TECHNICAL SUPPORT DOCUMENT
For
DRAFT AIR EMISSION PERMIT NO. 04700061-002

This technical support document (TSD) is intended for all parties interested in the draft permit and to meet the requirements that have been set forth by the federal and state regulations (40 CFR § 70.7(a)(5) and Minn. R. 7007.0850, subp. 1). The purpose of this document is to provide the legal and factual justification for each applicable requirement or policy decision considered in the preliminary determination to issue the draft permit.

1. General Information

1.1 Applicant and Stationary Source Location:

Table 1. Applicant and Source Address

Applicant/Address	Stationary Source/Address (SIC Code: **2869**)
Renewable Energy Group Inc 416 S Bell Ave Ames, IA 50010	REG Albert Lea, LLC 15200 780th Ave Albert Lea Freeborn County
Contact: **Doug Judge** Phone: **515-239-8031**	

1.2 Facility Description

REG Albert Lea, LLC (REG) is a biodiesel manufacturing plant located near Albert Lea, Minnesota. The facility currently produces biodiesel from soybean oil and methanol, but after the construction and installation of the equipment authorized by this permit action, the facility will be able to handle lower quality feedstocks as well. After the upgrade, the biodiesel facility will have the capacity to produce 31,500,000 gallons of biodiesel per year.

The facility is a minor source of emissions for particulate matter (PM), particulate matter less than ten microns (PM_{10}), particulate matter less than 2.5 microns ($PM_{2.5}$), nitrogen oxides (NOx), sulfur dioxide (SO2) and carbon monoxide (CO) and a synthetic minor for volatile organic compounds (VOCs) and methanol (a federally-designated Hazardous Air Pollutant, HAP). The main sources of methanol emissions are expected to be equipment leaks and the distillation process. Six emission sources and four storage tanks will be controlled by a flare for VOC and HAP emissions.

The facility currently processes soybean oil into biodiesel. After the installation of the equipment described in this permit action, the facility will be able to process low quality feedstocks such as used cooking oil, inedible corn oil, and lower quality animal fats.

For low quality feedstocks, the process will start with pre-treatment of the feedstock to remove metals, phosolipids, proteins, and other impurities using a filter of diatomaceous material and a centrifuge. The feedstock is then sent to a deacidification column where the feedstock is heated up rapidly in order to separate out water and fatty acidsfrom the triglycerides.

From the deacidification column the feedstock is sent to a number of reactors and decanters which are collectively referred to as the transesterification process. Methanol is added to react with the feedstock and sodium methylate is added as a catalyst. This chemical process converts triglyceride and methanol into biodiesel and glycerin.

After the transesterification reaction, hydrochloric acid is added to the biodiesel to neutralize the pH.

The next step in the process is to recover the unreacted methanol. This is accomplished with a methanol rectification column, a feedstock absorber and a water absorber. The recovered methanol is recycled back and used again in the transesterification process.

Once the methanol is removed from the biodiesel, the biodiesel is sent to the biodiesel distillation wipe-film evaporator (WFE) (EU009) for final processing. From the distillation WFE the biodiesel is sent to storage and loadout.

Vapors from the transesterification process (EU001), the nitrogen blanket (EU002), biodiesel loadout (EU003), acidulation (EU005) and biodiesel distillation (EU009) as well as vapors from the methanol and sodium methylate tanks are vented to the flare.

Other tanks on site are used for feedstock, free fatty acid, soapstock and biodiesel storage. There are 12 low vapor pressure tanks at the facility used for storage purposes.

Throughout the biodiesel production process there is nitrogen (in gas form) in the headspace of the reactors. This is called the nitrogen blanket (EU002). Nitrogen is used because of its low reactivity and flammability properties.

Additionally, REG buys steam from POET Biorefining – Glenville East (POET) for the purpose process thermal energy and heating buildings. This averages to about 12.5 mmbtu/hr of energy which is a small

TANKS 4.0.9d
Emissions Report - Detail Format
Tank Identification and Physical Characteristics

Identification

User Identification:	TK 030
City:	Albert Lea
State:	Minnesota
Company:	REG Albert Lea
Type of Tank:	Vertical Fixed Roof Tank
Description:	Feedstock Tank 30

Tank Dimensions

Shell Height (ft):	32.00
Diameter (ft):	52.00
Liquid Height (ft) :	32.00
Avg. Liquid Height (ft):	15.00
Volume (gallons):	508,369.80
Turnovers:	20.00
Net Throughput(gal/yr):	9,659,026.20
Is Tank Heated (y/n):	Y

