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

DEC - 2 2014

OFFICE OF
AIR AND RADIATION

Mr. Paul Woods
Chief Executive Officer
Algenol Biofuels, Inc.
16121 Lee Road, Suite 110
Fort Myers, Florida 33912

Dear Mr. Woods:

You petitioned the Agency on behalf of Algenol Biofuels, Inc. (Algenol) to approve a pathway for the generation of advanced biofuel RINs under the renewable fuel standard (RFS) program for ethanol produced by photosynthetic cyanobacteria using a proprietary production process called the Algenol Direct-to-Ethanol Process (the "Algenol DTE Process"). In the Algenol DTE Process, ethanol is produced from photosynthetically produced pyruvate, and secreted by the cyanobacteria into the surrounding aqueous media, and then isolated and purified for use as a transportation fuel. Additionally, the algal biomass created is processed to extract and produce a bio-oil co-product, and the remaining spent biomass is gasified to produce bio-methane that is used onsite in a combined heat and power (CHP) unit.

Through the petition process described under 40 CFR 80.1416, Algenol submitted data to the EPA to perform a lifecycle greenhouse gas (GHG) analysis of the Algenol DTE Process. This analysis involved a straightforward application of the same methodology and much of the same modeling used for previous RFS rulemakings.

The attached document, "Algenol Biofuels Request for Fuel Pathway Determination under the RFS Program," describes the data submitted by Algenol, the analysis conducted by the EPA, and our determination of the lifecycle greenhouse gas emissions associated with the fuel production pathway described in Algenol's petition. It also includes a full definition of the Algenol Pathway and the Algenol DTE Process evaluated by the EPA.

Based on our assessment, ethanol produced through the Algenol Pathway qualifies under the Clean Air Act (CAA) for advanced biofuel (D-code 5) RINs, assuming that the fuel meets the other definitional criteria for renewable fuel (e.g., used to reduce or replace petroleum-based transportation fuel, heating oil or jet fuel) specified in the CAA and EPA's implementing regulations.

This approval applies specifically to Algenol Biofuels Inc., and to the process, materials used, fuel produced, co-products produced, and process energy sources as outlined and described in the petition request submitted by Algenol. This approval is effective as of signature date. EPA will consider extending a similar approval to other petitioners utilizing similar fuel pathways as Algenol, but will do so on a case-by-case basis upon verification that the pathway described in the petition meets the applicable CAA requirements.

The OTAQ Reg: Fuels Programs Registration and OTAQEMTS: OTAQ EMTS Application will be modified to allow Algenol to register and generate RINs for advanced ethanol produced from cyanobacteria through the Algenol Pathway using a production process of "Algenol DTE Process."

Sincerely,

Christopher Grundler, Director
Office of Transportation and Air Quality

Enclosure

Algenol Biofuels Request for Fuel Pathway Determination under the RFS Program
Office of Transportation and Air Quality

Summary: Algenol Biofuels Inc. ("Algenol") petitioned the Agency under the Renewable Fuel Standard (RFS) program for approval to generate advanced biofuel (D-code 5) RINs for ethanol produced by photosynthetic cyanobacteria, using as energy sources only electricity and heat that are produced from an onsite combined heat and power (CHP) unit that is powered exclusively by a combination of natural gas and bio-methane, and using saltwater, waste carbon dioxide, (CO_2) and fertilizer as process inputs to produce ethanol through a fermentation process that occurs within the cyanobacteria. Ethanol is produced from photosynthetically produced pyruvate and secreted by the cyanobacteria into the surrounding aqueous media, and the ethanol is then isolated and purified through methods described in the Algenol petition and claimed as confidential business information (CBI). The algal biomass created is processed to extract and produce a bio-oil coproduct, and the remaining spent biomass is gasified to produce bio-methane that is used in the CHP unit. Algenol's fuel production process uses no more than 50.8 MJ of natural gas per gallon of ethanol produced.[1] The entire process as described in this paragraph is referred to in this document as the "Algenol Pathway" with respect to ethanol production or, more generally, as the Algenol Direct-to-Ethanol Process ("Algenol DTE Process").

