to the gasoline baseline.

[17] Spokas, K. 2010. "Review of the stability of biochar in soils: predictability of O:C molar ratios," *Carbon Management*, vol. 1, no. 2, pp. 289–303. See in particular Figure 5.

Pathway using orchard wood residue, almond shells, and pistachio shells as feedstocks. Table 3 shows the lifecycle GHG emissions associated with the CNG produced through this pathway, compared with a baseline where orchard wood residue is burned.

As shown in Table 3, CNG produced through the San Joaquin Renewables Pathway exceeds the CAA's 60% GHG reduction threshold for cellulosic biofuel. The CAA stipulates that the percent reduction is determined based on a comparison with the average 2005 diesel or gasoline, depending on which one is replaced by the biofuel in question. We compared CNG with baseline diesel because CNG transportation fuel is commonly used in transit buses, fleet vehicles and medium and heavy duty vehicles that would be more likely to use diesel in the baseline scenario.[18]

Table 3: Lifecycle GHG Emissions for CNG Produced Through the San Joaquin Renewables Pathway (kgCO2e/mmBtu)[19]

Lifecycle Stage	San Joaquin Renewables Pathway	2005 Diesel Baseline
Feedstock Collection & Transport		79
Avoided Wood Burning	-161	
Avoided Shell Aerobic Decomposition	-48	
Wood Chipping	1	
Wood and Shell Transport	1	
Gasification & Upgrading		
Material Inputs	1	
Feedstock Gasification	113	
Energy Use	31	
Co-Products	2	
Downstream		
Compression & Distribution	4	
Tailpipe	60	18
Net Emissions	**4**	**97**
Percent Reduction Relative to Baseline	**96%**	**--**

B. Application of the Criteria for Petition Approval

The San Joaquin Renewables petition request included a production process, feedstock category and fuel product already considered as part of the March 2010 RFS rule (75 FR 14670)

[18] If we compared CNG produced through the San Joaquin Renewables pathway with CNG produced from fossil natural gas, this would also result in a greater than 60% lifecycle GHG reduction.

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

and the July 2014 RFS rule (79 FR 42128). San Joaquin Renewables 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 CNG produced through the San Joaquin Renewables Pathway meets the 60 percent lifecycle GHG threshold requirement specified in the CAA for cellulosic biofuel.

The lifecycle GHG results presented above justify authorizing the generation of D-code 3 RINs for CNG produced through the San Joaquin Renewables Pathway, assuming that the fuel satisfies the definitional and other requirements 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 San Joaquin Renewables to generate RINs for CNG produced through the San Joaquin Renewables Pathway is expressly conditioned on San Joaquin Renewables satisfying all of the following conditions as detailed in this section, in addition to the other applicable requirements for 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, EPA may revoke this pathway approval if it determines that San Joaquin Renewables has failed to comply with any of the conditions specified herein. EPA has authority to bring enforcement action of 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 pathway approved in this document.

A. RIN Generation, Registration, Reporting and Recordkeeping Requirements

San Joaquin Renewables must adhere to the general RIN generation, registration, recordkeeping, and reporting requirements in 40 CFR Part 80, Subpart M that apply to renewable fuel producers, including the requirements for cellulosic biofuels. These requirements are found at 40 CFR 80.1426 for RIN generation, 40 CFR 80.1450 for registration, 40 CFR 80.1451 for reporting, and 40 CFR 80.1454 for recordkeeping. This condition applies to all pathways

approved through the petition process provided at 40 CFR 80.1416, but we restate it here for clarity and emphasis.

Additionally, EPA's determination that the orchard wood residue feedstock is predominantly cellulosic is predicated on the understanding that any remaining fruit or nuts are harvested before the biomass is removed from the orchard and used as a biofuel feedstock. This approval is conditioned on San Joaquin Renewables ensuring that the orchard wood residue feedstock contains no more than a *de minimis* amount of non-orchard wood biomass. Similarly, this pathway approval includes the use of almond and pistachio nut shells, which EPA has determined are crop residues. Other types of nut shells, in addition to almond and pistachio shells, may also qualify as feedstocks for use in the San Joaquin Renewables Pathway, and EPA could amend this pathway approval at a future date to include other types of nut shells. If San Joaquin Renewables seeks to use other nut shells as feedstocks in the San Joaquin Renewables Pathway, they will first need to submit and have EPA review and accept data on the cellulosic content and alternative uses for each kind of nut shell, in order to demonstrate that the nut shell is predominantly cellulosic and qualifies as crop residue under the RFS2 program.

