

Green Plains  
CENTRAL CITY LLC

*A subsidiary of Green Plains Renewable Energy, Inc.*

October 20, 2010

Re: Method 2A Application – Excluding Confidential Business Information

California Air Resources Board  
Stationary Source Division  
Criteria Pollutants Branch - 6th Floor  
1001 I Street  
P.O. BOX 2815  
Sacramento, CA 95812

To: Messrs. John Courtis and Wes Ingram:

Herewith, please find our application and supporting documents, except for Confidential Business Information, for a fuel lifecycle GHG emissions pathway using the Method 2A application process described in “Establishing New Fuel Pathways under the California Low Carbon Fuel Standard Procedures and Guidelines for Regulated Parties” report by the ARB (California Air Resources Board) issued on March 25, 2010.

We request a new pathway for our Central City, Nebraska ethanol plant as a sub-pathway of the existing LCFS Lookup Table pathway: Ethanol from Corn Midwest; Dry Mill; Dry DGS, NG<sup>1</sup>. The fuel lifecycle pathway of our Central City ethanol plant is the same as the referenced existing pathway except for lower power and energy consumption due to our modern plant design and production of modified distillers grain solubles (Modified DGS MDGS) at an average moisture content of 54%wt. rather than 10%wt. moisture for dry distillers grains solubles (Dry DGS or DDGS).

The attachment of this application provides the details and documentation of our application for a new pathway under Method 2A. Pages in the attachment with Confidential Business Information have been clearly marked as such, *but are not included in this non-confidential*

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<sup>1</sup> For reference, see CARB Report “Detailed California-Modified GREET Pathway for Corn Ethanol” February 27, 2009, Version 2.1. In this application this report is referred to at the “Corn Ethanol WTW Analysis.”

*version of the application. In this version of the application, the points where elements of Confidential Business Information have been removed from the text or accompanying tables are indicated so as to inform the public that the complete application to the ARB contained additional information to support this application, but that such information is considered by us to be Confidential Business Information.*

We have used the CA-GREET Model 1.8b to calculate the lifecycle greenhouse gas emissions from this sub-pathway. Based on the input changes to the model described in the attachments, the carbon intensity value of this new pathway is **82.17 gCO<sub>2</sub>e/MJ**. This CI intensity value is 14 gCO<sub>2</sub>e/MJ lower than the reference pathway and our production volume of approximately 100 million gallons per year more than meets the “5-10” substantiality rule and the other requirements of a new pathway.

We request your approval and would be glad to answer any questions you may have about our application. Following please find the names and contact information of the persons who are available to answer any questions about our application. Please note that Houston BioFuels Consultants LLC are assisting us with the application and may be contacted if you have questions or comments about our application

Affiliation:	Green Plains Central City LLC	Houston BioFuels Consultants LLC
Name:	Mr. Jeff Briggs, COO	Mr. Logan Caldwell, Consultant
Telephone number:	1-402-884-8700	1-281-360-8515
e-mail address	jeff.briggs@gpreinc.com	<a href="mailto:lc@hbloc.net">lc@hbloc.net</a>
Mailing Address	9420 Underwood Ave, Ste 100 Omaha, NE 68114	5707 Ridge Vista Drive Kingwood, TX 77345

Sincerely,



Jeff Briggs, COO

Attachments

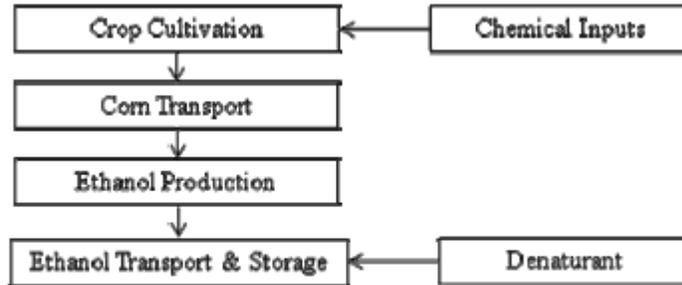
## **Attachments**

### Section Number and Contents

- I. WTW Diagram of Green Plains Central City LLC Sub-Pathway  
Including:
  - Energy and Material Balance for the Plant Design
  - Current State of Nebraska Air Permit and Air Permit Application
  