The cyanobacteria grown by Algenol simultaneously accumulates biomass and produces ethanol. The simultaneous growth of biomass and production of ethanol is referred to as continuous consolidated biomass and biofuel production ("CCBBP"). The accumulated biomass can be treated to generate an algal bio-oil coproduct used to produce biodiesel, renewable diesel, or other bio-oil derived products. The algal bio-oil to biodiesel/renewable diesel pathway already exists as a qualifying pathway under the RFS regulations and will not require a new pathway, therefore this determination document focuses only on the cyanobacteria to ethanol process. Based on data submitted by Algenol, available information regarding typical chemical and biochemical unit processes, and EPA's assessment in the March 2010 RFS rule (*75 FR 14670, March 26, 2010*) of the GHG emissions associated with ethanol distribution and use, EPA conducted a lifecycle assessment estimating that ethanol produced through the Algenol Pathway reduces lifecycle greenhouse gas (GHG) emissions compared to the statutory petroleum baseline by 69%. Based on these results we have determined that ethanol produced by the Algenol Pathway meets the 50% lifecycle greenhouse gas reduction requirement for advanced biofuel (D-Code 5) RINs.

This document is organized as follows:

- *Section I. Required Information and Criteria for Petition Requests*: This section is not specific to Algenol's request and applies to all petitions submitted pursuant to 40 CFR 80.1416. This

[1] For the purposes of this determination document, MJ and Btu are expressed on a lower heating value (LHV) basis and gallons of ethanol are expressed on an undenatured (neat) basis.

section contains 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.

- *Section II. Available Information*: This section contains background information on Algenol and describes the information that Algenol provided and how it complies with the petition requirements outlined in Section I.
- *Section III. Analysis and Discussion*: This section describes the lifecycle analysis done for today's determination and identifies how it differs from the analyses done for previous rulemakings. This section also describes how we have applied the lifecycle results to determine the appropriate D-code for ethanol produced through the Algenol Pathway.
- *Section IV. Public Participation*: This section describes how this petition is an extension of the analysis done as part of previous RFS rules.
- *Section V. Conclusion*: This section summarizes our conclusions regarding Algenol's petition, including the D-code Algenol may use in generating RINs for ethanol produced using the Algenol Pathway.

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 ("CAA") Section 211(o) required by the Energy Independence and Security Act of 2007 ("EISA"), EPA adopted new regulations, published at 40 CFR Part 80 Subpart M that 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 Renewable Identification Numbers ("RINs") for the qualifying renewable fuels they produce through approved fuel pathways.[2]

Pursuant to § 80.1426(f) (1) of the regulations:

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, paragraph (f)(6) of this section, or as approved by the Administrator.

Table 1 to § 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 § 80.1416. In addition, producers of facilities

[2] See EPA's website for information about the RFS regulations and associated rulemakings: http://www.epa.gov/otaq/fuels/renewablefuels/regulations.htm

identified in 40 CFR 80.1403(c) and (d) that are exempt from the 20% GHG emissions reduction requirement of the Act may generate RINs with a D code of 6 pursuant to § 80.1426(f)(6) for a specified baseline volume of fuel.

The petition process under § 80.1416 allows parties to request that EPA evaluate a new fuel pathway's lifecycle GHG reduction and provide a determination of the D code for which the new pathway may be eligible. EPA will consider extending a similar approval to other petitioners utilizing similar fuel pathways as Algenol upon verification that the pathway is sufficiently similar, and assuming all other requirements are met.

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 § 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.
- 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 the following, and should also include as appropriate supporting information such as state, county, or regional crop data, commodity reports, independent studies, industry or farm survey data, and reports or other documents supporting any claims:

- Type of feedstock and description of how it meets the definition of renewable biomass.
- Market value of the feedstock.
- List of other uses for the feedstock.
- List of chemical inputs needed to produce the renewable biomass source of the feedstock and prepare the renewable biomass for processing into feedstock.