Paint Characteristics

Shell Color/Shade:	Aluminum/Diffuse
Shell Condition	Good
Roof Color/Shade:	Aluminum/Diffuse
Roof Condition:	Good

Roof Characteristics

Type:	Cone
Height (ft)	1.33
Slope (ft/ft) (Cone Roof)	0.05

Breather Vent Settings

Vacuum Settings (psig):	-0.03
Pressure Settings (psig)	0.03

Meterological Data used in Emissions Calculations: Rochester, Minnesota (Avg Atmospheric Pressure = 14.04 psia)

TANKS 4.0.9d
Emissions Report - Detail Format
Liquid Contents of Storage Tank

TK 03011 - Vertical Fixed Roof Tank
Albert Lea, Minnesota

Mixture/Component	Month	Daily Liquid Surf. Temperature (deg F) Avg.	Min.	Max.	Liquid Bulk Temp (deg F)	Vapor Pressure (psia) Avg.	Min.	Max.	Vapor Mol. Weight.	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight	Basis for Vapor Pressure Calculations

Feedstock	All	0.00	0.00	0.00	0.00	0.0010	0.0010	0.0010	200.0000	264.40	Option 1: VP40 = .001

TANKS 4.0.9d
Emissions Report - Detail Format
Detail Calculations (AP-42)

TK 03011 - Vertical Fixed Roof Tank
Albert Lea, Minnesota

Annual Emission Calcaulations	
Standing Losses (lb):	0.0000
Vapor Space Volume (cu ft):	37,044.6971
Vapor Density (lb/cu ft):	0.0000
Vapor Space Expansion Factor:	0.0000
Vented Vapor Saturation Factor:	0.9991
Tank Vapor Space Volume:	
Vapor Space Volume (cu ft):	37,044.6971
Tank Diameter (ft):	52.0000
Vapor Space Outage (ft):	17.4433
Tank Shell Height (ft):	32.0000
Average Liquid Height (ft):	15.0000
Roof Outage (ft):	0.4433
Roof Outage (Cone Roof)	
Roof Outage (ft):	0.4433
Roof Height (ft):	1.3300
Roof Slope (ft/ft):	0.0500
Shell Radius (ft):	26.0000
Vapor Density	
Vapor Density (lb/cu ft):	0.0000
Vapor Molecular Weight (lb/lb-mole):	200.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0010
Daily Avg. Liquid Surface Temp. (deg. R):	459.6700
Daily Average Ambient Temp. (deg. F):	43.5292
Ideal Gas Constant R (psia cuft / (lb-mol-deg R)):	10.731
Liquid Bulk Temperature (deg. R):	459.6700
Tank Paint Solar Absorptance (Shell):	0.6000
Tank Paint Solar Absorptance (Roof):	0.6000
Daily Total Solar Insulation Factor (Btu/sqft day):	1,216.2281
Vapor Space Expansion Factor	
Vapor Space Expansion Factor:	0.0000
Daily Vapor Temperature Range (deg. R):	0.0000
Daily Vapor Pressure Range (psia):	0.0000
Breather Vent Press. Setting Range(psia):	0.0600
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0010
Vapor Pressure at Daily Minimum Liquid Surface Temperature (psia):	0.0010
Vapor Pressure at Daily Maximum Liquid Surface Temperature (psia):	0.0010
Daily Avg. Liquid Surface Temp. (deg R):	459.6700
Daily Min. Liquid Surface Temp. (deg R):	459.6700
Daily Max. Liquid Surface Temp. (deg R):	459.6700
Daily Ambient Temp. Range (deg. R):	19.5917
Vented Vapor Saturation Factor	

Vented Vapor Saturation Factor:	0.9991
Vapor Pressure at Daily Average Liquid:	
Surface Temperature (psia):	0.0010
Vapor Space Outage (ft):	17.4433
Working Losses (lb):	45.9954
Vapor Molecular Weight (lb/lb-mole):	200.0000
Vapor Pressure at Daily Average Liquid	
Surface Temperature (psia):	0.0010
Annual Net Throughput (gal/yr.):	9,659,026.2023
Annual Turnovers:	20.0000
Turnover Factor:	1.0000
Maximum Liquid Volume (gal):	508,369.8001
Maximum Liquid Height (ft):	32.0000
Tank Diameter (ft):	52.0000
Working Loss Product Factor:	1.0000
Total Losses (lb):	45.9954