- II. Green Plains Central City LLC Pathway Description/Background formation
- III. Table of CA-GREET Model Inputs for Green Plains Central City LLC Pathway
- IV. Basis for the Green Plains Central City LLC CA-GREET Input Values
- V. CA-GREET Model Output and Analysis of Results
- VI. Production Range of Green Plains Central City LLC Pathway
- VII. Sustainability of Green Plains Central City LLC Pathway
- VIII. Impact on Land Use
- IX. Documents supporting Production Period Quantities

**WTW Diagram of Green Plains Central City LLC Sub-Pathway  
I. of the Corn Ethanol Pathway**

Figure 1: Green Plains Central City LLC Sub-Pathway is the Same  
As the  
WTW Components for the Corn Ethanol Pathway<sup>2</sup>



*Figure 1. WTT Components for Ethanol Transported to California*

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<sup>2</sup> See CARB Report “Detailed California-Modified GREET Pathways for Corn Ethanol” February 27, 2009, Version 2.1, page 4.

## II. Green Plains Central City LLC Pathway Description/Background

### Green Plains Central City LLC Pathway Description/Background

1. Plant Location: This facility is located at 214 20<sup>th</sup> Street, Central City, Nebraska.
2. History – The facility started operation on May 6, 2004 with a capacity of 48 million gallons per year (MGY) of denatured ethanol. Expansion of the facility from 48 MGY to 100 MGY was completed and the expanded capacity was put into service in November 23, 2006. The facility was purchased by Green Plains Central City LLC on July 07, 2009.
3. Feedstock Type – Corn.
4. Product – Anhydrous Ethanol (denatured for fuel use).
5. Co-Products - Modified Wet Distillers Grains with Solubles with approximately 50-55% moisture.
6. Process fuel – Natural Gas supplied by US Energy through the Kinder Morgan Interstate Gas Transmission pipeline.
7. Power supply – Supplied by Southern Power District based in Grand Island, Nebraska.
8. Corn and Ethanol Transportation and Distribution – Corn is received by truck from local Midwest growers. Ethanol is shipped via rail to distant customers and by truck to local customers.
9. Technology – Dry Mill, Natural Gas Fired to produce anhydrous ethanol licensed from ICM Inc.
10. Process Flow Description – The following description and diagram of the dry mill process is from the ICM Inc. web site.

#### **Delivery/Storage**

Grain is delivered by truck or rail to the ethanol plant where it's loaded in storage bins designed to hold enough grain to supply the plant for 7–10 days.

#### **Milling**

The grain is screened to remove debris and ground into course flour.

#### **Cooking (Hot Slurry, Primary Liquefaction, and Secondary Liquefaction)**

During the cook process, the starch in the flour is physically and chemically prepared for fermentation.

**Hot Slurry**

The milled grain is mixed with process water, the pH is adjusted to about 5.8, and an alpha-amylase enzyme is added. The slurry is heated to 180–190°F for 30–45 minutes to reduce viscosity.

**Primary Liquefaction**

The slurry is then pumped through a pressurized jet cooker at 221°F and held for 5 minutes. The mixture is then cooled by an atmospheric or vacuum flash condenser.

**Secondary Liquefaction**

After the flash condensation cooling, the mixture is held for 1–2 hours at 180–190°F to give the alpha-amylase enzyme time to break down the starch into short chain dextrins. After pH and temperature adjustment, a second enzyme, glucoamylase, is added as the mixture is pumped into the fermentation tanks.

**Simultaneous Saccharification Fermentation**

Once inside the fermentation tanks, the mixture is referred to as mash. The glucoamylase enzyme breaks down the dextrins to form simple sugars. Yeast is added to convert the sugar to ethanol and carbon dioxide. The mash is then allowed to ferment for 50–60 hours, resulting in a mixture that contains about 15% ethanol as well as the solids from the grain and added yeast.

**Distillation**

The fermented mash is pumped into a multi-column distillation system where additional heat is added. The columns utilize the differences in the boiling points of ethanol and water to boil off and separate the ethanol. By the time the product stream is ready to leave the distillation columns, it contains about 95% ethanol by volume (190-proof). The residue from this process, called stillage, contains non-fermentable solids and water and is pumped out from the bottom of the columns into the centrifuges.