- Energy needed to obtain the feedstock and deliver it to the facility. If applicable, identify energy needed to plant and harvest the source of the feedstock and modify the source to create the feedstock.
- Current and projected yields of the feedstock that will be used to produce the fuels.
- Other additional information as requested by the Administrator to complete the lifecycle greenhouse gas assessment of the new fuel pathway.

II. Available Information

A. Background on Algenol Biofuels

Algenol petitioned the Agency under the RFS program to generate advanced biofuel RINs for ethanol made by cyanobacteria through the Algenol Pathway. Based on the requests in the petition, EPA is clarifying that the bio-oil co-product produced through the Algenol DTE Process qualifies as an algal oil feedstock in Rows F and H of Table 1 to § 80.1426. Analysis conducted for this determination only addresses Algenol's production of ethanol from cyanobacteria. A petition is required because the production of ethanol through a process such as that used in the Algenol Pathway is not an existing approved pathway in Table 1 to § 80.1426.

B. Information Available Through Existing Modeling

A fuel pathway under the RFS regulations (40 CFR Part 80 Subpart M) is defined by three components: (1) fuel type, (2) feedstock, and (3) production process. The pathway addressed in Algenol's petition involves the production and secretion of ethanol by cyanobacteria, and subsequent isolation and purification of the ethanol. The CAA specifies that "algae" qualify as renewable biomass, and in the March 2010 RFS rule EPA determined that the term "algae" broadly includes cyanobacteria (which is also known as bluegreen algae).[3] GHG emissions associated with sourcing and transporting the saltwater, waste CO_2, and fertilizer required for the growth of cyanobacteria were considered among the upstream GHG emissions in this analysis. However, all other GHG emissions associated with growing cyanobacteria were evaluated within the fuel production stage of the lifecycle analysis since cyanobacteria production occurs simultaneously in the same reaction vessel (in this case a photobioreactor) as ethanol production. No new modeling of the emissions associated with ethanol distribution and use was required because in the March 2010 RFS rule EPA previously estimated the GHG emissions from the distribution and end use of ethanol, and has used these estimates for this analysis. This petition only requires EPA to evaluate a modified fuel production process (including the upstream emissions associated with the process). This was a straightforward analysis based on the modeling methods used for prior RFS rules and substituting Algenol's process data, which only altered

[3] Federal Register. Vol. 75; No. 58. Friday, March 26, 2010. Rule and Regulations p. 14697.

the fuel production process. Certain emissions factors outlined in the March 2010 RFS rule such as for fertilizer production, natural gas and grid electricity were applied in this analysis.

Information Submitted by Algenol Biofuel

Algenol supplied all the information as required in 40 CFR 80.1416 that EPA needed to analyze the lifecycle GHG emissions associated with ethanol produced through the Algenol Pathway. The information submitted included a technical justification that has a description of the fuel, material inputs, and Algenol's proprietary 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.

III. Analysis and Discussion

A. Lifecycle Analysis

Determining a fuel pathway's compliance with the lifecycle GHG reduction thresholds specified in the CAA for different types of renewable fuel requires a comprehensive evaluation of the renewable fuel, as compared to the baseline gasoline or diesel that it replaces,[4] on the basis of its lifecycle GHG emissions. As mandated by the CAA, the GHG emissions assessments must evaluate the aggregate quantity of GHG emissions (including direct emissions and significant indirect emissions such as significant emissions from land use changes) related to the full lifecycle, including all stages of fuel and feedstock production, distribution, and use by the ultimate consumer.

