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**west virginia** department of environmental protection

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Randy C. Huffman, Cabinet Secretary  
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## **ENGINEERING EVALUATION / FACT SHEET**

### BACKGROUND INFORMATION

Application No.: R13-2848  
Plant ID No.: 039-00603  
Applicant: Emerald Biofuels LLC  
Facility Name: Institute  
Location: Institute, Kanawha County  
SIC Code: 2869 Renewable (green) diesel  
Application Type: Construction  
Received Date: July 7, 2010  
Engineer Assigned: David Keatley  
Fee Amount: \$1,000  
Date Received: July 7, 2010  
Complete Date: December 4, 2010  
Due Date: March 4, 2011  
Applicant Ad Date: June 24, 2010  
Newspaper: *The Charleston Gazette*  
UTM's: Easting: 432.401 km Northing: 4248.073 km Zone: 17  
Description: The applicant plans to construct a facility that will produce renewable diesel from oleaginous feedstocks. The plant will be located on the Bayer Crop Science (BCS) Facility and will be 100,000,000 gallons of renewable diesel per year. Construction of the facility should begin February 1, 2011 and the facility should be mechanically complete and ready to start up by July 1, 2012.

### DESCRIPTION OF PROCESS

Emerald Biofuels plans to construct a facility to manufacture renewable diesel, renewable naphtha, renewable LPG, and renewable lean gas from oleaginous feedstocks (animal fats and plant oils). These products will be produced by going through two processes a pretreatment process and an EcoFinishing process. The pretreatment process has two main steps: degumming and silica absorption/filtration. The Ecofinishing process has three main steps: a two-stage reaction, separation of products, and handling the unreacted hydrogen.

Feed materials will be delivered to the facility and stored in one of two 45,000 barrel feed material storage tanks (T-101 and T-102) that will be heated to increase fluidity and homogeneity of the feed material. The heated feedstock will be mixed with phosphoric acid in a tank (T-302). A base will be added to neutralize the acid and most of the gums will be removed by centrifuge (MC-1). Water will be added and the mixture will be kept in a holding tank (T-303). The mixture will be centrifuged (MC-2) again to remove even more gum. The gum will be stored in a tank (T-305) and either be sold as animal feed or disposed of as waste. Silica is then mixed with the degummed oil/fat stream, vacuum dried in a tank (T-306), and then the silica is filtered. The spent silica will be disposed of as solid waste. There is a baghouse (1-E) on the silica silo (T-301).

The pretreated feed will then be pumped to one of the two 10,000 barrel pretreatment tanks (T-103 and T-104). The pretreated steam will be reacted with hydrogen gas in a fixed-bed catalyst process. Hydrogen will be supplied by the existing Praxair facility. Hydrogen is used to fully deoxygenate the fatty acid stream producing propane in the first stage reactor (R-1). R-1 has process heater (H-1). Some of the propane is isomerized to butane in the second stage reactor (R-2). R-2 has a process heater (H-2). The emissions from H-1 and H-2 are combined and emitted at emission point 2-E.

To separate the different products the material goes from the second stage reactor to the cold separator. The vapors from the cold separator are sent to an amine scrubber (ME-2) and the unreacted hydrogen is recycled back to R-1. The liquids from the Cold Separator are heated and sent to the Product Stripper. In the Product Stripper the liquid is heated until the naphtha, LPG and, lean gas fractions vaporize. The liquid from the Product Stripper is the renewable diesel which is vacuum dried to reduce the water content and pumped to two 8,000 barrel tanks (T-203 and T-204). The quality of the renewable diesel is checked in these tanks and then transferred to two 45,000 barrel tanks (T-201 and T-202).

The stripper overheads are condensed in the Stripper Condenser. The underflow flow from the Stripper Condenser flows to the Debutanizer. The Debutanizer distillates the LPG from the naphtha/LPG mixture. The naphtha underflow goes to a 42,000 gallon storage tank (T-205) with a floating roof design to minimize volatile compound loss. The LPG is scrubbed by a amine scrubber. The LPG is stored onsite in four 1,000 gallon pressured tanks.