**Dehydration**

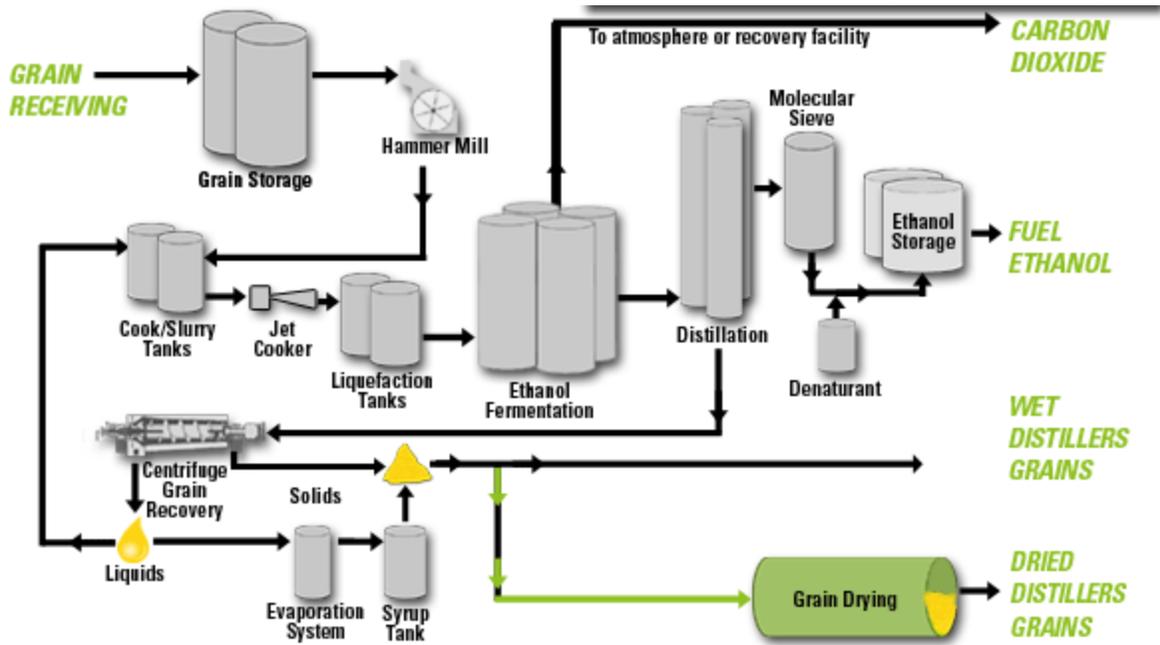
The 190-proof ethanol still contains about 5% water. It's passed through a molecular sieve to physically separate the remaining water from the ethanol based on the different sizes of the molecules. This step produces 200-proof anhydrous (waterless) ethanol.

**Ethanol Storage**

Before the ethanol is sent to storage tanks, a small amount of denaturant is added, making it unfit for human consumption. Most ethanol plants' storage tanks are sized to allow storage of 7–10 days' production capacity.

11. Process Flow Diagram (From ICM Inc. web-site)

Note that the diagram indicates Dried Distillers Grains co-product. In the case of Green Plains Central City LLC, the distillers grains are only partially dried in the Grain Drying equipment.



12. Current State of Nebraska Air Permit and Most Recent Air Permit Application – These documents are in separate files submitted together with this application file.

Energy and Material Balance Diagram - **Confidential Business Information and is not included in this non-confidential version of the application.**

### III. Table of CA-GREET Model Inputs for Green Plains Central City LLC Pathway

The following table shows the calculation of the input variables that were changed for the calculation of the Green Plains Central City LLC Pathway using the CA-GREET model. The values shown in light green/lime color are the input variables.

Table 1: Calculation of Input Variables Changed for the Green Plains Central City LLC Pathway  
**Table 1 contains Confidential Business Information and is not included in this non-confidential version of the application.**

The following table shows the CA-GREET corn ethanol dry mill default values and the modified values for the Green Plains Central City LLC Pathway:

Table 2: CA-GREET Model Inputs for the Green Plains Central City LLC Pathway

**Table 2 contains Confidential Business Information and is not included in this non-confidential version of the application.**

#### Discussion

The Green Plains Central City LLC sub-pathway differs from the existing Midwest Dry Mill, natural gas-fired, 100% dried distillers grains solubles (DDGS) as a result of less energy being needed to produce the modified distillers grains solubles (MDGS) for this sub-pathway. Less process fuel is needed because the distillers grains solubles are dried to approximately 54% moisture rather than approximately 10% for DDGS. Less power is needed, as well as less fuel, as a result of the Green Plains Central City LLC facilities being based on a modern design by ICM.