In examining the full lifecycle GHG impacts of renewable fuels for the RFS program, 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 ethanol produced through the Algenol Pathway under this petition request is consistent with the CAA's applicable requirements,

[4] As specified in EISA, "The term 'baseline lifecycle greenhouse gas emissions' means the average lifecycle greenhouse gas emissions, as determined by the Administrator, after notice and opportunity for comment, for gasoline or diesel (whichever is being replaced by the renewable fuel) sold or distributed as transportation fuel in 2005."

including the definition of lifecycle GHG emissions and threshold evaluation requirements. It was based on previous lifecycle analysis modeling that EPA completed for previous RFS rules as well as information regarding the Algenol Pathway that was submitted under a claim of CBI by Algenol on June 17, 2014. The information provided included the mass and energy balances necessary for EPA to evaluate the lifecycle GHG emissions of ethanol produced through the Algenol Pathway.

Feedstock and Fuel Production

Upstream Emissions: CO_2, Saltwater and Fertilizer Acquisition/Production and Transport – The Algenol Pathway involves the simultaneous consolidated production of feedstock material (cyanobacteria) and fuel (ethanol). The cyanobacteria are grown in saltwater, and concentrated waste CO_2 and fertilizer are added to promote growth. Algenol provided, as part of the information claimed as CBI, their process yields in terms of tonnes of CO_2, saltwater, and fertilizer used per tonne of finished ethanol. Upstream GHG emissions include waste CO_2 collection and transport, saltwater procurement, and fertilizer production and transport. Production of the CO_2 is not included within the lifecycle boundary because it is a waste material from an industrial process that would have been vented to the atmosphere if not collected for Algenol's use. Algenol's petition specifies that its facilities will source their CO_2 from adjacent industrial emitters with the ability to capture and deliver the CO_2 with the appropriate purity to Algenol.[5] Given this information, lifecycle emissions associated with the capture and delivery of CO_2 were determined to be 0.40 kilograms CO_2 equivalent per million British thermal units of ethanol ("$kgCO_2e$/mmBtu-ethanol").

To estimate the GHG emissions associated with procuring saltwater required for the Algenol process, EPA used an assumed depth of 100 meters based on information in the Lou et. al paper provided as part of Algenol's petition submission,[6] which reported an energy requirement factor for the saltwater pumping of 0.0066 mega joules ("MJ") per MJ of ethanol produced through the Algenol DTE Process. EPA estimated that saltwater procurement contributes 1.45 kg CO_2e/mmBtu-ethanol, assuming that the pumping is accomplished using grid electricity. We view this as a conservative estimate (i.e., the GHG emissions are likely to be less than we estimated) because the energy requirement factor in Lou et. al does not account for the increased ethanol yields (per gallon of water consumed) that have taken place in the Algenol DTE Process since its 2010 publication, nor does it account for the fact that the electricity would be produced from the onsite CHP unit rather than obtained from the grid.

The GHG emissions associated with the fertilizer used in the Algenol DTE Process were estimated as the sum of the emissions associated with the production and transportation of sodium

[5] Algenol's use of industrial waste CO_2 that would have been vented to the atmosphere if not collected for use by Algenol is a critical element of the Algenol Pathway considered in this document. Use of a different source of CO_2 would mean it is producing fuel through a pathway other than the Algenol Pathway evaluated here.

[6] Luo et. al. 2010. *"Life Cycle Energy and Greenhouse Gas Emissions for an Ethanol Production Process Based on Blue-Green Algae"*. Environmental Science and Technology. 2010. 44, 8670-8677

nitrate and monocalcium phosphate. Based on GHG emissions factors for fertilizer production our analysis for the March 2010 rule,[7] and data provided in the Algenol petition, EPA estimated that fertilizer production and transport would contribute 0.53 kg CO_2e/mmBtu-ethanol.

Upstream Emissions: Bioreactor Production – Although GHG emissions associated with facility infrastructure are not typically included in EPA's lifecycle assessments, Algenol's photobioreactors are unusual in that they have scheduled replacements within the lifetime of the facility. Therefore, while steel, concrete and other materials used to construct and operate Algenol's facility were not considered, the raw materials used to produce Algenol's photobioreactors were assessed and are included here. The dimensions, characteristics, spatial distribution, replacement frequency, and associated fuel yield of Algenol's photobioreactors were provided under claim of CBI in their petition. The photobioreactors used by Algenol are made of a specific type of high density polyethlene ("HDPE"). To estimate the GHG emissions associated with producing the HDPE required for each reactor, EPA used emissions factors reported by Luo et. al (1.28 kg CO_2e/kg polyethylene). Based on this information, EPA estimated that bioreactor production contributes 1.00 kg CO_2e/mmBtu-ethanol.