TANKS 4.0.9d
Emissions Report - Detail Format
Individual Tank Emission Totals

Emissions Report for: Annual

TK 03011 - Vertical Fixed Roof Tank
Albert Lea, Minnesota

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Feedstock	46.00	0.00	46.00

TANKS 4.0.9d
Emissions Report - Detail Format
Tank Indentification and Physical Characteristics

Identification		
User Identification:	TK 031	
City:	Albert Lea	
State:	Minnesota	
Company:	REG Albert Lea	
Type of Tank:	Vertical Fixed Roof Tank	
Description:	Feedstock Tank 31	
Tank Dimensions		
Shell Height (ft):		32.00
Diameter (ft):		52.00
Liquid Height (ft) :		32.00
Avg. Liquid Height (ft):		15.00
Volume (gallons):		508,369.80
Turnovers:		20.00
Net Throughput(gal/yr):		9,659,026.20
Is Tank Heated (y/n):	Y	
Paint Characteristics		
Shell Color/Shade:	Aluminum/Diffuse	
Shell Condition	Good	
Roof Color/Shade:	Aluminum/Diffuse	
Roof Condition:	Good	
Roof Characteristics		
Type:	Cone	
Height (ft)		1.33
Slope (ft/ft) (Cone Roof)		0.05
Breather Vent Settings		
Vacuum Settings (psig):		-0.03
Pressure Settings (psig)		0.03

Meterological Data used in Emissions Calculations: Rochester, Minnesota (Avg Atmospheric Pressure = 14.04 psia)

TANKS 4.0.9d
Emissions Report - Detail Format
Liquid Contents of Storage Tank

TK 031 - Vertical Fixed Roof Tank
Albert Lea, Minnesota

Mixture/Component	Month	Daily Liquid Surf. Temperature (deg F) Avg.	Min.	Max.	Liquid Bulk Temp (deg F)	Vapor Pressure (psia) Avg.	Min.	Max.	Vapor Mol. Weight.	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight	Basis for Vapor Pressure Calculations

Feedstock	All	0.00	0.00	0.00	0.00	0.0010	0.0010	0.0010	200.0000	264.40	Option 1: VP40 = .001

TANKS 4.0.9d
Emissions Report - Detail Format
Detail Calculations (AP-42)

TK 031 - Vertical Fixed Roof Tank
Albert Lea, Minnesota

Annual Emission Calcaulations	
Standing Losses (lb):	0.0000
Vapor Space Volume (cu ft):	37,044.6971
Vapor Density (lb/cu ft):	0.0000
Vapor Space Expansion Factor:	0.0000
Vented Vapor Saturation Factor	0.9991
Tank Vapor Space Volume:	
Vapor Space Volume (cu ft):	37,044.6971
Tank Diameter (ft):	52.0000
Vapor Space Outage (ft):	17.4433
Tank Shell Height (ft):	32.0000
Average Liquid Height (ft):	15.0000
Roof Outage (ft):	0.4433
Roof Outage (Cone Roof)	
Roof Outage (ft):	0.4433
Roof Height (ft):	1.3300
Roof Slope (ft/ft):	0.0500
Shell Radius (ft):	26.0000
Vapor Density	
Vapor Density (lb/cu ft):	0.0000
Vapor Molecular Weight (lb/lb-mole):	200.0000
Vapor Pressure at Daily Average Liquid	
Surface Temperature (psia):	0.0010
Daily Avg. Liquid Surface Temp. (deg. R):	459.6700
Daily Average Ambient Temp. (deg. F):	43.5292
Ideal Gas Constant R	
(psia cuft / (lb-mol-deg R)):	10.731
Liquid Bulk Temperature (deg. R):	459.6700
Tank Paint Solar Absorptance (Shell):	0.6000
Tank Paint Solar Absorptance (Roof):	0.6000
Daily Total Solar Insulation	
Factor (Btu/sqft day):	1,216.2281
Vapor Space Expansion Factor	
Vapor Space Expansion Factor:	0.0000
Daily Vapor Temperature Range (deg. R):	0.0000
Daily Vapor Pressure Range (psia):	0.0000
Breather Vent Press. Setting Range(psia):	0.0600
Vapor Pressure at Daily Average Liquid	
Surface Temperature (psia):	0.0010
Vapor Pressure at Daily Minimum Liquid	
Surface Temperature (psia):	0.0010
Vapor Pressure at Daily Maximum Liquid	
Surface Temperature (psia):	0.0010
Daily Avg. Liquid Surface Temp. (deg R):	459.6700
Daily Min. Liquid Surface Temp. (deg R):	459.6700
Daily Max. Liquid Surface Temp. (deg R):	459.6700
Daily Ambient Temp. Range (deg. R):	19.5917
Vented Vapor Saturation Factor	

