POET Method 2A Application

Utilizing CARB Draft Application Form, Version 9 (Dated 11/1/2010)

I. Application Submission Date: February 20, 2011

II. Company Contact Information

a. Company Name: POET, LLC

b. Mailing Address:

Address Line 1	4615 N. Lewis Ave
Address Line 2	
City	Sioux Falls
State/Province	SD
Zip/Postal Code	57104

c. Main Company Phone Number: 605-965-2200

d. Secondary Company Phone Number:

e. Fax number: 605-965-2203

f. Company Web Site URL: www.poet.com

g. Primary Method 2A/2B Contact Person:

Name: Erin Heupel

Position/Title: Director of Environment & Technology

Email Address: Erin.Heupel@POET.COM

Office Phone Number: (605) 965-3591 x10591

Mobile Phone Number:

Fax Number:

h. Consultant/Third Party Application Preparer:

Name: Jim Lyons

Position/Title: Senior Partner

Affiliation/Firm: Sierra Research

Email Address: jlyons@sierraresearch.com

Office Phone Number: 916-444-6666

Mobile Phone Number:

Fax Number: 916-444-8373

Consulting entity's web site URL: www.sierraresearch.com

i. LCFS Reporting Tool Organization ID code (if known):

j. U.S. Environmental Protection Agency (U.S. EPA) Company ID (if known):

k. U.S. EPA Facility ID (if known):

III. Pathway Information

a. Pathway application type. Applicants are encouraged to discuss their pathway application types with ARB staff before proceeding. Please check one box only.

☒ Method 2A: Sub-pathway ☐ Method 2B: New Pathway

b. Brief description of proposed pathway. Please emphasize the important innovations and/or distinctive characteristics associated with the proposed pathway or sub-pathway

This application details Midwest corn ethanol production via 6 distinct dry-mill production processes developed by POET, LLC. Five of the 6 processes produce both wet and dry DGS co-products, and one process (as evaluated in this application) only produces dry DGS co-product. Given that Carbon Intensity, or CI, for wet and dry DGS co-products are evaluated separately in this application, the 6 processes represent 11 distinct sub-pathways in this application (again since dry and wet DGS co-products are handled separately). The 6 individual processes are described as follows.

1. **Raw Starch Hydrolysis (RSH)**

   With the traditional ethanol dry grind process used in the reference processes, the corn kernels are crushed without removing their components and then slurried with water and alpha amylase (an enzyme that breaks starch down into maltose). The slurry is then cooked at high temperatures to gelatinize and liquefy the starch (i.e., the liquefaction process). After liquefaction, the mash is cooled, and gluco amylase (enzymes that break starch down into glucose) are added to convert the liquefied starch into fermentable sugars - a process known as saccharification. Finally, yeast is added to the mash to ferment the sugars to ethanol and carbon dioxide (i.e., the fermentation process).

   In comparison, the raw starch hydrolysis method utilized in POET process number 1 eliminates the cooking step described above. Specifically, the cold

cook process, which occurs at 86 to 104 degrees Fahrenheit, eliminates the liquefaction and saccharification steps. The ground corn is slurried with water and both gluco amylases and alpha amylases, followed directly by fermentation. The percentage of natural gas and electricity energy used for the dry DGS RSH process is 88.1% and 11.9%, respectively; for the wet DGS process, the percentages are 81.5% and 18.5 %. Data show that ethanol yield (gallons/bushel) increases with RSH over conventional methods.

2. Raw Starch Hydrolysis/Combined Heat and Power

This process follows the basic RSH process described in process 1, with the addition of an energy system configuration that utilizes wasted heat from electricity generation to generate a significant part of the plant's process (thermal) energy requirements. The percentage of natural gas and electricity energy used for the dry DGS process is 96.0% and 4.0%, respectively; for the wet DGS process, the percentages are 93.7% and 6.3%.

3. Raw Starch Hydrolysis/Solid Waste & Landfill Gas Fuels

This process follows the basic RSH process described in process 1, except the energy is provided by a mix of process fuels for the dry DGS processes as follows:

Energy Source	% Use (Dry DGS)
Electricity	12.5
Natural Gas	61.2
Landfill Gas	10.5
Waste Wood	12.2
Field Waste	2.6
Thin Stillage	0.9

Landfill gas is supplied by a 11-mile pipeline from the municipally operated landfill directly to the POET facility.

This process produces 100% dry DGS co-product.