Feedstock and Fuel Production: Simultaneous Production of Renewable Biomass and Fuel – In addition to the energy used to produce CO2 and saltwater for the CCBBP process, the Algenol DTE Process requires a substantial amount of energy for isolating ethanol from the saltwater growth medium and purifying it to fuel grade, through processes that Algenol has claimed as CBI. The lifecycle GHG emissions for the fuel production stage of the Algenol Pathway includes the use of natural gas[8] to power the onsite CHP unit that supplies all of the system's electrical requirements and heat demands. For the pipeline natural gas used in the Algenol DTE Process, we used the emissions factor from the March 2010 RFS rule for average natural gas supplied in the United States (69 kg CO_2e/mmBtu). Based on Algenol's reported process parameters and data, we estimated the total lifecycle GHG emissions for the combined feedstock and fuel production stage to be 46 kg CO_2e/mmBtu-ethanol.

Co-Products Credits –The Algenol DTE Process proceeds via four distinct steps: 1) simultaneous biomass and ethanol accumulation, 2) ethanol isolation and purification, 3) hydrothermal liquefaction of concentrated microbial biomass, and 4) gasification of residual organic matter. Bio-oil and biomethane are generated by hydrothermal liquefaction ("step three") and gasification of residual organic matter ("step four"), respectively. The bio-oil produced during step three can be used to produce a variety of industrial products typically derived from other vegetable oils, or it can be refined

[7] The Greenhouse Gases. Regulated Emissions, and Energy Use in Transportation (GREET) Model. (2013). Agricultural inputs spreadsheet. Argonne National Laboratory. https://greet.es.anl.gov/

[8] Algenol's use of biogas to offset some of the natural gas for its CHP unit is treated as a credit, as discussed in the next section.

into a finished transportation fuel such as biodiesel, gasoline, diesel, or jet fuel.[9] EPA considered a number of scenarios to account for avoided GHG emissions associated with Algenol's bio-oil coproduct, such as assuming it would be refined into renewable diesel incorporated into an overall lifecycle carbon intensity for the combined fuel products, or assuming that the bio-oil remained unused with no credit for the bio-oil at all. However, EPA determined that it is appropriate to offer a credit based on the assumption that Algenol's bio-oil coproduct would displace another renewable oil feedstock. This is an appropriate assumption because it does not disregard the value of the bio-oil co-product, or require additional assumptions about its downstream processing and end-use.

EPA estimated a credit for the bio-oil co-product by assuming that Algenol's by-product bio-oil displaces a mass equivalent amount of soybean oil, as soybean oil is the most commonly used biomass-based diesel feedstock in the United States.[10] For this analysis, EPA applied a credit of 0.65 kg CO_2e per pound of soybean oil, based on EPA's lifecycle analysis of soybean oil biodiesel for the March 2010 RFS rule. The difference between the emissions associated with soybean oil production, and the emissions associated with the production of Algenol bio-oil served as the basis for the co-product credit. The emissions reductions were normalized to the energy content of ethanol generated by the Algenol DTE Process. Based on this analysis EPA determined that a credit of 11.6 kg CO_2e/mmBtu-ethanol can be offered for Algenol's bio-oil co-product.[11]

Algenol's petition specifies that the methane generated in step four is used to offset natural gas in the CHP unit. EPA determined that the corresponding emissions offset is 9.75 kg CO_2e/mmBtu-ethanol if the biogas is used in the CHP unit as outlined in the petition. The co-product credit listed in Table 1 represents the sum of the bio-oil and renewable methane co-product credits.