Vented Vapor Saturation Factor:	0.9991
Vapor Pressure at Daily Average Liquid:	
Surface Temperature (psia):	0.0010
Vapor Space Outage (ft):	17.4433
Working Losses (lb):	45.9954
Vapor Molecular Weight (lb/lb-mole):	200.0000
Vapor Pressure at Daily Average Liquid	
Surface Temperature (psia):	0.0010
Annual Net Throughput (gal/yr.):	9,659,026.2023
Annual Turnovers:	20.0000
Turnover Factor:	1.0000
Maximum Liquid Volume (gal):	508,369.8001
Maximum Liquid Height (ft):	32.0000
Tank Diameter (ft):	52.0000
Working Loss Product Factor:	1.0000
Total Losses (lb):	45.9954

TANKS 4.0.9d
Emissions Report - Detail Format
Individual Tank Emission Totals

Emissions Report for: Annual

TK 031 - Vertical Fixed Roof Tank
Albert Lea, Minnesota

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Feedstock	46.00	0.00	46.00

TANKS 4.0.9d
Emissions Report - Detail Format
Tank Indentification and Physical Characteristics

Identification		
User Identification:	TK 032	
City:	Albert Lea	
State:	Minnesota	
Company:	REG Albert Lea	
Type of Tank:	Vertical Fixed Roof Tank	
Description:	Biodiesel Distillation Bottoms	
Tank Dimensions		
Shell Height (ft):		30.00
Diameter (ft):		12.00
Liquid Height (ft) :		30.00
Avg. Liquid Height (ft):		15.00
Volume (gallons):		25,380.89
Turnovers:		12.00
Net Throughput(gal/yr):		304,570.66
Is Tank Heated (y/n):	Y	
Paint Characteristics		
Shell Color/Shade:	Aluminum/Diffuse	
Shell Condition	Good	
Roof Color/Shade:	Aluminum/Diffuse	
Roof Condition:	Good	
Roof Characteristics		
Type:	Cone	
Height (ft)		0.33
Slope (ft/ft) (Cone Roof)		0.06
Breather Vent Settings		
Vacuum Settings (psig):		-0.03
Pressure Settings (psig)		0.03

Meterological Data used in Emissions Calculations: Rochester, Minnesota (Avg Atmospheric Pressure = 14.04 psia)

TANKS 4.0.9d
Emissions Report - Detail Format
Liquid Contents of Storage Tank

TK 032 - Vertical Fixed Roof Tank
Albert Lea, Minnesota

Mixture/Component	Month	Daily Liquid Surf. Temperature (deg F) Avg.	Min.	Max.	Liquid Bulk Temp (deg F)	Vapor Pressure (psia) Avg.	Min.	Max.	Vapor Mol. Weight	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight	Basis for Vapor Pressure Calculations

Biodiesel Distillation Bottoms	All	0.00	0.00	0.00	0.00	0.0003	0.0003	0.0003	200.0000	350.00	Option 1: VP40 = .0003

TANKS 4.0.9d
Emissions Report - Detail Format
Detail Calculations (AP-42)