**The last sentence of the preceding paragraph contained Confidential Business Information and is not included in this non-confidential version of the application.**

#### IV. Basis for the Green Plains Central City LLC CA-GREET Input Values –

The input values presented in this application are based on the total corn, natural gas and power consumed and distillers grains and ethanol produced at the Green Plains Central City LLC, Nebraska ethanol plant from August 1, 2009 through June 30, 2010 (“Production Period”). Since the input values are in terms of per gallon of undenatured ethanol, the total of each utility value has been divided by the total gallons of undenatured ethanol produced during the Production Period.

##### Discussion of how the Production Period Was Selected

The Production Period used as the basis for the CA-GREET input values is eleven months due to two factors:

- Green Plains Renewable Energy, Inc (“GPRE”) purchased the Central City ethanol plant in early July 2009, from the lenders who had title to the plant after the original owners went bankrupt and shut down the plant in November 2008. On July 29, 2009, the plant was restarted.<sup>3</sup>
- The last month of operation before the application process was begun for the new sub-pathway was June 2010.

Plant operation during the eleven months of operation in the Production Period was steady with only minor variations to be expected from any manufacturing facility. The data collected during this period is an accurate representation of the new pathway. The figure below trends the moisture content of the MDGS during the Production Period. Once each week the MDGS was sampled and analyzed for moisture and other properties. **This last sentence of this paragraph contains Confidential Business Information and is not included in this non-confidential version of the application**

Figure 2: MDGS Weekly Moisture Content Trend during Production Period

**Figure 2 contains Confidential Business Information and is not included in this non-confidential version of the application.**

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<sup>3</sup> GPRE press releases on July 6<sup>th</sup> and 30<sup>th</sup>, 2009, recount the plant shut down, acquisition and start-up dates. The link to these press releases: <http://investor.gpreinc.com/releases.cfm?Year=&ReleasesType=&PageNum=2>

## V. CA-GREET Model Output and Analysis of Results

The Green Plains Central City LLC pathway carbon intensity value is a sub-pathway of the existing CARB Lookup Table Corn Ethanol pathway shown in the table below.

Table 3: CARB Lookup Table Reference Pathway: Midwest Dry Mill, 100% DDGS, NG Fuel

CARB Lookup Table Reference Pathway: Midwest Dry Mill Ethanol Plant, 100% DDGS, NG Fuel Pathway							
	CA-GREET Model Output		Calculations to convert Output to g/CO2e/MJ				
	IPPC factors	Corn	Ethanol				
	gCO2e/g	Btu or Grams per mmbtu of Fuel Throughput			gCO2e/mmbtu	gCO2e/MJ	
		US Avg Corn	100% DDGS	Corn w/loss	Total corn + EtOH		
Total energy		187,247	1,469,428	187,434	1,656,863		
VOC		16.8	55.5	17	72		
CO		151.3	31.4	151	183		
CH4	25	17.4	73.7	17	91	2,277.0	2.16
N2O	298	41.7	0.4	42	42	12,571.0	11.92
CO2	1	15,064	41,354	15,079	56,433	56,433.4	53.49
<b>Sub-total lifecycle CI before denaturant and lt. vehicle combustion</b>						71,281.4	67.57
Denaturant and lt. vehicle combustion effects factor							0.80
<b>Total Lifecycle CI before ILUC with denaturant and lt. vehicle combustion effects included</b>							68.37
Indirect Land Use Change Factor (ILUC)							30
<b>Total CI of Pathway including Indirect Land Use Change</b>							98.37
<p>Note: The calculated result of this pathway prior to making the input changes for the Green Plains Central City, LLC ethanol plant is 67.57 gCO2e/MJ. This matches the Corn Ethanol WTW Analysis result of 67.6 gCO2e/MJ (Table B. GHG Emissions Summary for Dry and Wet Mill Corn Ethanol, page 5) before the denaturant and light vehicl combustion factor of 0.8 gCO2e/MJ is added.</p>							

In the following table the Green Plains Central City LLC pathway carbon intensity value is calculated from the output of the CA-GREET model using the input parameters specific to the pathway.

Table 4: Green Plains Central City LLC Sub-Pathway

Green Plains Central City LLC Sub-Pathway of the Midwest Dry Mill Ethanol Plant, with 100% MDGS and NG							
	CA-GREET Model Output		Calculations to convert Output to g/CO2e/MJ				
	IPPC factors	Corn	Ethanol				
	gCO2e/g	Btu or Grams per mmbtu of Fuel Throughput			gCO2e/mmbtu	gCO2e/MJ	
		US Average	100% MDGS	Corn w/loss	Total corn + EtOH		
Total energy		187,023	1,222,732	187,210	1,409,942		
VOC		16.748	53.598	17	70		
CO		151.095	20.369	151	172		
CH4	25	17.379	44.641	17	62	1,550.9	1.47
N2O	298	41.693	0.247	42	42	12,510.6	11.86
CO2	1	15,046	25,072	15,061	40,133	40,132.6	38.04
<b>Sub-total lifecycle CI before denaturant and lt. vehicle combustion</b>						54,194.1	51.37
Denaturant and lt. vehicle combustion effects factor							0.80
<b>Total Lifecycle CI before ILUC with denaturant and lt. vehicle combustion effects included</b>							52.17
Indirect Land Use Change Factor (ILUC)							30
<b>Total CI of Pathway including Indirect Land Use Change</b>							82.17