Fuel distribution and use – The fuel type, ethanol, and hence the fuel distribution and use for ethanol, was already considered as part of the March 2010 RFS rule. Therefore, we applied the existing fuel distribution and use lifecycle GHG impacts for corn starch ethanol to our analysis of Algenol's petition. The emissions factor for ethanol distribution and use is 2.1 kgCO_2e per mmBtu of ethanol.

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[9] Rows F and H of Table 1 to §80.1426 list approved fuel pathways for algal oil feedstocks. The co-product bio-oil produced by the Algenol DTE Process is an algal oil. Per these established RFS pathways, fuels produced from Algenol bio-oil qualifies for advanced (D4 or D5) RINs.

[10] Compared to other commonly used biomass-based diesel feedstocks, such as used cooking oil and waste grease, it is more likely that soybean oil would be displaced because it is a higher cost feedstock and can alternatively be used as cooking oil.

[11] EPA also calculated whether it would make a difference for purposes of qualifying ethanol produced through the Algenol Pathway as advanced biofuel if it were assumed that the bio-oil were used to produce RIN-generating renewable diesel, jet fuel, naphtha and LPG using a hydrotreating production process. EPA estimated that under such a scenario both the ethanol and renewable diesel would meet the 50% advanced biofuel lifecycle GHG reduction threshold.

Lifecycle GHG Results – Based on the analysis described above, we estimated the total lifecycle GHG emissions associated with ethanol produced through the Algenol Pathway. The results are set forth in Table 1. We also evaluated the lifecycle GHG reduction obtained by the Algenol Pathway as compared to the 2005 gasoline baseline.

Table 1: Lifecycle GHG Emissions from the Algenol Pathway (kgCO2e/mmBtu)[12]

Lifecycle GHG Emissions		
Lifecycle Stage	Algenol Ethanol (kg CO_2eq/mmBtu-ethanol)	2005 Gasoline Baseline (kg CO_2eq/mmBtu-diesel)
Upstream emissions	3	--
Fuel production	46	19
Fuel distribution and use	2	79
Emission credits	-21	--
Total emissions	30	98
Change from gasoline baseline	**69%**	

B. Application of the Criteria for Petition Approval

Algenol provided all necessary information required for this type of petition request. Algenol's petition request involved a consolidated feedstock and fuel production process, which simplified the analysis required for this lifecycle determination, and the fuel product had already been considered as part of the March 2010 RFS rule.

Based on the data submitted and information already available through analyses conducted for previous RFS rulemakings, EPA conducted a lifecycle assessment and determined that ethanol produced pursuant to the Algenol Pathway meets the 50% lifecycle GHG threshold requirement specified in the CAA for advanced biofuel RINs (D-Code 5).

Compared to the statutory petroleum baseline, ethanol produced pursuant to the Algenol Pathway results in a 69% reduction in lifecycle GHG emissions. These results justify allowing the generation of advanced biofuel RINs for ethanol produced through the Algenol Pathway, assuming that the fuel meets the other definitional criteria for renewable fuel (e.g., used to reduce or replace

[12] Lifecycle GHG emissions are normalized per mmBtu of RIN-generating fuel produced. Totals may not be the sum of the rows due to rounding.

petroleum-based transportation fuel, heating oil or jet fuel) specified in the CAA and EPA implementing regulations.

IV. Conditions and Associated Regulatory Provisions

The authority for Algenol to generate RINs pursuant to the Algenol Pathway is expressly conditioned on Algenol satisfying all of the applicable requirements for renewable fuel producers set forth in the RFS regulations and all of the conditions set forth in this document. The conditions specified herein are enforceable under the CAA. They are established pursuant to the informal adjudication reflected in this decision document, and also pursuant to regulations cited below and 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 for any violations, EPA may revoke this pathway approval if it determines that Algenol has failed to comply with any of the conditions specified herein.