4. Raw Starch Hydrolysis/Corn Fractionation

This process adds one extra step to the first component of the process described in the RSH process 1 above. Corn fractionation separates the corn "germ" from the rest of the kernel. The germ contains non-fermentable components (i.e., oil, protein, and enzymes) and its removal at the beginning of the process results in a higher percentage of starch in the slurry, which requires a lower dose of enzymes to process. In addition, the removal of non-fermentable compounds reduces energy requirements associated with the drying load. The percentage of natural gas and electricity energy used for the dry DGS process is 87.9% and 12.1%, respectively; for the wet DGS process, the percentages are 77.6% and 22.4%. The result of POET's fractionation process is differentiated, multiple DGS co-products of bran, syrup (solubles), full-gat germ, high-protein DGS and DGS.

5. Conventional Cook Process/Combined Heat and Power

This is the traditional ethanol dry grind process used in the CARB reference process (described in process 1 above) with the addition or an energy system

configuration that utilizes wasted heat from electricity generation to generate a significant part of the plant's process (thermal) energy requirements (also used in process 2), and a liquid carbon dioxide by-product at the end of the process. The percentage of natural gas and electricity energy used for the dry DGS process is 97.5% and 2.5%, respectively; for the wet DGS process, the percentages are 96.1% and 3.9%.

6. Raw Starch Hydrolysis, Biogas Fuel

This process is identical to process 1 described above, with biogas used as the primary process fuel (rather than natural gas used by process 1). The percentage of biogas and electricity energy used for the dry DGS process is 88.1% and 11.9%, respectively; for the wet DGS process, the percentages are 81.5% and 18.5%. The biogas is delivered via pipeline directly from an adjacent facility which produces the biogas.

c. For Method 2A Applications only:

1. Reference pathway (Existing fuel pathway to which the proposed new sub-pathway is most closely related). The carbon intensity of the reference pathway must be higher by at least 5 gCO_2e/MJ than the carbon intensity of the proposed pathway described in this application. Show all pathway information exactly as it appears in the LCFS Lookup Table:

Fuel: Ethanol from Corn

Pathway Description: There are 4 Reference Pathways as part of this application for direct comparison to the 11 newly defined sub-pathways:

(1) Midwest; Dry Mill; Dry DGS; NG
(2) Midwest; Dry Mill; Wet DGS; NG[1]
(3) Midwest; Dry Mill; Dry DGS; 80% NG 20% Biomass[2]
(4) Midwest; Dry Mill; Wet DGS; 80% NG 20% Biomass[3]

Carbon Intensity Values (gCO_2e/MJ):

Direct Emissions: In numeric order listed above:

(1) 68.40 g CO2e/MJ
(2) 60.10 g CO2e/MJ
(3) 63.60 g CO2e/MJ
(4) 56.80 g CO2e/MJ

[1] Reference pathways (1) and (2) are most closely related to the sub-pathways from POET processes 1, 2, 4 and 5 as described in III.b (for dry and wet DGS co-products, respectively).
[2] Reference pathway (3) is most closely related to the sub-pathways from POET processes 3 and 6 as described in III.b (for dry DGS co-products).
[3] Reference pathway (4) is most closely related to the sub-pathway from POET process 6 as described in III.b (for wet DGS co-products).

Land Use or Other Indirect Effect:
30.00 g CO2e/MJ (ARB default for corn ethanol, used for all Reference pathways)

Total: In numeric order listed above:
(1) 98.40 g CO2e/MJ
(2) 90.10 g CO2e/MJ
(3) 93.60 g CO2e/MJ
(4) 86.80 g CO2e/MJ

2. Compositional differences (if any) between the fuel produced by the new sub-pathway and the reference pathway identified in item c, 1, above).

There are no compositional differences between corn ethanol produced by the 11 newly defined sub-pathways of this application versus corn ethanol produced by the Reference pathways.

d. Final carbon Intensity of the proposed pathway or sub-pathway:

Process # as Described in III.b.	DGS Type	Carbon Intensity (CI, g CO2e/MJ)		
		Direct CI	Indirect CI	Total CI
1	Dry	62.44	30.00	92.44
	Wet	53.69	30.00	83.69
2	Dry	58.49	30.00	88.49
	Wet	50.01	30.00	80.01
3	Dry	58.50	30.00	88.50
4	Dry	61.66	30.00	91.66
	Wet	50.26	30.00	80.26
5	Dry	60.52	30.00	90.52
	Wet	50.47	30.00	80.47
6	Dry	44.70	30.00	74.70
	Wet	43.21	30.00	73.21

e. Annual volume of fuel that would be produced using the proposed new pathway (millions of gallons per year [MGY]):

Process # as Described in III.b.	DGS Type	Annual Fuel Volume (MGY)
1	Both (Combined)	989
2	Both (Combined)	105
3	Dry	92
4	Both (Combined)	88
5	Both (Combined)	41
6	Both (Combined)	60

f. Annual volume of fuel produced using the proposed new pathway that would enter the California market: California sales volumes are TBD – at some level in excess of the regulatory minimum requirement.