The Stripper Condenser overheads are sent to a Sponge Absorber where naphtha is used to recover LPG. The underflow from the Sponge Absorber (rich naphtha) is sent to the Debutanizer that has trayed columns to provide separation. The overhead from the Sponge Absorber is scrubbed by an amine scrubber and is lean gas. The lean gas will be used as a fuel gas for H-1 an H-2 and the additional lean gas will be used in another processes boiler that is currently at the BCS facility.

The amine scrubbers from the Cold Separator, Debutanizer, and Sponge Absorber sends rich amine to the amine regeneration system. The amine regeneration system removes the acid gas from the rich amine and sends lean amine to the amine

scrubbers. The acid gases from the amine regeneration system are sent to Lo-Cat chemical redox unit to convert H<sub>2</sub>S to elemental sulfur. The treated gas stream from the Lo-Cat unit will be routed to H-1 and H-2 for use as supplemental combustion air.

## SITE INSPECTION

Todd Shrewsbury and the permit writer performed a site inspection on August 19, 2010. Directions to the facility from Charleston are the following: take I64 W to Exit 53 Roxalana Rd. Take SR 25 W the site is a few miles on the left.

## ESTIMATE OF EMISSIONS BY REVIEWING ENGINEER

Source ID	Emission Source	Pollutant	Maximum Hourly Emissions (lb/hr)	Maximum Annual Emissions (tpy)
1S	Silica Silo Baghouse	Total Particulate Matter	0.5	0.01
2S, 3S, and 4S	Hydrotreat and Isomerization Process Heaters & Lo-Cat	Nitrogen Oxides	0.68	2.98
		Carbon Monoxide	1.14	5
		Total Particulate Matter	0.1	0.5
		Sulfur Dioxide	0.224	0.99
		Volatile Organic Compounds	0.07	0.33
5S	Flare	Nitrogen Oxides	0.19	0.81
		Carbon Monoxide	0.16	0.68
		Total Particulate Matter	0.01	0.06
		Volatile Organic Compounds	1	0.516
6S	Raw Feedstock Tank #1 (T101)	Volatile Organic Compounds	1	0.516
7S	Raw Feedstock Tank #2 (T102)	Volatile Organic Compounds	1	0.516
8S	Pretreated Feedstock Tank (T103)	Volatile Organic Compounds	0.1	0.2
9S	Pretreated Feedstock Tank (T104)	Volatile Organic Compounds	0.1	0.2
10S	Renewable Diesel Product Tank (T201)	Volatile Organic Compounds	1.1	0.55
11S	Renewable Diesel Product Tank (T202)	Volatile Organic Compounds	1.1	0.55
12S	Renewable Naptha Product Tank (T301)	Volatile Organic Compounds	0.22	0.96
13S	Renewable Diesel	Volatile Organic Compounds	0.36	0.18

	Day Tank (T204)			
14S	Renewable Diesel Day Tank (T205)	Volatile Organic Compounds	0.36	0.18

## REGULATORY APPLICABILITY

### **45CSR4** *To Prevent and Control the Discharge of Air Pollutants into the Open Air which Causes or Contributes to an Objectionable Odor or Odors*

The facility is subject to the requirements of 45CSR4 and shall not allow the discharge of air pollutants which cause or contribute to an objectionable odor at any location occupied by the public.

### **45CSR13** *Permits for Construction, Modification, Relocation and Operation of Stationary Sources of Air Pollutants, Notification Requirements, Administrative Updates, Temporary Permits, General Permits, and Procedures for Evaluation*

Emerald Biofuels, LLC's Institute Facility is subject to 45CSR13 because it has the potential to emit 38.99 lb/hr and 151.22 tons/yr of uncontrolled volatile organic compounds which exceeds the threshold of 6 lb/hr and 10 tons/year of any uncontrolled regulated air pollutant.