A. Registration

In addition to the general registration provisions in 40 CFR subpart M that apply to renewable fuel producers, the EPA is specifying pursuant to 40 CFR 80.1450(i) and 80.1416(b)(2)(vii), that for registration of the pathway for production of ethanol through the Algenol Pathway, Algenol must have registration materials accepted by EPA that include a plant specific plan detailing how Algenol intends to demonstrate on an ongoing basis, and document through records to be maintained for a minimum of five years from the date of RIN generation, that its material inputs, process operations, energy demands, and fuel and co-product outputs conform to the definition of the "Algenol Pathway" in this decision document, including the requirement that Algenol use no more than 50.8 MJ of natural gas per gallon of ethanol produced.

B. Reporting

Algenol must adhere to the general reporting requirements in 40 CFR subpart M that apply to renewable fuel producers. EPA is interpreting the regulations regarding the types and quantities of feedstocks used pursuant to § 80.1451(b)(1)(ii)(K) to require that Algenol report the quantity of carbon dioxide and saltwater used to produce ethanol through the Algenol Pathway.

C. Recordkeeping

Algenol must adhere to the general recordkeeping requirements in 40 CFR subpart M that apply to renewable fuel producers. EPA is interpreting the requirements related to the type and quantity of fuel used for process heat pursuant to § 80.1454(b)(3)(vii) to refer to the amount of natural gas and

biomethane used to produce ethanol via the Algenol Pathway. Use by Algenol of any other energy type in the production of ethanol would be inconsistent with this pathway approval. In addition, Algenol must adhere to the recordkeeping elements of the plant-specific plan developed and accepted at registration, and referenced in Paragraph IV.A.

D. RIN Generation

Algenol must adhere to the general RIN generation requirements specified in 40 CFR 80.1426. In addition, Algenol may only generate RINs pursuant to the Algenol Pathway approved in this decision document if the fuel is produced in accordance with the Algenol Pathway as defined in this document, including the requirement that Algenol use no more than 50.8 MJ of natural gas per gallon of ethanol produced.[13]

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 RFS rule, we took public comment on our lifecycle assessment of pathways involving the production of ethanol, 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 significant new modeling. See 58 FR 14797 (March 26, 2010).

In responding to this petition, we have largely relied on the same modeling that we conducted for prior rules, and have simply adjusted the analysis to account for Algenol's data. These analyses did not require additional feedstock modeling, and when applicable, include use of the same emission factors and types of emission sources that were used in prior RFS rules. Thus, the fundamental

[13] The petition submitted by Algenol indicates that their process would use less natural gas and would produce a bio-oil co-product. However, we have determined included the requirement that if Algenol uses no more than 50.8 MJ of natural gas per gallon of ethanol produced to ensure ethanol produced through the Algenol pathway will meet the 50% GHG emission reduction threshold required for advanced renewable fuels.

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 definition 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, ethanol produced through the Algenol Pathway qualifies under the CAA for advanced biofuel (D-code 5) RINs, assuming that the fuel meets the other definitional criteria for renewable fuel (e.g., used to reduce or replace petroleum-based transportation fuel, heating oil or jet fuel) specified in the CAA and EPA's implementing regulations.

This approval applies specifically to Algenol Biofuels Inc., and to the process, materials used, fuel produced, co-products produced, and process energy sources as outlined and described in the petition request submitted by Algenol.[14] This approval is effective as of signature date. EPA will consider extending a similar approval to other petitioners utilizing similar fuel pathways as Algenol, but will do so on a case-by-case basis upon verification that the pathway described in the petition meets the applicable CAA requirements.

The Algenol Pathway does not meet the requirements for delayed RINs outlined in §80.1426(g) because the complete petition was not received by EPA by January 31, 2011, as required by §80.1426(g)(1)(i)(A).

The OTAQ Reg: Fuels Programs Registration and OTAQEMTS: OTAQ EMTS Application will be modified to allow Algenol to register and generate RINs for advanced ethanol produced from cyanobacteria through the Algenol Pathway using a production process of "Algenol DTE Process."

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