1. This production volume is expected to be achieved within how many years from the start of production? For processes 1 through 5, production lines are fully operational. Process 6 will reach the application production level in 2013.

2. Does the applicant expect this volume to be achieved by a single or by multiple facilities? Both situations apply in this application:

☒ A single facility (Applicable to Processes 3, 5 & 6 described in III.b)

☒ Multiple facilities (Applicable to Processes 1, 2 & 4 described in III.b)

3. If the applicant expects this volume to be achieved by multiple facilities, would all facilities be owned by a single firm?

☐ Single firm

☒ Multiple firms

g. Lower Heating Value of the fuel to be produced from the new pathway (MJ per gallon): CA-GREET1.8b default value of 80.53 MJ/gal is assumed to apply to all 14 corn ethanol sub-pathways. Note that 80.53 MJ/gal was converted from the 73,660 BTU/gal, which are the units reported in CA-GREET1.8b.

h. The range of production volumes over which the proposed pathway carbon intensity value is valid. The values reported below must be supported in the documentation accompanying this application.

Process # as Described in III.b.	DGS Type	Lower Bound Fuel Volume (MGY)	Upper Bound Fuel Volume (MGY)
1	Both (Combined)	10	989
2	Both (Combined)	10	105
3	Dry	10	92
4	Both (Combined)	10	88
5	Both (Combined)	10	41
6	Both (Combined)	10	60

i. Please provide any information that may be helpful in determining the land use change impacts (if any) of the proposed pathway. Although it is ARB's responsibility to perform all land use change impact analyses, the applicant may provide any information that may be useful to the ARB in completing that analysis.

POET, LLC does not possess any information related to indirect CI impacts (due to land use changes) related to corn farming. The ARB default value for corn ethanol indirect impacts (30 g CO2e/MJ) is used in this application without exception as stated clearly in this application that the land-use change impact is the responsibility of CARB.

IV. Application Submittal Checklist. Listed below are the documents and files that may be submitted in support of a method 2A/2B application. Check the box to the left of each document or file type included in your submittal. After each submittal category is a check box labeled "includes trade secrets." Check that box if the submittal category contains any information the applicant considers to be a trade secret. In the actual submittal, the specific information falling into the trade secret category must be clearly marked. Additional information regarding the submission of trade secrets can be found in the Instructions above.

- ☒ Pathway life cycle analysis report (required).
  - ☐ *Includes trade secrets*
- ☒ CA-GREET model results (please submit the full CA-GREET spreadsheet) (required).
  - ☐ *Includes trade secrets*
- ☒ All operating permits issued by the local air pollution control authority (required)
- ☒ One or more process flow diagrams covering the complete production process, including all inputs (feedstocks, process energy, etc.) and outputs (finished fuel, co-products, wastes, etc.) (required).
  - ☐ *Includes trade secrets*
- ☒ A comprehensive list of all stationary combustion-powered equipment associated with the production facility. List entries should name the equipment, briefly describe its function, identify the fuel or fuels used, and quantify fuel use on a per-gallon-of-finished-fuel-produced basis (required)
  - ☐ *Includes trade secrets*
- ☐ Equipment technical specifications
  - ☐ *Includes trade secrets*
- ☐ Production process schematics, technical drawings flow diagrams, maps, or other graphical representations (other than/in addition to the required process flow diagram)
  - ☐ *Includes trade secrets*
- ☐ Engineering reports
  - ☐ *Includes trade secrets*
- ☐ Technical papers or journal articles
  - ☐ *Includes trade secrets*

☐ Emissions monitoring data or emissions modeling results

☐ *Includes trade secrets*

☐ Spreadsheets, data files, and similar files documenting the calculations behind the fuel life cycle analysis

☐ *Includes trade secrets*

☒ Other: In the space below, describe any additional submittals. Rationales for documents submitted or omitted may also be provided.

☐ *Includes trade secrets*

Other submittals include:

1. **References:** A single compressed file containing a compilation all external references used as part of this application (each file will be in Adobe Acrobat format).