B. Requirements for CNG sold for use as transportation fuel

The RFS regulations include requirements for CNG produced from biogas. For example, these sections of the regulations include the requirement that the quantity of biogas CNG for which RINs were generated was sold for use as transportation fuel and for no other purposes. Although San Joaquin produces CNG from orchard wood residue and almond and pistachio shells, not biogas, San Joaquin must satisfy all of the relevant regulatory requirements that apply to CNG produced from biogas. The regulations include but are not limited to the RIN generation requirements at 40 CFR 80.1426(f)(10)(ii) or (11)(ii) as applicable, the registration requirements at 40 CFR 80.1450(b)(1)(v)(D), and the recordkeeping requirements at 40 CFR 80.1454(k)(1). If the RFS regulatory requirements at 40 CFR Part 80, Subpart M related to CNG are supplemented or revised in the future, San Joaquin must continue to satisfy all of the relevant new or revised regulatory requirements that apply to CNG.

EPA may modify the conditions specified above, as it deems necessary and appropriate to ensure that fuel produced pursuant to the San Joaquin Renewables Pathway achieves the required lifecycle GHG reductions, including to make the conditions align with any future changes to the RFS regulations. If EPA makes any changes to the conditions noted in this document for fuel produced pursuant to the San Joaquin Renewables Pathway, the Agency will explain such changes in a public determination letter, similar to this one, and specify in that letter the effective date for any such changes.

V. Public Participation

The definition of cellulosic biofuel in CAA 211(o)(1) specifies that the term means renewable fuel that is "derived from any cellulose, hemicellulose, or lignin that is derived from

renewable biomass and that has lifecycle greenhouse gas emissions, as determined by the Administrator, that are at least 60 percent less than the baseline lifecycle greenhouse gas emissions." As part of the March 2010 RFS2 rule (75 FR 14670) and the July 2014 Pathways II rule (79 FR 42128) we took public comment on our lifecycle assessment of pathways involving the production of CNG, the use of crop residue, and the use of gasification and upgrading, including all models used and all modeling inputs and evaluative approaches.

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 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 RFS2 rule and the July 2014 Pathways II rule, and have adjusted the analysis to account for San Joaquin Renewables' process data, evaluation of emissions from alternative uses of the feedstocks, transport of the feedstocks to the facility, and evaluation of tailpipe emissions from CNG. This includes use of the same emission factors and types of emission sources that were used in previous 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 "cellulosic biofuel." Our approach today is also consistent with our description of the petition process in the preamble to the March 2010 RFS Rule and our promulgation of 40 CFR 80.1416, as our work in responding to the petition was a logical extension of analyses already conducted.

VI. Conclusion

Based on our assessment, CNG produced through the San Joaquin Renewables Pathway from orchard wood residue and almond and pistachio shells qualifies for D-code 3 RINs, provided all the conditions and associated regulatory provisions specified in Section IV of this document are satisfied, and 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 the San Joaquin Renewables facility in McFarland, California, and to the process, materials used, fuels produced, and process energy types and

amounts outlined and described in the petition request submitted by San Joaquin Renewables.[20] This approval is effective as of signature date. RINs may only be generated for CNG produced through the San Joaquin Renewables Pathway that is produced after the date of activation of San Joaquin Renewables' registration for the new pathway.[21] RINs for the San Joaquin Renewables Pathway may only be generated by San Joaquin Renewables.

The OTAQ Reg: Fuels Programs Registration and OTAQ EMTS Application will be modified to allow San Joaquin Renewables to register and generate RINs for compressed natural gas produced from crop residue using a production process of "BING Process."

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

[21] 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." After the San Joaquin Renewables Pathway has been activated, San Joaquin Renewables may use orchard wood residues and almond and pistachio shells to generate D-code 3 RINs for fuel produced through the San Joaquin Renewables Pathway.