## **VI. Production Range of Green Plains Central City LLC Pathway**

The new pathway should be applicable to the Green Plains Central City LLC plant for at least 40% to 114% of Nameplate Capacity.

### Discussion

Please refer to the following letter from the Green Plains Renewable Energy, Inc. Director of Engineering for an explanation for the basis of the production range over which this pathway is applicable. **This letter contains Confidential Business Information and is not included in this non-confidential version of the application**

## **VII. Sustainability of Green Plains Central City LLC Pathway**

The Green Plains Central City LLC pathway is based on well-established modern designs and agronomy practices and is managed by professional staff well-qualified<sup>4</sup> to assure that over time the energy efficiency of and emissions from the pathway do not deteriorate. Any deterioration would result in a less profitable business. Thus the sustainability of the plant is well aligned with the business objectives of the owners.

The Central City ethanol plant one of six ethanol plants owned and operated by Green Plains Renewable Energy, Inc.<sup>5</sup> This plant and four others have the same ICM technology and plant design that provides the opportunity for further improvements in energy efficiency and yield, and therefore carbon intensity, over time.

## **VIII. Impact on Land Use**

The difference between the land use of this sub-pathway and that of the pathway described in the Corn Ethanol WTW Analysis is negligible.

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<sup>4</sup> The GPRE website has an overview of the management and ethanol production facilities. The web link is: <http://www.gpreinc.com/Overview>

<sup>5</sup> Ibid.

## **IX. Documents supporting Production Period Quantities**

Table 5: Summary of Inputs and Outputs during the Production Period of August 1, 2009 through June 30, 2010 **contains Confidential Business Information and is not included in this non-confidential version of the application**

The corn, ethanol and distillers grains co-product quantities during the Production Period are based on the GPRE Key Activity Report (“KAR”), which is used by GPRE for its official manufacturing accounting process. As such, these are the official quantities reviewed and approved by GPRE management. The electricity and natural gas quantities shown in the above table are also in the KAR system, but in addition can also be validated with invoices from the utility suppliers. The following letter by the executive vice-president and treasurer of Green Plains Renewable Energy, Inc provides evidentiary support for the amounts used in this pathway application.

August 10, 2010

Ladies & Gentlemen:

I have reviewed the attached quantities for Green Plains Central City LLC (Central City) for the months of August 2009 through June 2010 and, based upon this review, I hereby certify that to the best of my knowledge the attached quantities are accurate and complete for the periods reflected.

The quantities on the attached summary are sourced from various documents and processes as summarized below:

- Electricity and natural gas usage quantities are based on the usage information from the metered billing statements received each month from the utilities.
- Corn ground is based on our inventory control process. In summary, the amount of corn ground is equivalent to the beginning inventory of corn plus bushels delivered less ending inventory. The corn is weighed at delivery on a state certified scale.
- Ethanol produced and distillers grains produced are based on our inventory control process. In summary, the amount produced is equivalent to ending inventory plus shipments less beginning inventory for each commodity. Ethanol sold is measured through state certified flow meters. Distillers grains are weighed at shipment on a state certified scale.

Furthermore, the consolidated financial results, including inventory levels and expenses are subject to audit by our accounting firm, KPMG LLP.

Sincerely yours,



Ron B. Gillis  
EVP-Finance, Treasurer

The following pages contain the invoices for electricity and natural gas during the production period. Natural gas invoices are on a calendar month basis, but electricity is invoiced on a semi-monthly (twice per month) basis. **These pages are not included in this non-confidential version of the application.** The following table has been prepared to show the semi-monthly invoice quantity of electricity used by Green Plains Central City LLC during the production period of August 1, 2009 through Jun 30, 2010.

Table 6: Semi-Monthly Electricity Invoice Quantities during the Production Period

**This table contains Confidential Business Information and is not included in this non-confidential version of the application**