TK 032 - Vertical Fixed Roof Tank
Albert Lea, Minnesota

Annual Emission Calcaulations	
Standing Losses (lb):	0.0000
Vapor Space Volume (cu ft):	1,708.9007
Vapor Density (lb/cu ft):	0.0000
Vapor Space Expansion Factor:	0.0000
Vented Vapor Saturation Factor:	0.9998
Tank Vapor Space Volume:	
Vapor Space Volume (cu ft):	1,708.9007
Tank Diameter (ft):	12.0000
Vapor Space Outage (ft):	15.1100
Tank Shell Height (ft):	30.0000
Average Liquid Height (ft):	15.0000
Roof Outage (ft):	0.1100
Roof Outage (Cone Roof)	
Roof Outage (ft):	0.1100
Roof Height (ft):	0.3300
Roof Slope (ft/ft):	0.0600
Shell Radius (ft):	6.0000
Vapor Density	
Vapor Density (lb/cu ft):	0.0000
Vapor Molecular Weight (lb/lb-mole):	200.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0003
Daily Avg. Liquid Surface Temp. (deg. R):	459.6700
Daily Average Ambient Temp. (deg. F):	43.5292
Ideal Gas Constant R (psia cuft / (lb-mol-deg R)):	10.731
Liquid Bulk Temperature (deg. R):	459.6700
Tank Paint Solar Absorptance (Shell):	0.6000
Tank Paint Solar Absorptance (Roof):	0.6000
Daily Total Solar Insulation Factor (Btu/sqft day):	1,216.2281
Vapor Space Expansion Factor	
Vapor Space Expansion Factor:	0.0000
Daily Vapor Temperature Range (deg. R):	0.0000
Daily Vapor Pressure Range (psia):	0.0000
Breather Vent Press. Setting Range(psia):	0.0600
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0003
Vapor Pressure at Daily Minimum Liquid Surface Temperature (psia):	0.0003
Vapor Pressure at Daily Maximum Liquid Surface Temperature (psia):	0.0003
Daily Avg. Liquid Surface Temp. (deg R):	459.6700
Daily Min. Liquid Surface Temp. (deg R):	459.6700
Daily Max. Liquid Surface Temp. (deg R):	459.6700
Daily Ambient Temp. Range (deg. R):	19.5917
Vented Vapor Saturation Factor	

Vented Vapor Saturation Factor:	0.9998
Vapor Pressure at Daily Average Liquid:	
Surface Temperature (psia):	0.0003
Vapor Space Outage (ft):	15.1100
Working Losses (lb):	0.4351
Vapor Molecular Weight (lb/lb-mole):	200.0000
Vapor Pressure at Daily Average Liquid	
Surface Temperature (psia):	0.0003
Annual Net Throughput (gal/yr.):	304,570.6643
Annual Turnovers:	12.0000
Turnover Factor:	1.0000
Maximum Liquid Volume (gal):	25,380.8887
Maximum Liquid Height (ft):	30.0000
Tank Diameter (ft):	12.0000
Working Loss Product Factor:	1.0000
Total Losses (lb):	0.4351

TANKS 4.0.9d
Emissions Report - Detail Format
Individual Tank Emission Totals

Emissions Report for: Annual

TK 032 - Vertical Fixed Roof Tank
Albert Lea, Minnesota

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Biodiesel Distillation Bottoms	0.44	0.00	0.44

TANKS 4.0.9d
Emissions Report - Detail Format
Tank Indentification and Physical Characteristics

Identification		
User Identification:	TK 33	
City:	Albert Lea	
State:	Minnesota	
Company:	REG Albert Lea	
Type of Tank:	Vertical Fixed Roof Tank	
Description:	FFA Distillate Tank 33	
Tank Dimensions		
Shell Height (ft):		28.00
Diameter (ft):		26.00
Liquid Height (ft) :		28.00
Avg. Liquid Height (ft):		15.00
Volume (gallons):		111,205.89
Turnovers:		43.00
Net Throughput(gal/yr):		4,781,853.43
Is Tank Heated (y/n):	Y	
Paint Characteristics		
Shell Color/Shade:	Aluminum/Diffuse	
Shell Condition	Good	
Roof Color/Shade:	Aluminum/Diffuse	
Roof Condition:	Good	
Roof Characteristics		
Type:	Cone	
Height (ft)		0.67
Slope (ft/ft) (Cone Roof)		0.05
Breather Vent Settings		
Vacuum Settings (psig):		-0.03
Pressure Settings (psig)		0.03

Meterological Data used in Emissions Calculations: Rochester, Minnesota (Avg Atmospheric Pressure = 14.04 psia)

TANKS 4.0.9d
Emissions Report - Detail Format
Liquid Contents of Storage Tank

TK 33 - Vertical Fixed Roof Tank
Albert Lea, Minnesota

Mixture/Component	Month	Daily Liquid Surf. Temperature (deg F) Avg.	Min.	Max.	Liquid Bulk Temp (deg F)	Vapor Pressure (psia) Avg.	Min.	Max.	Vapor Mol. Weight.	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight	Basis for Vapor Pressure Calculations