### **45CFR60 Subpart Kb**

*Standards of Performance for Volatile Organic Liquid Vessels (Including Petroleum Liquid Storage Vessels) for Which Construction, Reconstruction, or Modification Commenced After July 23, 1984*

To be subject to this regulation the threshold for tanks containing volatile organic liquids is 19,813 gallons. This subpart does not apply to storage vessels with a capacity greater than or equal to 151 m<sup>3</sup> storing a liquid with a maximum true vapor pressure less than 3.5 kPa. Diesel, plant oils, and animal fats have a true vapor pressure below this 3.5 kPa and the tanks containing them are not subject to this subpart. Pressure vessels designed to operate in excess of 204.9 kPa and without emissions to the atmosphere are also not subject. The four LPG tanks don't vent to the atmosphere and operate at a higher pressure than 204.9 kPa. Naphtha has a true vapor pressure of 51.7 kPa and the naphtha storage tank (T-205) exceeds the threshold for volume, so T-205 is subject to Subpart Kb. Emerald proposes to install a fixed roof that has an internal floating roof. Subpart Kb has many specifications for a tank with a fixed roof in combination with an internal floating roof that will be included in the permit. Subpart Kb also has testing requirements that require visual inspection of many of the components of the tank. Subpart Kb also requires keeping records for control equipment, inspections, and any damage that occurs.

**45CFR60 Subpart NNN** *Standards of Performance for Volatile Organic Compound (VOC) Emissions From Synthetic Organic Chemical Manufacturing Industry (SOCMI) Distillation Operations*

Emerald has six distillation units. Three of the distillation units are not subject to Subpart NNN because they meet the definition of a recovery device. The Sponge Absorber, Cold Separator (V-11) and Debutanizer (V-10) are subject to Subpart NNN.

Emerald proposes a reduction in emissions of TOC (less methane and ethane) by 98 weight-percent to comply with Subpart NNN. The Sponge Absorber, Cold Separator, and Debutanizer will use the process heaters (H1 or H2) to achieve this minimum reduction in VOC emissions.

**40 CFR 60 Subpart VVa** *Standards of Performance for Equipment Leaks of VOC in the Synthetic Organic Chemicals Manufacturing Industry for Which Construction, Reconstruction or Modification Commenced After November 7, 2006*

This facility manufactures synthetic organic chemicals and will be constructed after November 7, 2006 are subject to this subpart. Each owner or operator shall demonstrate compliance with the requirements of this regulation within 180 days of initial startup. Emerald Biofuels will have to meet the followings standards: pumps in light liquid service (40CFR60.482-2a), pressure relief devices in gas/vapor service (40CFR60.482-4a), sampling connection systems (40CFR60.482-5a), open-ended valves or lines (40CFR60.482-6a), valves in gas/vapor service and in light liquid service (40CFR60.482-7a), pumps, valves, and connectors in heavy liquid service and pressure relief devices in light liquid or heavy liquid service (40CFR60.482-8a), delay of repair (40CFR60.482-9a), closed vent systems and control devices (40CFR60.482-10a), and connectors in gas/vapor service and in light liquid service (40CFR60.482-11a). There are two alternative standards for valves if the owner or operator elects to comply with them (40CFR60.483-1a; 40CFR60.483-1b). The owner or operator also has the ability to apply to the administrator for determination of equivalence for any means of emission limitation that achieves a reduction in emissions of VOC at least equivalent to the reduction in emissions of VOC achieved by the controls required. Emerald Biofuels shall also follow the test methods and procedures (40CFR60.485a), recordkeeping requirements (40CFR60.486a), and reporting requirements (40CFR60.487a).

TOXICITY OF NON-CRITERIA REGULATED POLLUTANTS

No HAPs or TAPs were estimated to be more than two significant digits past the decimal point.

#### AIR QUALITY IMPACT ANALYSIS

Based on the annual emissions rates this facility will not be a major source as defined by 45CSR14, so no air quality impact analysis was performed.

#### RECOMMENDATION TO DIRECTOR

The information provided in the permit application indicates Emerald Biofuels's renewable diesel plant meets all the requirements of applicable rules and regulations. Therefore, impact on the surrounding area should be minimized and it is recommended that the Kanawha County location should be granted a 45CSR13 construction permit for their facility.

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David Keatley  
Engineer

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Date